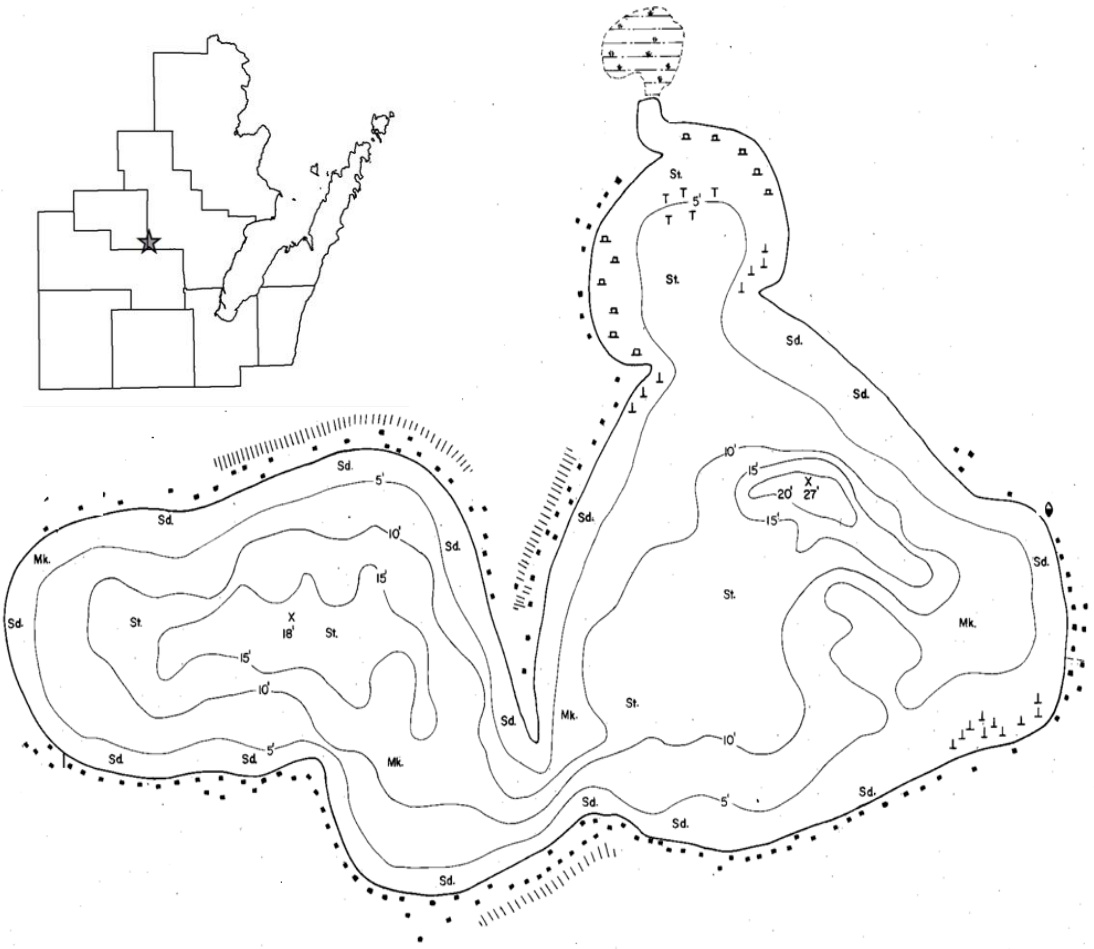
Berry Lake, Oconto County Wisconsin
Fisheries Survey Report, 2007

Waterbody Identification Code 418300



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February 2008

Berry Lake, Oconto County Wisconsin Fisheries Survey Report, 2007

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SUMMARY

Wisconsin Department of Natural Resources personnel in cooperation with the Menominee Tribal Conservation Department conducted a fisheries survey of Berry Lake, Oconto and Menominee Counties during the 2007 field season. This survey was meant to compliment the sampling efforts conducted in the summer and fall of 2003 by the WDNR, and reported by Kapuscinski (2006). Spring fyke netting was conducted in April and one night of electrofishing was completed in May 2007.
The following species, listed in order of decreasing occurrence, were sampled: bluegill, yellow bullhead, northern pike, brown bullhead, pumpkinseed, largemouth bass, rock bass, yellow perch, walleye, and black crappie. No minnow or sucker species were collected. In comparison to past surveys, size structure of panfish populations has improved greatly. However, this change is likely a response to a reduction in reproduction. The current low water level of Berry Lake is likely negatively impacting natural reproduction of all species. Northern pike appear to be very slow growing and may benefit from more protective regulations. Management recommendations include shoreline habitat enhancement and protection and to discontinue any predator stocking until lake levels come up and forage base returns to acceptable levels.

Lake and location
Berry Lake, Oconto County, T28N R17E Sec 19 and Menominee county, T28N R16E Sec 24
Physical / chemical attributes (Carlson, Andrews, and Threinen 1977)
Surface acres: 201
Maximum depth 27 feet
Lake type: seepage
Watershed: 2.6 square miles, including 32 acres of adjoining wetlands
Basic water chemistry: hard water that is slightly acid and of high transparency, pH = 6.9, conductance at 77 ˚F = 156
Littoral substrate: 70 percent sand and 30 percent muck
Aquatic vegetation: Diverse, Eurasian water milfoil present
Other features: Waterfowl make limited use of this lake. Public access with limited parking is available from a town of Underhill landing.

Purpose of surveys
Compliment the summer and fall assessments that were conducted in 2003. Survey the fish community composition, assess growth rates of gamefish and panfish populations, and estimate current northern pike population.

Dates of fieldwork
Fyke netting survey conducted April 2- 17. Electrofishing survey conducted May 22nd.

BACKGROUND

Berry Lake is a hard water seepage lake of 201 acres, a maximum depth of 27 feet, and a mean depth of 8 feet. Berry Lake has no outlet and water levels tend to fluctuate up to four feet (Langhurst 1988). Berry Lake was classified as mesotrophic by Cleereman (1994) based on phosphorus concentration, chlorophyll a concentration, and Secchi depth. Berry Lake contains a diverse aquatic plant population, but recently Eurasian water milfoil has been documented (James Reyburn, Wisconsin Department of Natural Resources, personal communication). Berry Lake's shoreline is highly developed, which results in increased levels of anthropogenic disturbance to the lake ecosystem (Cleereman 1994).

The Town of Underhill owns and maintains a boat landing that is open to the public. The landing is adequate under most conditions, but can be difficult to utilize when lake levels are low (Greg Kornely and Rod Lange, WI DNR, personal communication). The Menominee Indian Tribe of Wisconsin owns several hundred feet of un-developed shoreline on the western portion of the lake.

Past surveys have shown Berry Lake's fish community to be composed primarily of black crappie *Pomoxis nigromaculatus*, bluegill *Lepomis macrochirus*, brown bullhead *Ameiurus nebulosus*, largemouth bass *Micropterus salmoides*, northern pike *Esox lucius*, pumpkinseed *Lepomis gibbosus*, yellow bullhead *Ameiurus natalis*, and yellow perch *Perca flavescens*. Other species sampled have included bluntnose minnow *Pimephales notatus*, golden shiner *Notemigonius crysoleucas*, green sunfish *L. cyanellus*, Iowa darter *Etheostoma exile*, mimic shiner *Notropis volucellus*, rock bass *Ambloplites rupestris*, walleye *Sander vitreus*, and white sucker *Catostomus commersonii*. There are no special fishing regulations for Berry Lake (Table 1).

The purpose of this report is to compliment the fisheries data collected during the summer and fall of 2003, to assess the growth and age composition of Berry Lake's gamefish and panfish populations and to compare results to previous survey reports.

METHODS

Data collection

Six standard 3 foot hoop fyke nets with ¾" bar, 1.5" stretch mesh were fished from April 2nd through April 17th 2007, and lifted periodically for a total effort of 60 net days (Figure 1, Table 2). All fish captured were identified to species and counted each day. Gamefish and panfish were measured for total length within 0.1 inch. Scales and dorsal spines (largemouth bass only) were collected from a sub-sample of fish stratified within 0.5 inch bins. Northern pike were marked with a dorsal fin clip to perform a multiple mark recapture population estimate.

A WI DNR standard direct current electrofishing boat was used to sample the entire 3.2 miles of shoreline on the evening of May 22, 2007 (Figure 1). Three stations were sampled on this lake (Table 3). At station 1 and 2, all fish encountered were attempted to be collected, identified to species, and enumerated. Gamefish only were collected at station 3. At all stations, gamefish and panfish were measured within 0.1 inch for total length. Scales and dorsal spines (largemouth bass only) were collected from a sub-sample of fish stratified within 0.5 inch bins. Ages were assigned to fish after scales and spines were aged using standard WI DNR procedures.

Data analysis

Total catch, catch per gear type, catch per fyke net night, and catch per mile of shoreline electrofished were calculated for all species. Age frequency distribution and mean length at age analyses were conducted for largemouth bass, bluegill, pumpkinseed, and northern pike. Mean length at age was calculated for black crappie and walleye. Proportional stock density was calculated for bluegill. Catch data was combined for both gear types for all analyses. An age length key was created to assign ages to un-aged fish based on proportional representation of the known age fish subsample, within 0.25 inch length bins. Age-frequency distribution was calculated once ages were allocated to all fish in the sample. Mean length at age was calculated as mean length at time of capture. Mean lengths of known age fish were plotted with Wisconsin statewide and Oconto County averages as well as mean length at age from the 1988 survey of Berry Lake (Langhurst 1988). Proportional stock density (PSD; Anderson and Neumann 1996) was calculated

for bluegill. For bluegill, specific quality length is 6 inches, and stock length is 3 inches as proposed by Gabelhouse (1984). A Schnabel multiple-census population estimate was calculated for northern pike from the fyke netting sample.

RESULTS AND DISCUSSION

A total of 598 fish of eleven different species were collected in the samples. Catch per gear type, catch per fyke net night, and catch per mile of shoreline electrofished are shown for each species sampled in Berry Lake (Table 4). Bluegill was the most abundant species sampled, yellow and brown bullhead, pumpkinseed, largemouth bass, and northern pike were common. Rock bass, walleye, and yellow perch were sampled in low numbers. There was no minnow or sucker forage species collected. Bluntnose minnow, golden shiner, mimic shiner, white sucker and Iowa darter have been previously sampled in Berry Lake, but were not collected in this survey (Kapuscinski 2006).

Black crappie

There were a total of 9 black crappie sampled. Average length was 9.6 inches with a range from 5.9 to 12.8 inches. Although there were relatively few sampled, black crappie showed comparable growth rates with the statewide and Oconto County averages for black crappie (Figure 2). They are most likely naturally reproducing, but there were no fish younger than 4 years of age in the sample. Current low water conditions may be limiting black crappie recruitment.

Bluegill

A total of 134 bluegills averaging 6.4 inches total length (range 2.3-9.6) were sampled from Berry Lake. Comparison of the bluegill length at age to state and Oconto County averages showed slower growth at younger ages and then larger ultimate growth after 6 years of age (Figure 3). When compared with length at age data from 1985, bluegills attained longer lengths at the same age indicating better growth (Figure 3). Comparison of the 2007 data with the 2003 data is tenuous because of the differences in sampling gear and season. Whereas the 2003 sample was collected with mini fyke nets and electrofishing in the summer, the 2007 data was collected with 3 foot nets in April and

electrofishing in May. However, there is a marked difference between the bluegill population from 2003 when the average bluegill was less than 3 inches in length (Kapuscinski 2006) and the 2007 sample. The proportional stock density of the bluegill population increased from 2 estimated in 2003 (Kapuscinski 2006) to 78.3. This demonstrates a shift from a high proportion of small fish (less than 3 inches) to a high proportion of fish greater than quality length (6 inches). This change could be explained by the seasonal abundance of smaller fish in the summer survey of 2003 or a gear bias, but a reduction in bluegill reproduction and resultant shift in age and size structure is more likely. The 2007 age frequency distribution shows a decrease in year class strength of fish younger than 5 (Figure 4). The lack of representation of fish from year classes younger than 5 indicates a reduction in the recruitment of bluegills to the population. The increase in growth is likely a compensatory response to reduced natural reproduction. If there is reduced competition for food because of fewer bluegills, the remaining bluegills can attain a larger size. Although there may have been a seasonal bias against catching smaller bluegills, the small size of the two, three, and four year old year classes relative to the five, six, and seven year olds, is strong evidence of reduced reproduction and a compensatory increase in growth.

Largemouth bass

A total of 36 largemouth bass were sampled in 2007 with an average length of 12.5 inches (range 4.8-15.0). There were fewer sampled than in the 2003 survey, but the average size is slightly larger. The mean length at age data showed comparable growth with the Oconto County average and smaller size at the same age with the statewide average (Figure 5). There was an increase in growth compared to the 1985 survey, for fish six years of age and younger (no older fish were captured in 2007 to allow for comparison with fish older than six). There appears to also be a reduction in largemouth bass recruitment from the age frequency distribution (Figure 6).

Northern pike

A total of 85 northern pike were sampled and five marked fish were recaptured during the surveys. A population estimate of 473 fish (95%C.I. 223-911) was calculated from the recaptures during the fyke net census. This estimate is similar to the population estimate

of 567 calculated in 1985 (Langhurst 1988). The average length was 17 inches with a range of 13.1 to 21.0. Individual fish sex was determined if fish showed external evidence of gender. The sex ratio was 10:1 male to female. Northern pike mean length at age was very low compared to both state and Oconto County averages (Figure 7). In comparison, the 1985 survey showed excellent northern pike growth. The age frequency distribution indicated good representation of all age classes older age 3 fish (Figure 8).

This data might indicate a recent reduction of northern pike natural reproduction, but more likely northern pike less than 3 years of age are not as likely to be captured in fyke nets. The lack of forage, minnows and suckers, is probably responsible for the recent reduced growth of northern pike (Diana 1987). As well as a reduced forage base, the unbalanced sex ratio could also explain the apparent slower growth. Female pike grow faster and reach greater size (Becker 1983). If harvest pressure is focused on larger fish (over 22 inches), then harvest could be disproportionately targeting female pike and leaving a majority of small slower growing males in the population. Likely, the slow growth is a combination of reduced forage base and harvest pressure on larger female fish.

Pumpkinseed

A total of 53 pumpkinseeds averaging 7.3 inches in total length with a range of 3.9-9.7 were sampled in 2007. This species again showed a marked improvement in size structure from 2003 when the average total length was 2.6 inches. Mean length at age demonstrated better growth than the state average and comparable growth to other Oconto County lakes (Figure 9). The age frequency distribution showed no fish younger than 5 years of age, indicating little to no recent natural reproduction (Figure 10). This is a similar trend compared with the bluegill population of a reduction in natural reproduction and a subsequent increase in age and size structure.

Walleye

A total of 11 walleye were collected in 2007. The average size was 19.2 with a range of 7.6-21 inches. Two of the walleye collected were age 1 fish and probably from the stocking that occurred in 2006. There is little evidence of natural reproduction with no fish between the ages of 1 and 7. The last recorded stocking event before 2006 was 1995,

so the lake may have the ability to support limited natural reproduction at times. Growth rates were better than the Oconto county average and comparable to the statewide average (Figure 11).

CONCLUSIONS AND RECOMMENDATIONS

Fish populations of Berry Lake as a whole seem to be in decline. This finding is likely attributable to the current low water levels, reduction in lake volume and effective littoral zone. Species in the sunfish family, including largemouth bass, bluegill, and pumpkinseed, all showed recent reductions in natural reproduction but increases in average size. Northern pike are exhibiting very slow growth. The lack of forage is most likely the cause of slow growth, but possibly exacerbated by harvest of the faster growing pike and likely females. Walleye and black crappie were sampled in low numbers and also showed little natural production. Unfortunately, accurate mortality estimates for the populations could not be generated due to the recent changes in the levels of recruitment. The water level of Berry Lake has historically fluctuated. In years with low water, there are reductions in habitats for spawning and nursery areas for young of the year fish, leading to population declines. In years with high water, fish may have increased spawning habitat and increased reproduction but size structure may decrease with increasing numbers of small fish. Growth can also be reduced in years where there are greater numbers of fish competing for the same food resources.

Shoreline development can be a large contributing factor to the decline in fish populations (Jennings et al. 2003). If large woody debris and submergent and emergent aquatic vegetation are removed or disturbed by riparian landowners, then cumulative reductions in habitat for fish can severely depress recruitment of fish. These changes lead to reduced reproduction of gamefish and panfish as well as forage fish. Piers and docks have been shown to impact aquatic plant communities thereby supporting fewer fish and aquatic invertebrates than natural habitats (Schindler et al. 2000, Radomski and Geoman 2001). Removal of woody debris eliminates critical habitat for young of the year fish and reduces survival (Sass et al. 2006). Removal of woody debris has also been correlated with reductions in fish growth rates (Schindler et al. 2000). Riparian landowners should consider habitat improvements to improve littoral zone habitats which

should improve growth and recruitment of fish. During the May of 2007 electroshocking survey, the highest number of panfish captured were in the undeveloped portion (naturally vegetated) of the lake bordering the Menominee Indian Tribal lands. Protection and improvement of littoral zone habitat should be the top priority for improvement of Berry Lake's fishery. Improved habitat can lead to increased reproduction and growth of all species. If interest exists amongst stakeholders, an alternative more protective regulation for northern pike could be considered to improve the size structure. Additional stocking of predator fish (northern pike, walleye, largemouth and smallmouth bass) should be discontinued until the lake level increases and more forage fish are present.

ACKNOWLEDGMENTS

Lee Meyers, Rodney Lange, Mike Donofrio, Don Reiter and the Menominee Tribal Conservation Department collected the data summarized in this report. Rod Lange collated the data and aged the fish.

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TABLE 1.— Current fishing regulations for Berry Lake.

Species	Open season	Daily limit	Minimum length
Largemouth bass	first Saturday in May - first Sunday in March	5	14 inches
Northern pike	first Saturday in May - first Sunday in March	5	none
Panfish: bluegill, crappie, pumpkinseed, sunfish, and yellow perch	open all year	25 in total	none
Rock bass	open all year	none	none
Walleye	first Saturday in May - first Sunday in March	5	15 inches

TABLE 2.— Net locations for six fyke nets fished on Berry Lake from April 2nd to April 17th 2007.

Net Number	Latitude	Longitude
1	44.886758	88.478065
2	44.887886	88.479841
3	44.88754	88.484017
4	44.889852	88.470337
5	44.893864	88.477537
6	44.893864	88.475377

TABLE 3.— Electrofishing station descriptions from Berry Lake May 22nd, 2007.

Electrofishing Station	Start latitude	Start longitude	Distance (miles)	Time (minutes)
1	44.88954	88.47101	.5	14
2	44.89351	88.47592	1.5	45
3	44.88781	88.48907	1.2	33

TABLE 4.— Catch summary for fyke netting and electrofishing samples from Berry Lake, 2007. Six fyke nets were fished for a total of 60 net nights from April 2nd through April 17th. Electrofishing sample was collected on May 22nd. Gamefish only were collected at electrofishing Station 3. Bullhead captured during electrofishing were not identified to species.

Species	Fyke nets		Electrofishing Station #1		Electrofishing Station #2		Electrofishing Station #3	
	Total Catch	Mean Catch per net night	Total Catch	Catch per mile	Total Catch	Catch per mile	Total Catch	Catch per mile
Black Crappie	7	0.14	0	0	2	1.3	-	-
Bluegill	104	1.96	0	0	30	20.0	-	-
Brown Bullhead	72	1.20	-	-	-	-	-	-
Green Sunfish	0	0	0	0	16	10.67	-	-
Largemouth Bass	12	.25	1	2.0	7	6.7	16	13.3
Northern Pike	88	1.54	0	0	1	0.7	3	2.5
Pumpkinseed	51	1.01	1	2.0	1	0.7	-	-
Rock Bass	19	0.40	0	0	6	4.0	-	-
Walleye	9	0.15	0	0	0	0	2	1.7
Yellow Bullhead	112	2.30	-	-	-	-	-	-
Yellow Perch	2	0.04	0	0	15	10.0	-	-
Bullhead Spp.	-	-	4	8.0	32	21.3	-	-

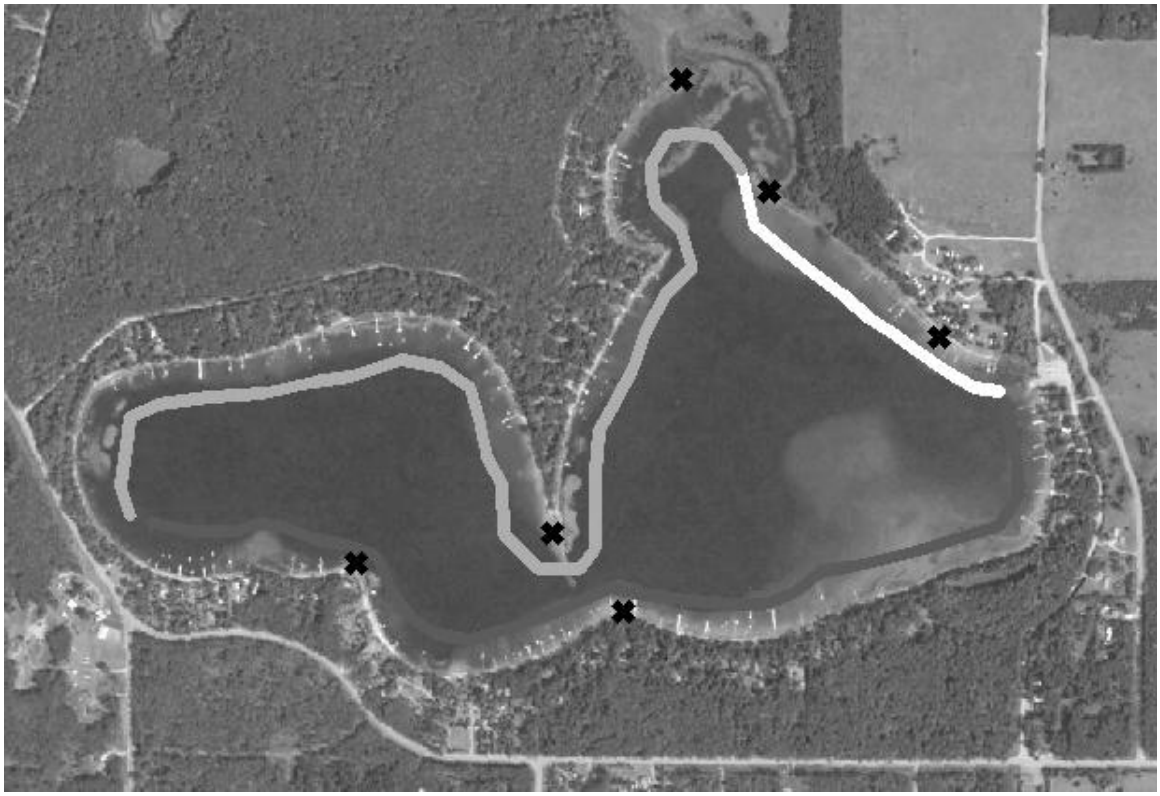

Figure 1.— Arial photo of Berry Lake, Oconto and Menominee counties Wisconsin with sampling effort locations in the spring of 2007. Xs indicate fyke netting locations. Electrofishing stations are shown as thick lines, Station 1 - white, Station 2 – light gray, Station 3 – dark gray.

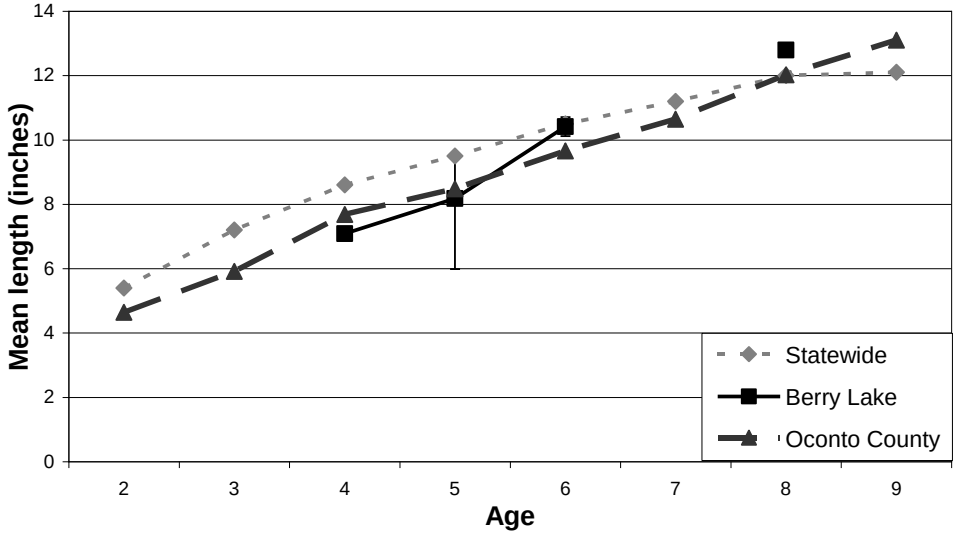

Figure 2.— Black crappie mean length at age from Berry Lake (black squares and solid line). Statewide (diamonds and dotted line) and Oconto County (triangles and dashed line) mean length at ages are also shown. Error bars show size range within age groups from Berry Lake.

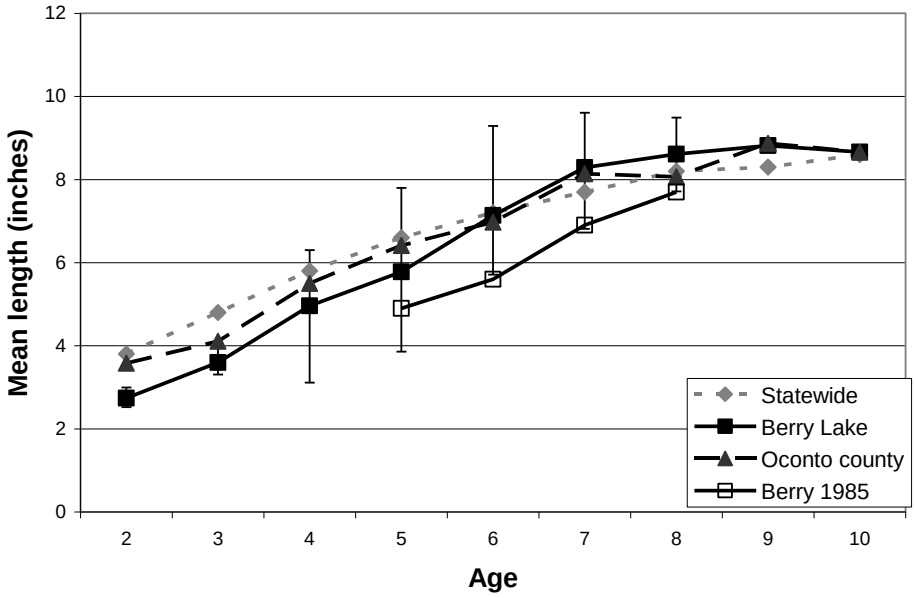

Figure 3.— Bluegill mean length at age from Berry Lake (black squares and solid line). Statewide (diamonds and dotted line), Oconto County (triangles and dashed line) and Berry Lake from 1985 (open squares with solid line) mean length at ages are also shown. Error bars show size range within age groups from Berry Lake.

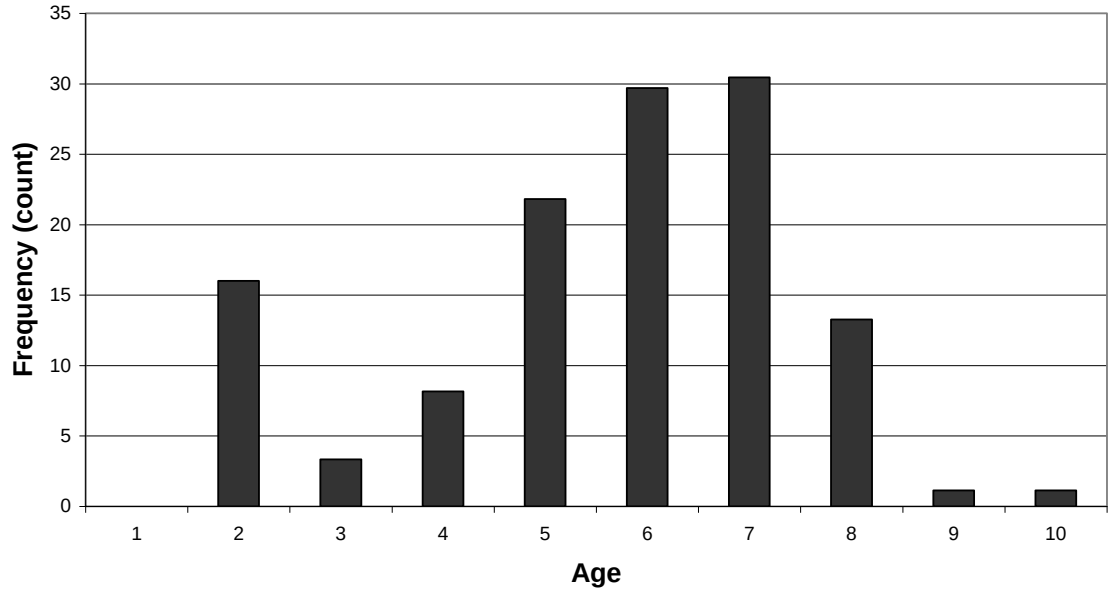

Figure 4.— Bluegill age frequency distribution. Ages were determined by examination of scales. Ages were allocated to un-aged fish by use of an age-length key.

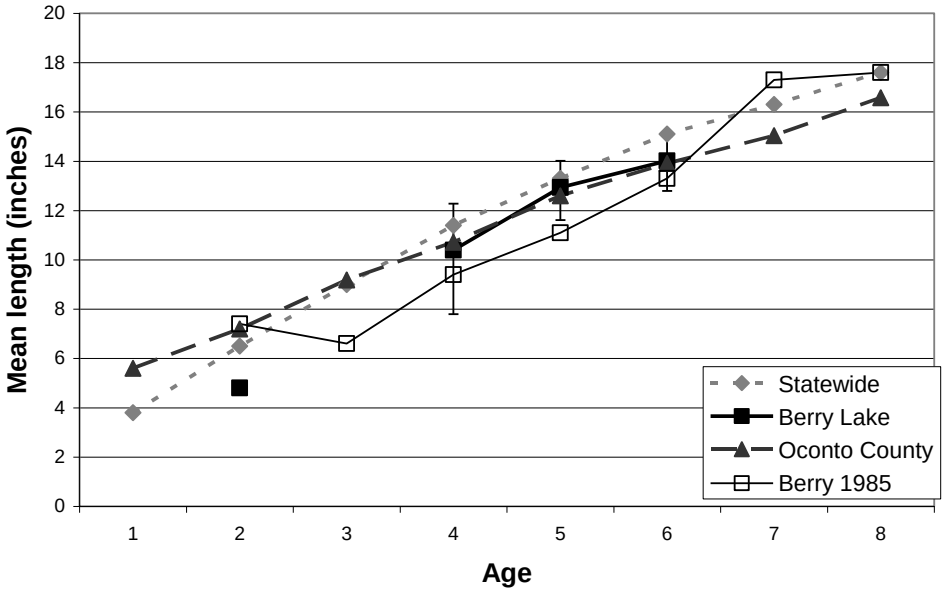

Figure 5.— Largemouth bass mean length at age from Berry Lake (black squares and solid line). Statewide (diamonds and dotted line), Oconto County (triangles and dashed line) and Berry Lake from 1985 (open squares with solid line) mean length at ages are also shown. Error bars show size range within age groups from Berry Lake.

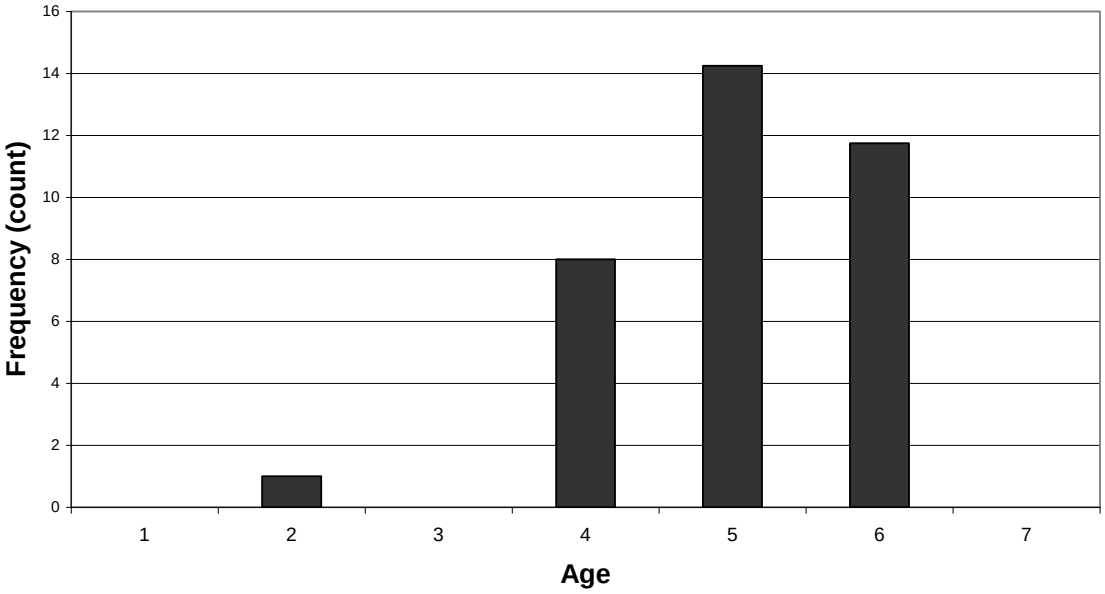

Figure 6.— Largemouth bass age frequency distribution. Ages were determined by examination of scales and dorsal spine cross-sections. Ages were allocated to un-aged fish by use of an age-length key.

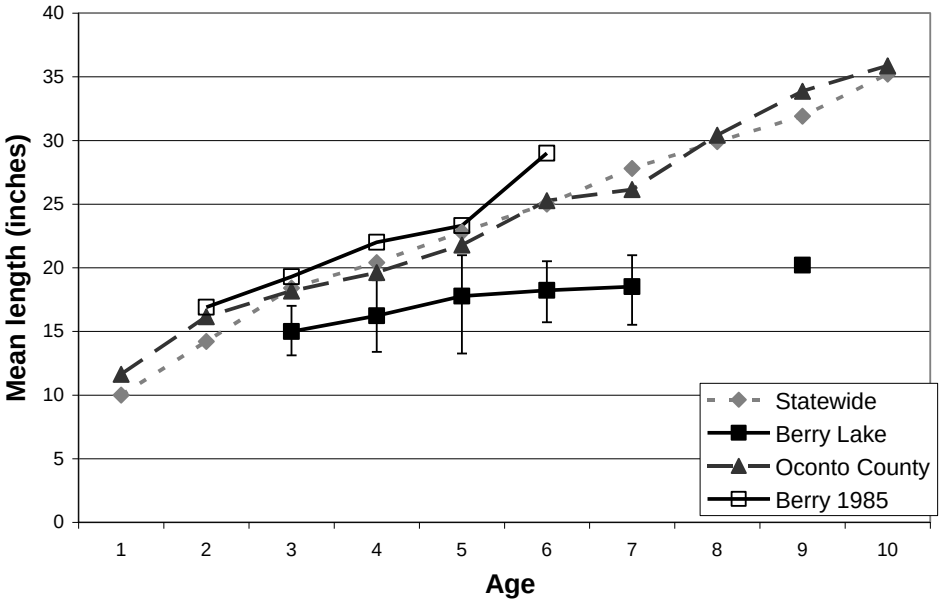

Figure 7.— Northern Pike mean length at age from Berry Lake (black squares and solid line). Statewide (diamonds and dotted line), Oconto County (triangles and dashed line) and Berry Lake from 1985 (open squares with solid line) mean length at ages are also shown. Error bars show size range within age groups from Berry Lake.

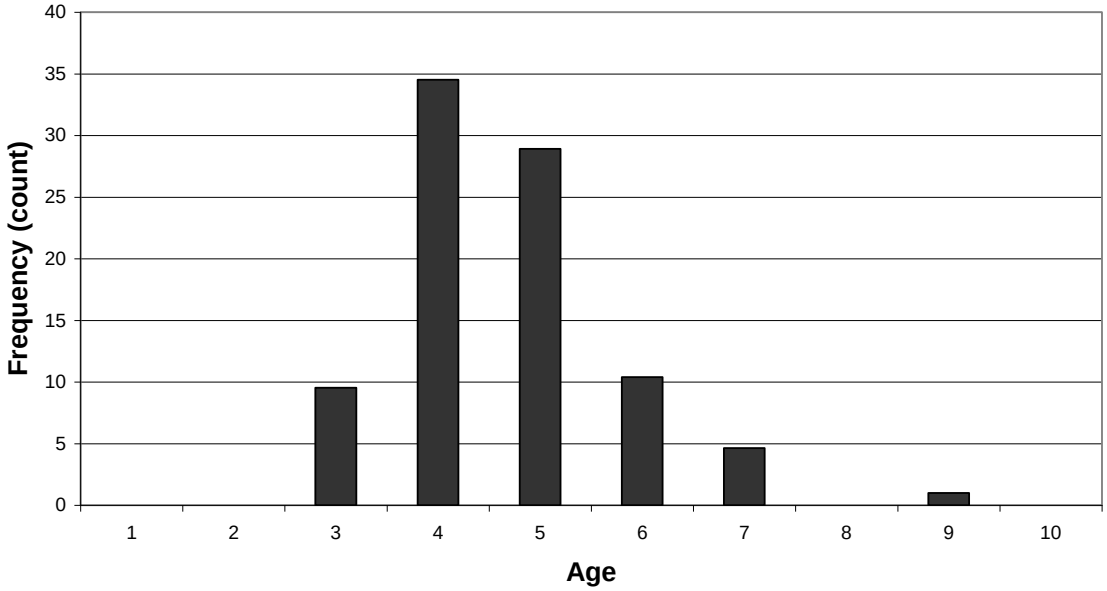

Figure 8.— Northern pike age frequency distribution. Ages were determined by examination of scales. Ages were allocated to un-aged fish by use of an age-length key.

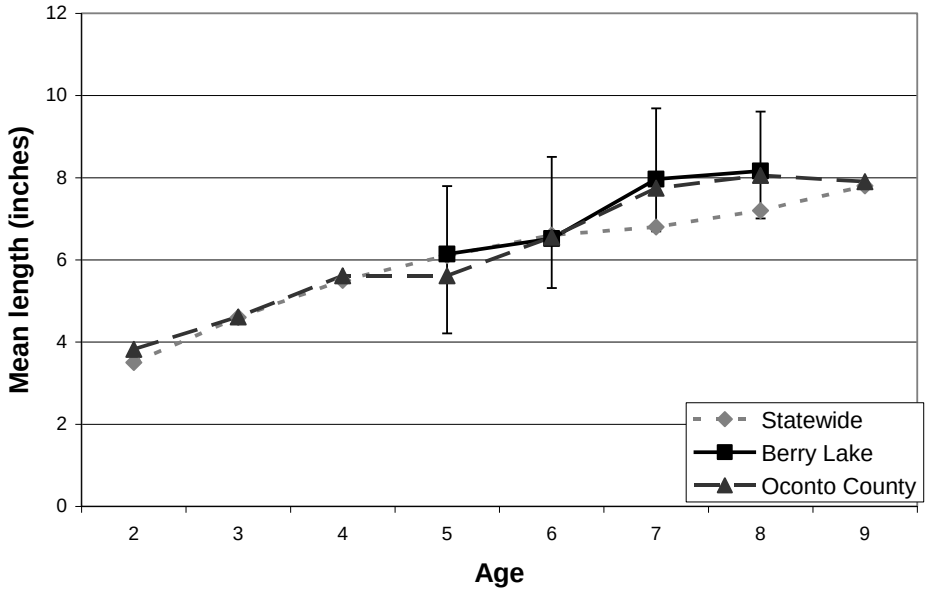

Figure 9.— Pumpkinseed mean length at age from Berry Lake (black squares and solid line). Statewide (diamonds and dotted line) and Oconto County (triangles and dashed line) mean length at ages are also shown. Error bars show size range within age groups from Berry Lake.

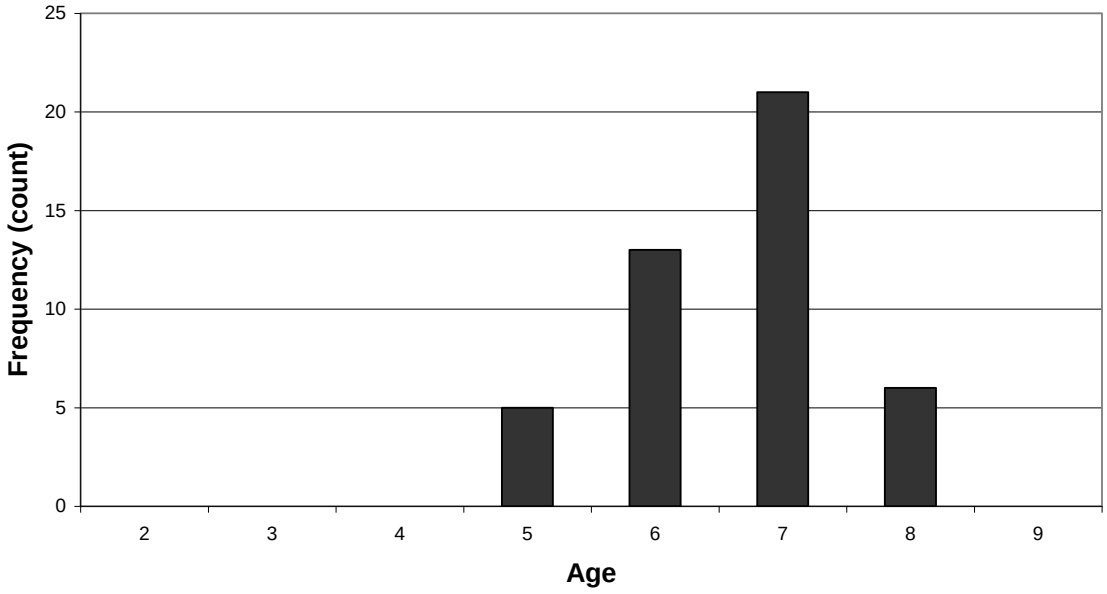

Figure 10.— Pumpkinseed age frequency distribution. Ages were determined by examination of scales. Ages were allocated to un-aged fish by use of an age-length key.

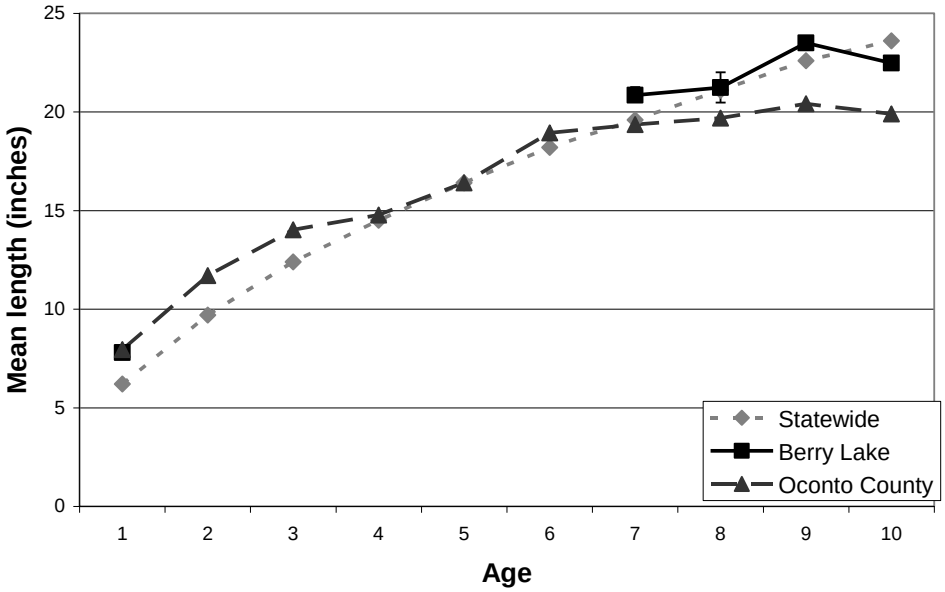

Figure 11.— Walleye mean length at age from Berry Lake (black squares and solid line). Statewide (diamonds and dotted line) and Oconto County (triangles and dashed line) mean length at ages are also shown. Error bars show size range within age groups from Berry Lake.