

**Bear Lake
Treaty Assessment Survey
Barron County, Wisconsin
2008-2009
(MWBIC: 2105100)**



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Executive Summary

Bear Lake, a 1,358-acre drainage lake located in northcentral Barron County near Haugen, Wisconsin was surveyed in 2008-2009 following the Wisconsin Department of Natural Resources Treaty Assessment protocol. Projected angler effort for all species of fish was 34.6 hours/acre, of which 59% was directed towards panfish. Northern pike were the most common gamefish caught and harvested by anglers followed by largemouth bass and walleye. The 2008 adult walleye population (0.5 fish/acre) was 58 and 67 percent lower compared to past surveys of 1.2 fish/acre in 2000 and 1.5 fish/acre in 1996. Largemouth bass relative abundance has been increasing over time compared to prior surveys on Bear Lake. Management recommendations call for changes in walleye stocking and implementation of a new angling regulation for walleye and largemouth bass.

Introduction

Bear Lake is a 1,358-acre drainage lake located in northcentral Barron County, near the village of Haugen, Wisconsin. A dam with a 15 foot head is present at the outlet of Bear Lake. The maximum water depth of Bear Lake is 87 feet and 14.9 miles of shoreline are present. Four public boat landings are present. Bear Lake has a diverse fishery consisting of walleye Sander vitreus, northern pike Esox lucius, largemouth bass Micropterus salmoides, smallmouth bass Micropterus dolomieu as well as bluegill Lepomis macrochirus, black crappie Pomoxis nigromaculatus, pumpkinseed L. gibbosus, yellow perch Perca flavescens, green sunfish L. cyanellus, cisco Coregonus artedii and bullheads Ameiurus spp.

Fish stocking since 1990 has been exclusively walleye of various sizes (Table 1). According to Becker (1983), Bear Lake was likely within the native range of walleye in Wisconsin. No other fish stocking occurs. The objectives of this study were to assess the status of the walleye population as part of the treaty assessment sampling rotation of lakes for the ceded territory of Wisconsin. Secondary objectives included assessing the status of other important fish species such as largemouth bass, smallmouth bass, northern pike and panfish.

Methods

Bear Lake was sampled during 2008-2009 following the Wisconsin Department of Natural Resources treaty assessment protocol (Hennessy 2002). This sampling included spring fyke netting and electroshocking to estimate walleye and largemouth bass abundance, fall electroshocking to estimate year class strength of walleye young-of-the-year (YOY) and gamefish relative abundance as well as a creel survey (both open water and ice). Walleye abundance was determined for adult fish. Adult walleye were defined as being ≥ 15 in or sexable (Hennessy 2002). Survey data were also collected to estimate abundance and angler catch information on other species such as northern pike, largemouth bass, smallmouth bass and panfish.

Creel census data were collected in 2008-2009 beginning the first Saturday in May and continuing through the first Sunday in March of the following year (the open season for game fish angling in Wisconsin). No creel survey data were collected during November because thin ice created dangerous fishing conditions. Creel survey methods followed a stratified random design as described by Rasmussen et al. (1998). Walleye exploitation rates were calculated using the proportion of finclipped walleye (from spring population estimates) observed and measured during the creel survey. The minimum length limit

for walleye in Bear Lake was 15 in with a daily bag that fluctuates on an annual basis dependent on annual safe harvest estimates, ranging from two to five fish. The daily bag for walleye during 2008-2009 was 2 fish. The minimum length limit for largemouth bass was 14 in with a daily bag of 5 in total. No minimum length limits are in effect for northern pike or panfish and the bag limits were 5 and 25, respectively.

Data collected during the 2008-2009 survey were compared with previous survey data on Bear Lake in 2000 and 1996 and historic spring electrofishing surveys from 1979 and 1993. In addition, northern pike catch and harvest statistics were compared with 55 northern Wisconsin lakes (Margenau et al. 2003). Growth data were compared with local (Barron and Polk County) and regional (18 county WDNR Northern Region) means utilizing the WDNR Fisheries and Habitat database. Age assessment for walleye was determined from both scale samples (< 12 in) and dorsal spine sections (≥ 12.0 in). Juvenile walleye (YOY) electrofishing runs were conducted in 1992, 1996, 2000, 2001, 2003, 2004, 2006, and 2008.

Results

Angling Effort. Projected angling pressure for all fish species in 2008-2009 was 34.6 hours/acre. This was 10% and 36% higher than in 2000 and 1996 which were 31.6 and 25.5 hours/acre, respectively. In 2008-2009, 59% of the directed angling effort was for panfish and 41% was directed towards gamefish (Table 2).

Walleye. The adult walleye population in 2008 was 661 or 0.5 fish/acre (95% C.I. = 434-888). Adult walleye abundance was 58% and 67% lower in 2008 compared to 2000 and 1996, respectively (Figure 1). The adult walleye population in 2000 was 1,655 or 1.2 fish/acre (95% C.I. = 1493-1817) and in 1996 was 2,082 or 1.5 fish/acre (95% C.I. = 1645-2519). Historic spring electrofishing surveys for walleye also show a decrease in walleye relative abundance over the last three decades (Figure 2). Size structure of walleye was well represented, however the ratio of male to female walleye (5.6:1) was high (Figure 3).

Year class strength of walleye has been poor (Table 1). Absent and very weak year classes were documented from 1992-2008, even in years when walleye were stocked.

Angling effort for walleye made up 7.9% of the total directed effort (open water and ice combined) on Bear Lake in 2008-2009. Projected angler harvest was 209 walleye. Mean length of walleye harvested in 2008-2009 was 19.2 in (SE = 0.74, N=28). Tribal spear anglers harvested 40 walleye in 2008. Combined angler and tribal exploitation was estimated at 14%. Growth of walleye in Bear Lake was slightly below to average for 4-5 year old fish and above average for 6-7 year old fish when

compared to local and regional means (Table 3).

Largemouth Bass. Historic spring electrofishing surveys for largemouth bass suggest relative abundance has increased from 0 fish/hr in 1979 to 52 fish/hr in 2008 (Figure 4). Length frequency analysis suggests a balanced largemouth bass fishery is present (Figure 5). More specifically, PSD and RSD-15 were 74 and 24.

Anglers directed slightly more effort towards largemouth bass in 2008-2009 when compared to walleye. 13.1% of the directed angling effort targeted largemouth bass. Angler catch rate was 0.37 fish/hr. Projected angler harvest for largemouth bass in 2007-2008 was 650 fish. Mean length of largemouth bass harvested in 2008-2009 was 15.7 in (SE = 0.16, N = 66). Growth of largemouth bass was average for age 3-4 fish but below average for age 5-6 fish when compared to the local and regional means (Table 4).

Smallmouth Bass. Spring electrofishing CPE for smallmouth bass was low at 2 fish/hr. Anglers directed only 1.6% of the directed angling effort for smallmouth bass. Angler catch rates were 0.09 fish/hr. Projected angler catch was 355 fish of which projected harvest was only 12 fish.

Northern Pike. Population abundance was not estimated for northern pike during the 2008-2009 netting and electrofishing. Anglers pursuing northern pike in 2008-2009 represented 18.0% of the directed angling effort on Bear Lake. Projected angler harvest of northern pike was 1,400. Mean length of northern pike harvested in 2008-2009 was 21.9 in (SE=0.30, N=169).

Panfish. Bluegill spring CPE was 428 fish/hr. Bluegill PSD and RSD-8 was 71 and 0, respectively. Anglers pursuing bluegill in 2008-2009 accounted for 30.7% of the directed angling effort, while black crappie accounted for 23.4%. Combined, 54.1% of the directed angling effort in 2008-2009 was for black crappie and bluegill. The projected number of bluegill harvested in 2008-2009 was 33,042 and the projected number of black crappie harvested in 2008-2009 was 10,519. The average length of bluegill and black crappie harvested in 2008-2009 was 7.2 in (SE = 0.1, N= 1,297) and 9.7 in (SE = 0.5, N = 394), respectively. Yellow perch were a much smaller component of the panfish angling effort. In 2008-2009, only 0.2% of the directed angling effort was for yellow perch and projected harvest was 683 fish. The average length of yellow perch harvested was 9.5 in (SE = 0.17, N=54). The remaining fishing effort targeted pumpkinseed, green sunfish and cisco. Projected harvest of these species was 1,903, 12 and 6 fish, respectively.

Discussion

Walleye. Adult walleye abundance has decreased from 1996-2008. This decrease is likely related to poor year class strength. Walleye natural reproduction appears to be absent in Bear Lake, whereas it did occur historically (Cornelius, 2002). In addition, walleye small fingerling stocking has not provided any measurable recruitment even with the accelerated stocking densities of over 100 small fingerlings/acre during 2001-2004. Predation on early life stages of walleye may be affecting year class strength and subsequent adult densities. Brooking et al. (2001) stated that when other top predators such as largemouth bass and northern pike increase in relative abundance in a lake, the likelihood of increased predation on small fingerling walleye is high and likely hinders stocking success. Data collected during this survey shows largemouth bass abundance has increased in Bear Lake over the past two decades. Largemouth bass have also been found to be effective predators on other stocked fish such as esocids (Stein et al. 1981). This study found that largemouth bass predation accounted for up to 45% of stocked hybrid muskellunge (Esox masquinongy x E. lucius) mortality within 40 d of stocking. In addition, Nate et al. (2003) indicated that high largemouth bass and northern pike densities characterized lakes with walleye populations that are maintained by stocking versus natural reproduction. Four other fishery surveys completed on nearby Ward, Half Moon, Big Butternut and Lower Turtle Lakes (Benike 2005a; Benike 2005b, Benike 2005c, Benike 2006) in Polk and Barron Counties also showed a similar trend of decreasing walleye abundance with an increase in largemouth bass abundance during the same time period. Most recently, Fayram et al. (2005) documented that largemouth bass interact strongly with walleye populations through predation as well as, limit stocked walleye survivalship. The authors further suggest that management goals seeking to simultaneously maximize both largemouth bass and walleye populations may be unrealistic. Considering the relative abundance of largemouth bass in Bear Lake has increased from 1979 (0 fish/hr) to 2008 (54 fish/hr), it's reasonable to assume that largemouth bass may be utilizing walleye as prey. Two management actions should be undertaken in an effort to increase recruitment and restore the walleye fishery. First, walleye stocking could be converted to large fingerling walleye on a trial basis for an 8-10 year period in an effort to improve recruitment. Two recent studies on Beaver Dam Lake in Barron County (Benike 2008) and 24 separate lakes in Wisconsin (Kampa 2009) indicated that large fingerling walleye stocking outperformed small fingerling walleye by over 4,500% and 400% respectively. Secondly, bass regulations should also be liberalized. The increase in bass abundance over the past two decades could be

limiting walleye recruitment. Returning bass abundance to historic levels seems appropriate and will help minimize any impact bass predation may have on walleye recruitment in Bear Lake.

Largemouth Bass. Largemouth bass relative abundance has been increasing over time, however angling effort and interest has remained relatively low (13.1%) in 2008-2009. Management of Bear Lake is at a crossroads. Walleye abundance is declining and largemouth bass abundance is increasing. Considering very few lakes are managed for walleye in Barron County, largemouth bass should be a secondary species of importance on Bear Lake. Liberalization of bass regulations should increase angler harvest of small bass, reduce bass abundance and hopefully reduce bass predation on walleye. A secondary benefit of liberalizing bass regulations is bass growth and possibly size structure may improve by reducing densities as well as intraspecific competition.

Smallmouth bass. Smallmouth bass are very low in abundance (2 fish/hr). Few anglers targeted or caught smallmouth bass likely from low abundance. Smallmouth bass provide a very low density secondary fishery at this time in Bear Lake.

Northern Pike. Northern pike were the most common gamefish harvested by anglers on Bear Lake. Mean length of northern pike harvested was similar (21.9 in) when compared to (21.6 in) from a study of 55 northern Wisconsin lakes (Margenau et al. 2003). Northern pike appear to be an important component of the gamefishery on Bear Lake and a respectable action orientated fishery is currently provided.

Panfish. Panfish were the most common fish caught and harvested on Bear Lake. Size structure of larger bluegill was poor (RSD-8=0) and mean length of bluegill harvested (7.2 in) is reflective of this poor size structure. Black crappie size structure was considerably better with a mean length harvested at 9.7 in and provide a better angling opportunity for larger panfish.

Management Recommendations

1. In an effort to increase the density of the walleye population (1.5-2.0 fish/acre) in Bear Lake stocking quotas should be converted from small to large fingerling walleye for an 8-10 year period and be re-evaluated.
2. The minimum length limit for walleye should be increased from 15 to 18 inches. This regulation change will reduce angler harvest of female walleye, increase angler catch rates and increase the number of adult fish in the population.

3. In an effort to reduce any largemouth bass predation on stocked walleye, largemouth bass abundance should be lowered to less than 20 fish/hr as measured by spring electrofishing. A no minimum length limit with a daily bag of 5 fish in total should be pursued to allow as well as encourage anglers to harvest largemouth bass.

4. No panfish management changes are recommended, however in the future, if bluegill size structure remains poor and growth is not a limiting factor panfish regulations should be re-evaluated.

Literature Cited

- Becker, G. C. 1983. Fishes of Wisconsin. University of Wisconsin Press, Madison.
- Benike, H. 2005a. Changes in the Gamefish Community of a Small Northwestern Wisconsin Lake Over a 25-Year Period, Ward Lake, Polk County, Wisconsin. Wisconsin Department of Natural Resources, Internal Fisheries Management Report. Barron Field Office.
- Benike, H. 2005b. Treaty Assessment Survey, Half Moon Lake, Polk County, Wisconsin 2001. Wisconsin Department of Natural Resources, Internal Fisheries Management Report. Barron Field Office.
- Benike, H. 2005c. Treaty Assessment Survey, Big Butternut Lake, Polk County Wisconsin 2003. Wisconsin Department of Natural Resources, Internal Fisheries Management Report. Barron Field Office.
- Benike, H. 2006. Treaty Assessment Survey, Lower Turtle Lake, Barron County Wisconsin 2004. Wisconsin Department of Natural Resources, Internal Fisheries Management Report. Barron Field Office.
- Benike, H. 2008. Beaver Dam Lake Fisheries Survey, Barron County, Wisconsin 2005-2007.

- Wisconsin Department of Natural Resources, Internal Fisheries Management Report. Barron Field Office.
- Brooking, T.E., R. J. Jackson, L. G. Rudstam, and A. J. VanDeValk. 2001. Factors affecting survival of stocked walleye in New York Lakes. Progress Report 1991-2000. Cornell University. Cornell University Biological Field Station. 36pp.
- Cornelius, R. 2002. Fish Survey, Bear Lake, 2000. Wisconsin Department of Natural Resources. Internal Fisheries Management Report. Barron Field Office.
- Fayram, A. H., Hansen, M.J., and T.J. Ehlinger. 2005. Interactions between Walleyes and Four Fish Species with Implications for Walleye Stocking. North American Journal of Fisheries Management 25:1321-1330.
- Hennessy, J. 2002. 2001-2002 Ceded Territory fishery assessment report. Wisconsin Department of Natural Resources. Administrative Report 55, Madison.
- Kampa, J. M. and G.R. Hatzenbeler. 2009. Survival and Growth of Walleye Fingerlings Stocked at Two Sizes in 24 Wisconsin Lakes. North American Journal of Fisheries Management 29:996-1000.
- Margenau, T. L., S. J. Gilbert, and G. R. Hatzenbeler. 2003. Angler catch and harvest of northern pike in northern Wisconsin lakes. North American Journal of Fisheries Management 23:307-312.
- Nate, N.A., M. A. Bozek, M. J. Hansen, C. W. Ramm, M. T. Bremigan, and S. W. Hewett. 2003. Predicting the occurrence and success of walleye populations from physical and biological factors of northern Wisconsin lakes. North American Journal of Fisheries Management 23:1207-1214.
- Rasmussen, P. W., M. D. Staggs, T. D. Beard, Jr., and S. P. Newman. 1998. Bias and confidence interval coverage of creel survey estimators evaluated by simulation. Transactions of the American Fisheries Society 127:469-480.
- Stein, R. A., R. F. Carline, and R. S. Hayward. 1981. Largemouth bass predation on stocked tiger muskellunge. Transactions of the American Fisheries Society 110:604-612.

Table 1. Walleye stocking and fall fingerling catch per unit of effort (CPUE) from electrofishing for Bear Lake, Barron County, Wisconsin. Fall fingerling CPUE may also include naturally reproduced walleye.

Length	Number	Stocking rate	Fall Electrofishing
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Year	(in)	Stocked	(no/acre)	(no YOY/mile)
1991	< 3.0"	68,593	50	ns*
1992	< 3.0"	18,849	14	0.6
1992	> 5.0"	5,238	4	ns
1993	< 3.0"	67,900	50	ns
1993	> 5.0"	5,185	4	ns
1995	<3.0"	72,366	53	ns
1996	<3.0"	67,900	50	0.0
1996	>5.0"	2,039	1+	0.0
1997	<3.0	67,900	50	ns
1998	<3.0	12,845	9	ns
1999	<3.0"	89,005	66	ns
2000	>3.0"	14,850	11	0.0
2001	<3.0"	154,198	113	1.0
2003	<3.0"	157,733	116	0.3
2004	fry	525,000	386	2.1
2004	<3.0"	129,519	95	2.1
2006	>5.0"	13,578	10	1.7
2008	<3.0"	47,526	35	0.0

* ns indicates no sampling was done.

Table 2. 2008-2009 creel survey data for major game and panfish species, Bear Lake, Barron County, Wisconsin.

Species	Directed Effort %	Projected Catch	Projected Harvest	Mean len. (in) Harvested
Walleye	7.9	1322	209	19.2
Largemouth bass	13.1	6550	650	15.7
Smallmouth bass	1.6	355	12	14.1
Northern pike	18.0	10,310	1400	21.9
Bluegill	30.7	85,959	33,042	7.2
Black crappie	23.4	28,579	10,519	9.7
Yellow perch	0.2	5,161	683	9.5

Table 3. Walleye mean length (in) at age, Bear Lake 2008, and local and regional means, Wisconsin. Local and regional mean length information is from WDNR Fisheries and Habitat database.

Age	N	Bear Lake Mean 2008	Barron & Polk County (Local Mean)	Northern Region (Regional Mean)
4	40	14.4	15.4	14.1
5	5	14.8	17.5	16.1
6	15	19.8	18.8	17.7
7	10	22.3	20.4	19.3

Table 4. Largemouth bass mean length (in) at age, Bear Lake 2008, and local and regional means, Wisconsin. Local and regional mean length information is from the WDNR Fisheries and Habitat database.

Age	N	Bear Lake Mean 2008	Barron & Polk County (Local Mean)	Northern Region (Regional Mean)
3	7	9.4	9.3	9.0
4	9	11.0	11.7	11.0
5	16	12.3	13.2	12.7
6	12	13.9	14.9	14.6

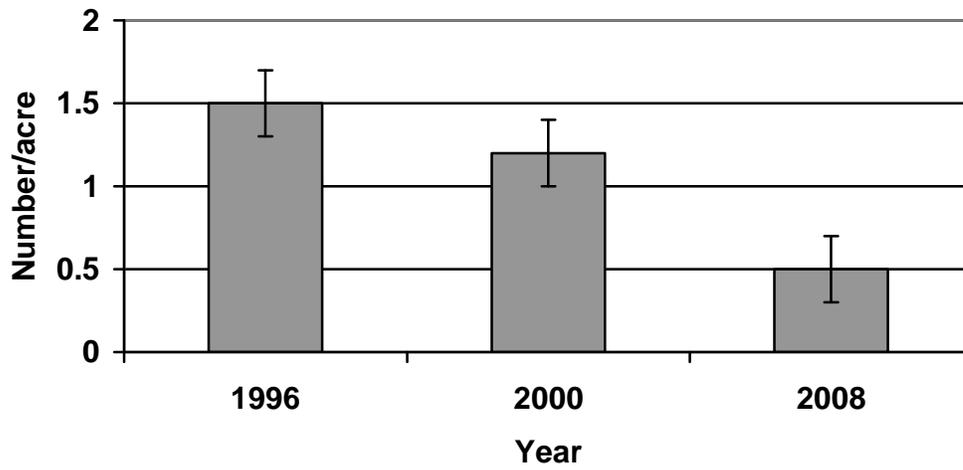


Figure 1. Adult walleye population density (number/acre), Bear Lake, Barron County, Wisconsin.

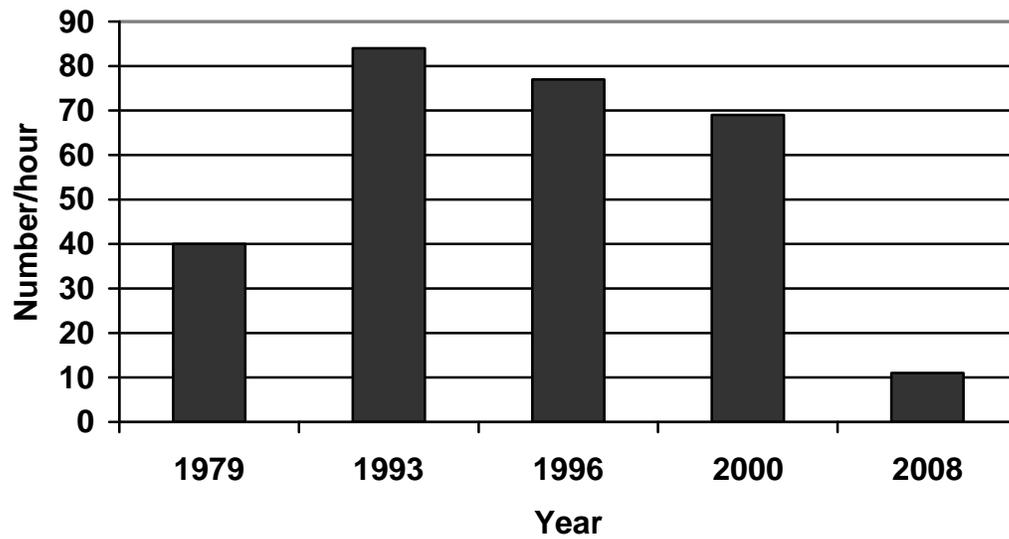


Figure 2. Relative abundance of walleye from spring electrofishing surveys, Bear Lake, Barron County, Wisconsin.

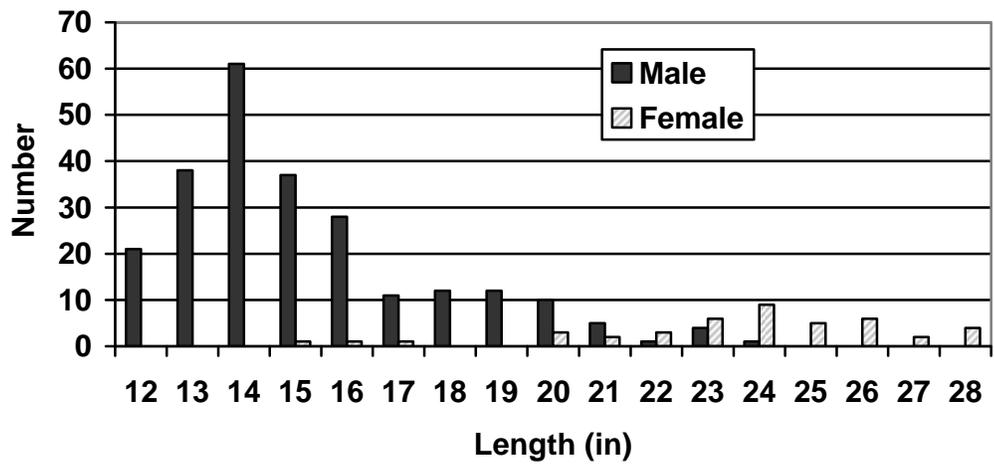


Figure 3. Walleye length frequency by sex, Bear Lake, Barron County, Wisconsin (N=284).

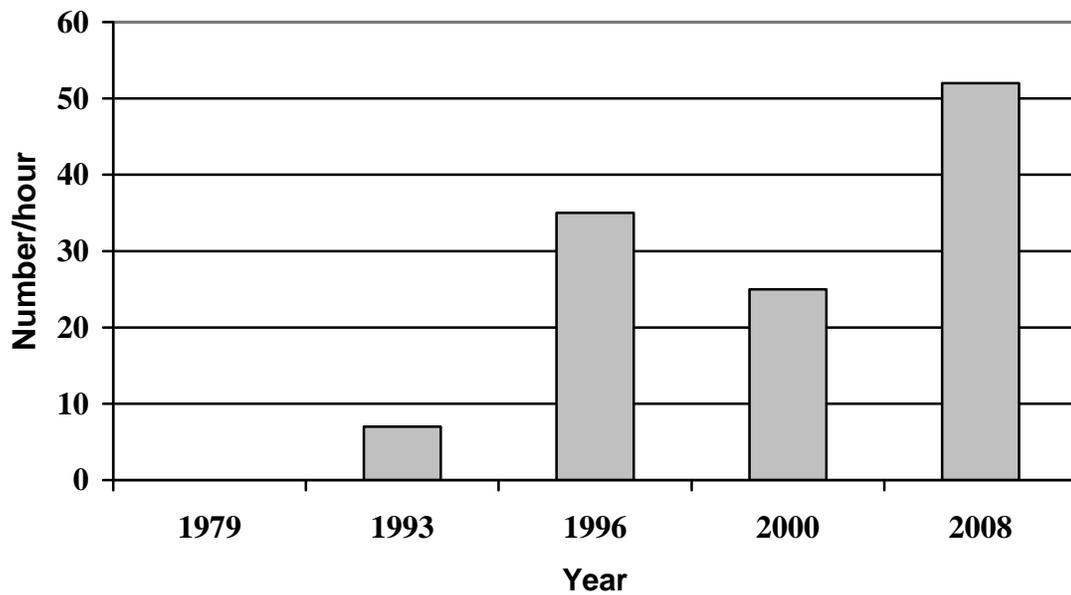


Figure 4. Relative abundance of largemouth bass from spring electrofishing surveys, Bear Lake, Barron County, Wisconsin.

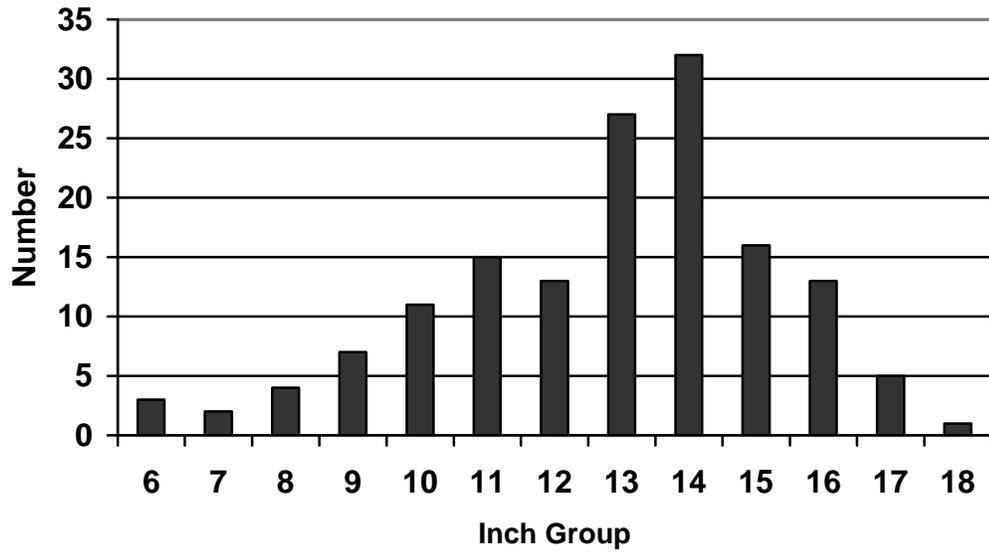


Figure 5. Largemouth bass length frequency, Bear Lake, Barron County, Wisconsin 2008.

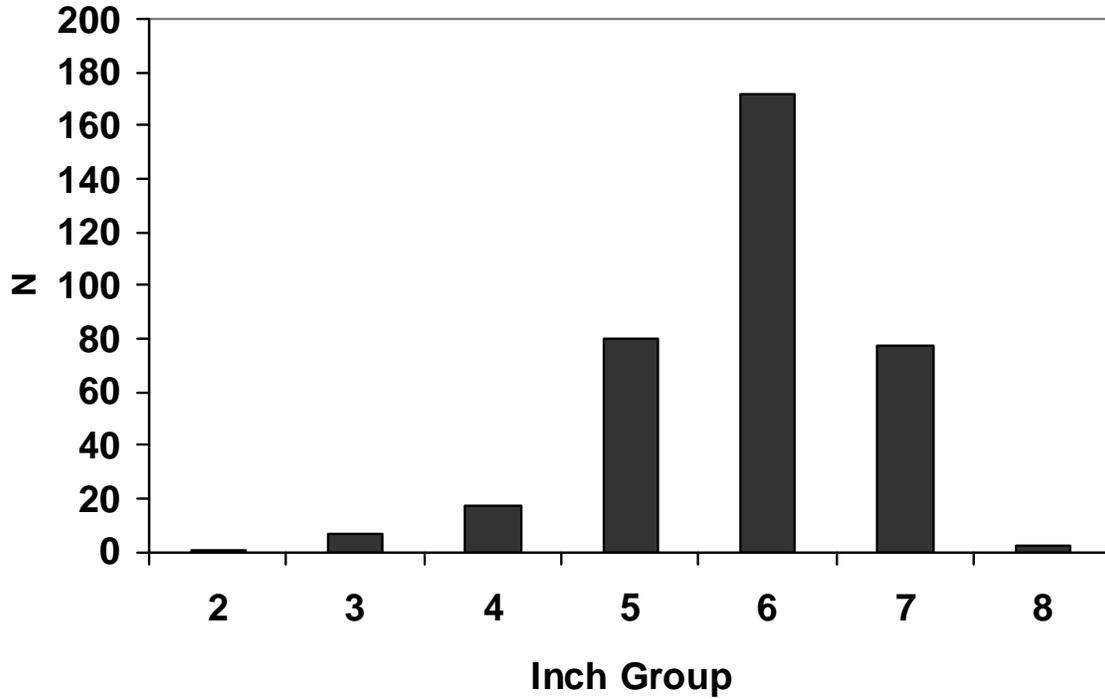


Figure 6. Bluegill length frequency, Bear Lake, Barron County, WI.