CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: January 25, 2005 FILE REF: 3600

TO: Randy Schumacher

FROM: Sue Beyler and Steve Gospodarek

SUBJECT: Spring 2004 Comprehensive Survey and Musky Evaluation on Oconomowoc Lake, Waukesha County. WBIC 849600

Abstract

This is our second comprehensive survey on Oconomowoc Lake since the public access opened in 1994 and provided us an excellent opportunity to monitor changes in the fishery that may be occurring as a result of increased fishing pressure. Our active management of Oconomowoc Lake since 1994 is stocking of both walleye and northern pike fingerlings, and an 18-inch minimum length limit for walleyes. The statewide 26-inch minimum length limit for northern pike came into effect in 1995.

Population density of both walleye and northern pike have increased over the 10-year period, which included biennial stocking of walleye fingerlings and annual stocking of northern pike. A small decrease in the mean length of walleyes is the result of higher numbers of young walleyes (under 18-inches long) rather than a decline in the number of large walleyes. Mean length of northern pike increased as a result of the new length limit.

Despite the fact that we do not stock muskies directly into Oconomowoc Lake, the musky population increased 80 percent since our last survey. We have documented musky migration as far downstream as Lac La Belle. Oconomowoc Lake now has nearly the same musky density and biomass as Okauchee, which is stocked each year with musky fingerlings. Muskies have been blamed on some lakes for negative impacts to walleyes and other gamefish and panfish species. The results of this study refute that assumption.

Both largemouth and smallmouth bass increased in number and biomass during the 10-year period. Smallmouth, in particular, have expanded their population with a 3-fold increase in number and a 4-fold increase in standing stock. Smallmouth nest in deeper water than largemouth and may, therefore, be less vulnerable to early season catch and harvest.

Bluegill catch rate also increased dramatically since the last survey. The very low catch rate and population estimate for bluegills seen in our 1994 study was a source of concern. Earlier reports from people who fished the lake in the 1980's indicated that relatively few anglers sometimes harvested large numbers of bluegills. This is a prime example that even a medium-sized lake can be over-fished, even by a small group of anglers targeting panfish. Additional protection, in the form of reduced bag limits, may be needed to maintain panfish populations in infertile lakes such as Oconomowoc.

Methods

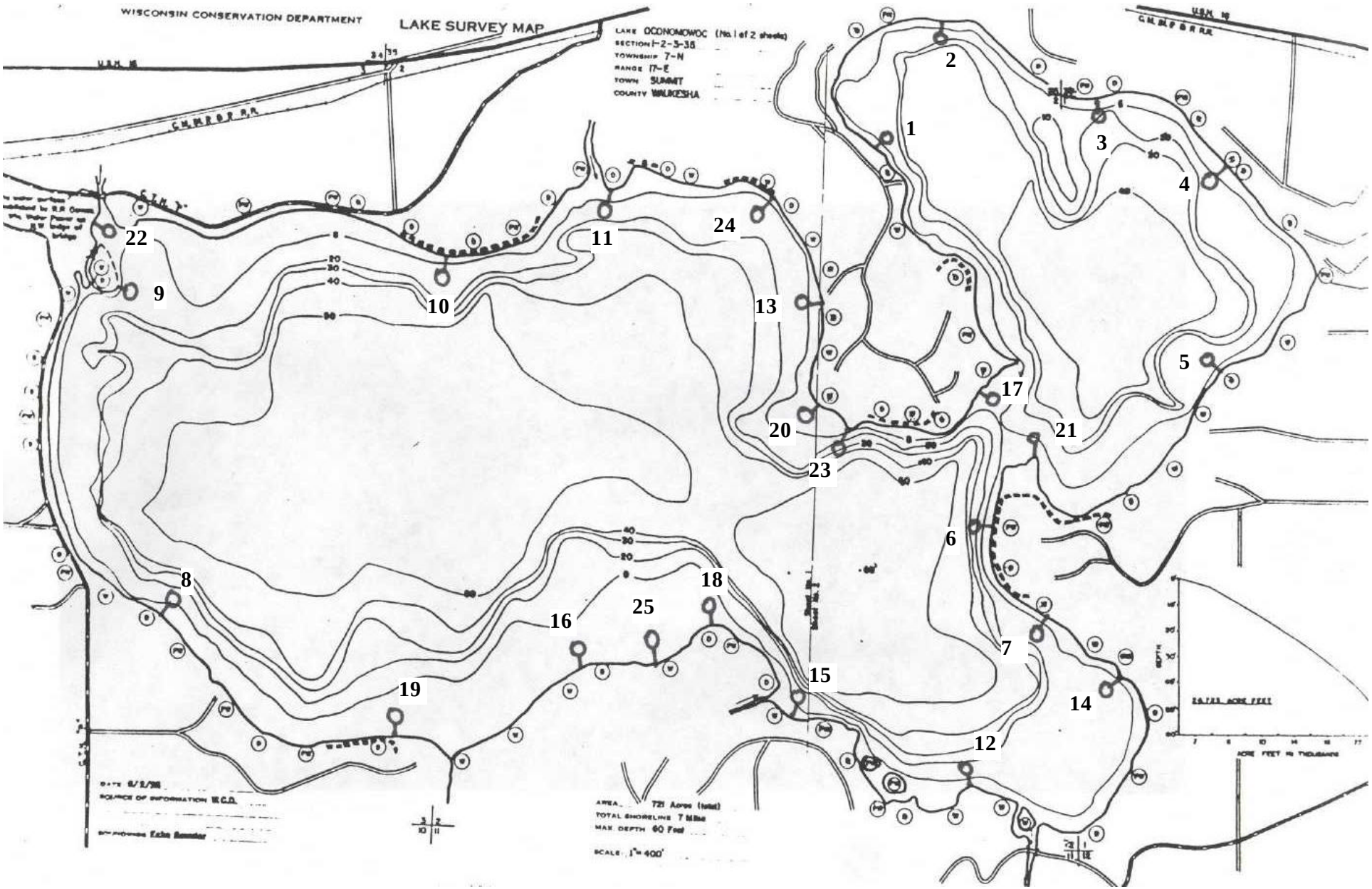
We used both fyke nets and electrofishing to sample the fish populations on Oconomowoc Lake. Fyke nets were set on March 24, just as the ice was leaving the lake. From 5 to 12 nets were fished at any one time with nets added and moved as greater areas of the lake opened up. Our early netting focused on northern pike. Nets were left in until April 16 to cover walleye spawning season. Total fyke netting effort was 259 net nights. Panfish were measured from randomly selected nets. In the other nets, panfish were only identified and counted.

Our early electrofishing focused on catching muskies, so we concentrated our effort on the Oconomowoc River from Oconomowoc Lake upstream to the Okauchee Lake dam and the area around the mouth of the river. Later April and May electrofishing for walleyes and bass included entire circuits of the lakeshore. Pulsed D.C. electrofishing at approximately 240 volts and 12 to 16 amps was used with two dipnetters.

All gamefish were identified, measured in inches and tenths, weighed in pounds, and scales were collected for aging. If gamefish were very abundant, we collected scales from only 10 fish per inch group of each species. Panfish were measured in inches and tenths, and scales were collected from 10 per half-inch group, by species.

Muskies, northern pike, walleyes and bass were fin-clipped to identify recaptures. Muskies, northerns and walleyes were given a differential fin-clip by sex; a left pectoral clip for males, right pectoral for females and upper caudal for sex unknown. Bass were all given upper caudal clips.

Figure 1. Survey map of Oconomowoc Lake, with fyke net locations indicated by numbered circles.



Results – Muskies

Almost our entire musky sample from Oconomowoc Lake was taken by electrofishing from the Oconomowoc River between the Okauchee Lake dam and the inlet to Oconomowoc Lake. We captured only 7 muskies in fyke nets in the lake itself. Muskies congregate in the river in spring during their spawning season. The Okauchee Lake dam prevents further upstream movement.

In 5 hours of electrofishing over 4 days we captured 72 male and 34 female muskies, not including recaps (Table 1). Mean length of males was 35.7 inches and for females was 40.5 inches. Mean weight was 11.76 lbs. And 18.16 lbs., respectively. Males ranged in length from 26.7 to 44.5 inches (Figure 2). Females ranged from 33.3 to 45.8 inches (Figure 3). Our largest musky was a 45.9-inch female that weighed 30.20 lbs.

Table 1. Muskies captured by electrofishing on Oconomowoc Lake and the Oconomowoc River upstream to the Okauchee Lake dam on March 22 and 29, and April 1 and 8, 2004. Total electrofishing time was 5 hours. Sample from targeted area, not random.

Sex	Number Captured	Mean Length	Std. Dev.	Mean Weight	Std. Dev.
Male	72	35.7	3.13	11.76	3.266
Female	34	40.5	3.36	18.16	4.878

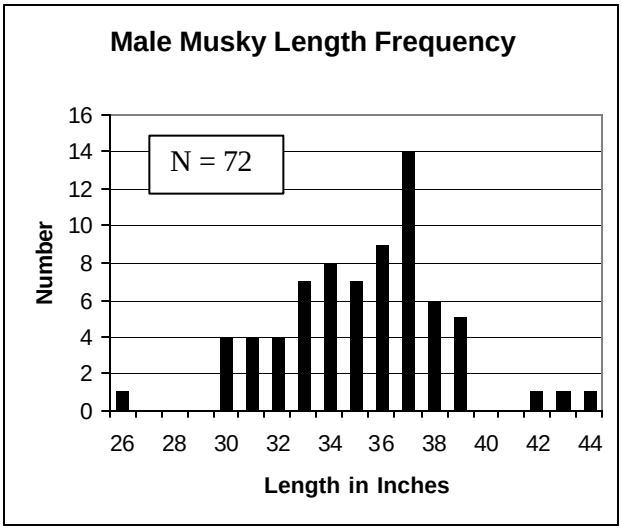


Figure 2. Length frequency of male muskies captured by electrofishing on Oconomowoc Lake, spring 2004.

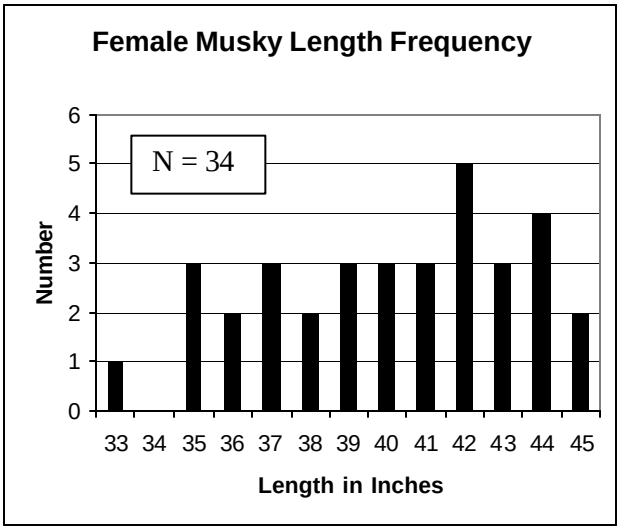


Figure 3. Length frequency of female muskies captured by electrofishing on Oconomowoc Lake, spring 2004.

We estimated the population of adult muskies by mark and recapture using electrofishing for both the marking and recapture runs. We marked 61 male muskies and 23 female muskies during 3 marking runs. On our recapture run, we captured 30 male muskies, of which 19 were recaptured fish, and 17 females, of which 6 were recaptures. Using Chapman's version of the Peterson single census formula,

$N = \frac{(M+1)(C+1)}{R+1}$, we obtained a population estimate of 96 males (95% confidence range of 63 – 154) and 62 females (95% confidence range of 31 – 135), or 0.2 per acre of adult males and females combined.

Applying the mean weight of male and female muskies to the population estimate gives us an estimated total biomass of 2,255 lbs. (1,129 males and 1,126 females) or 2.94 lbs. per acre.

We determined year-class strength, mean length at age and mean weight at age by collecting scale samples from all muskies captured. Seven year classes of males and 5 year classes of females were found in our aging study (Tables 2 and 3).

Table 2. Mean length and weight of each year class of male muskies captured from Oconomowoc Lake, spring 2004.

Age	Number Aged	Mean Length	Std. Dev.	Mean Weight	Std. Dev.
IV	5	31.7	3.14	8.08	2.269
V	30	34.1	2.36	10.00	2.190
VI	18	35.9	2.19	11.96	2.090
VII	7	38.1	1.13	14.73	2.134
VIII	8	38.7	3.52	14.34	3.432
IX	2	40.2	3.04	15.46	4.448
X	1	39.4	-	16.20	-
Total	71	35.8	3.26	11.76	3.266

Table 3. Mean length and weight of each year class of female muskies captured from Oconomowoc Lake, spring 2004.

Age	Number Aged	Mean Length	Std. Dev.	Mean Weight	Std. Dev.
V	3	36.5	0.70	13.10	1.819
VI	5	36.2	2.48	12.58	2.794
VII	9	39.5	2.31	16.61	3.110
VIII	8	42.3	1.99	19.10	3.637
IX	8	43.7	1.56	23.36	3.342
Total	33	40.5	3.36	18.16	4.878

We graphed the mean length of each year class of male and female muskies against the statewide average of male and female muskies from the fish management reference book (taken mainly from northern Wisconsin waters). Both male and female musky growth in Oconomowoc Lake is two or more years ahead of these statewide averages (Figures 4 and 5).

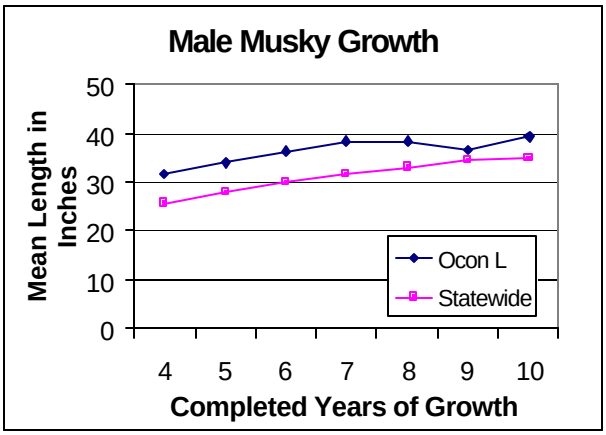


Figure 4. Mean length at age for male muskies captured from Oconomowoc Lake, 2004

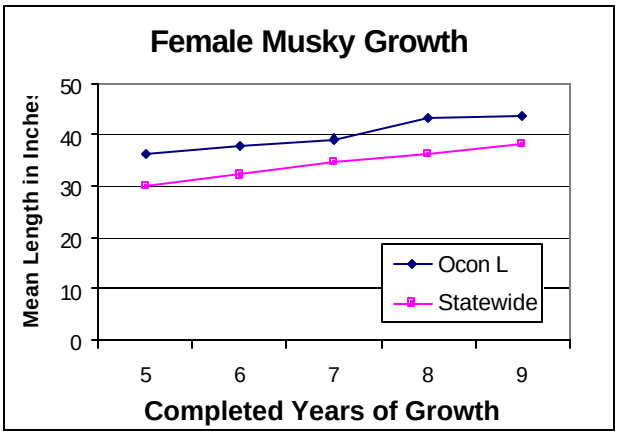


Figure 5. Mean length at age for female muskies captured from Oconomowoc Lake, 2004

Catch curves for male and female muskies were constructed from the year class data, and annual mortality rate calculated from the results (Figures 6 and 7). Male muskies in our sample have an annual mortality rate of 49 percent from age 5 to age 10. Age 5 male muskies are just reaching the 34-inch minimum legal length limit. Female muskies, from age 7 to 9, show annual mortality rate of only 6 percent.

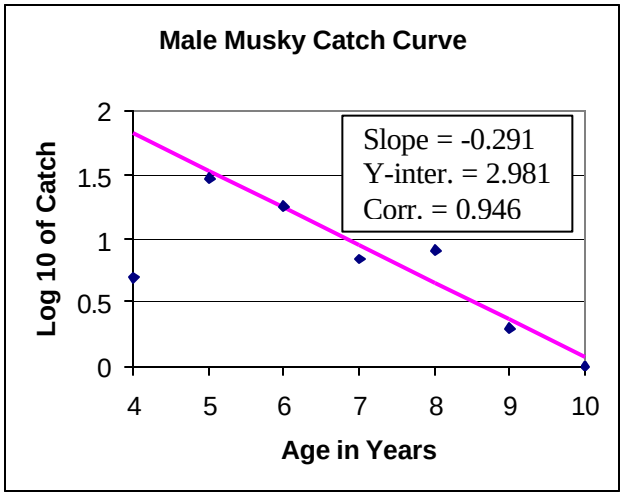


Figure 6. Catch curve of male muskies captured by electrofishing from Oconomowoc Lake, spring 2004.

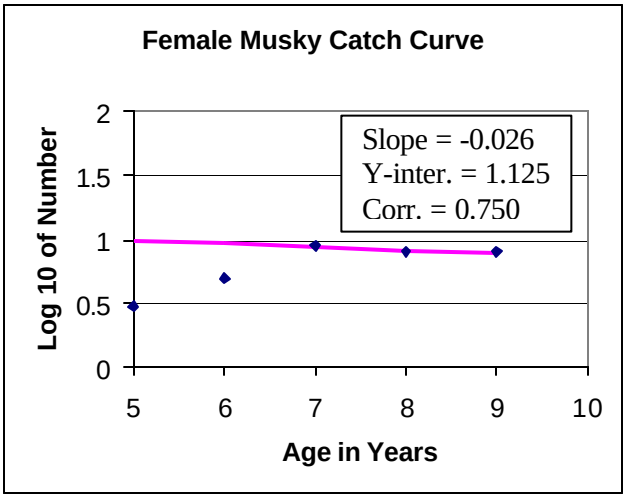


Figure 7. Catch curve of female muskies captured by electrofishing from Oconomowoc Lake, spring 2004.

Walleyes

Walleyes were captured both in fyke nets and by electrofishing. We measured 531 male, 207 female and 17 immature walleyes caught in fyke nets (Table 4). Walleyes in our sample had a mean length of 15.3 inches (males), 17.4 inches (females) and 9.8 inches (immature). In addition to those caught in fyke nets, 11 male and 55 female walleyes were captured during the musky electrofishing survey in early April. These walleyes had a mean length of 16.5 inches and 16.7 inches, respectively.

Table 4. Catch rate and mean length of walleyes captured by fyke net from Oconomowoc Lake, spring 2004. Number Captured does not include recaps. Total effort was 259 net nights. Nets were set for multiple species, and did not target only walleyes.

Sex	Number Captured	Catch per Net Night	Mean Length	Std. Dev	Mean Weight	Std. Dev.
Male	531	2.1	15.3	1.87	1.32	0.478
Female	207	0.8	17.4	2.36	2.16	1.088
Immature	17	0.1	9.8	2.97		
Total	755	2.9				

Male walleyes ranged from 6 to 25 inches in length (Figure 8). The bulk of the sample fell between 13 and 17 inches, with the peak at 15. Female walleyes ranged from 12 to 27 inches, with the peak at 16 inches in length (Figure 9).

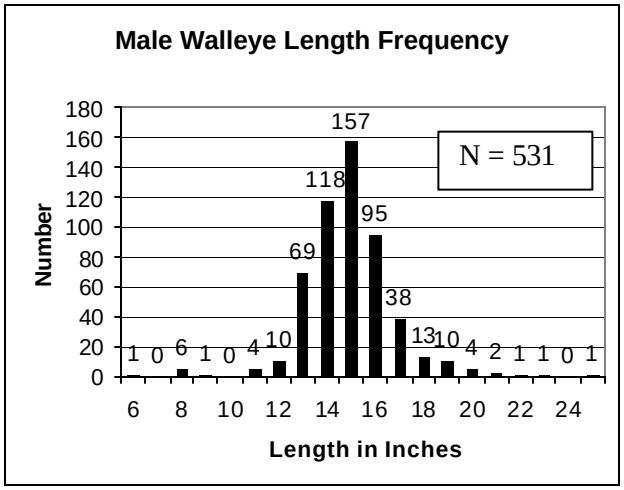


Figure 8. Length frequency of male walleyes captured by fyke net from Oconomowoc Lake, spring 2004.

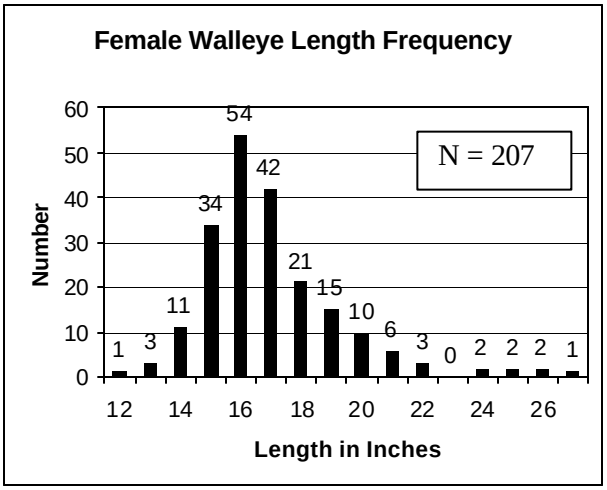


Figure 9. Length frequency of female walleyes captured by fyke net from Oconomowoc Lake, spring 2004.

Walleyes were marked in fyke nets and early-April electrofishing, and recaptured during two nights of electrofishing in late-April to produce a population estimate. A total of 804 adult walleyes (542 males and 262 females) were marked. During our recapture runs on April 19 and 21, many adult walleyes were finished spawning, which made it difficult to determine the sex of unmarked walleyes. Therefore, we combined sexes to obtain an adult walleye (males and females combined) population estimate. We captured 383 walleyes in our recapture runs, of which 135 were marked. Using the Chapman single-census formula, as above, we obtain an estimate of 2,273 adult walleyes (95% confidence range of 1,920 to 2,688), or 3 per acre. Applying the proportion of males and females in our sample to our adult population estimate gives us a breakdown of 1,523 males and 750 females. Applying the population estimates to the mean length for male and female walleyes gives us a biomass estimate of 3,630 lbs., or 4.73 pounds per acre.

We aged walleyes using scales. Nine year-classes of male walleyes and 8 year-classes of females were found (Tables 5 and 6). Mean length and mean weight of each year class was calculated.

Table 5. Number, mean length and mean weight of each year class of male walleyes in our sample from Oconomowoc Lake, spring2004. *Stocked year classes; others are from natural reproduction.

Age	Number	Mean Length	Std. Dev.	Mean Weight	Std. Dev.
I *	2	8.1	0.07	0.19	0.085
II	8	9.5	2.37	0.34	0.212
III *	107	14.0	0.94	1.01	0.220
IV	212	15.0	0.84	1.21	0.208
V *	123	16.2	0.93	1.51	0.297
VI	37	17.6	1.57	1.94	0.514
VII *	16	19.2	1.40	2.59	0.660
VIII	3	19.3	1.07	2.46	0.441
IX *	0	-	-	-	-
X	1	23.4	-	4.81	-
Total	509	15.3	1.80	1.32	0.478

Table 6. Number, mean length and mean weight of each year class of female walleyes in our sample from Oconomowoc Lake, spring2004. *Stocked year classes; others are from natural reproduction.					
Age	**Number**	**Mean Length**	**Std. Dev.**	**Mean Weight**	**Std. Dev.**
III *	14	14.6	0.84	1.23	0.259
IV	56	16.3	1.40	1.71	0.480
V *	65	17.3	1.24	1.95	0.462
VI	37	18.9	1.55	2.58	0.689
VII *	11	21.3	2.60	3.94	1.587
VIII	3	23.9	2.30	5.34	1.252
IX *	3	25.7	0.51	5.98	0.451
X	1	27.0	-	7.00	-
Total	190	17.6	2.46	2.16	1.088

We graphed the mean length at age for male and female walleyes against the southeast region (SER) and statewide averages from the Fish Management Reference Book (Figures 10 and 11). Male walleyes are very comparable in growth rate to the statewide average, but somewhat slower than the average for southeast Wisconsin lakes. Female walleye growth rate is slightly higher than that seen statewide and in the southeast region.

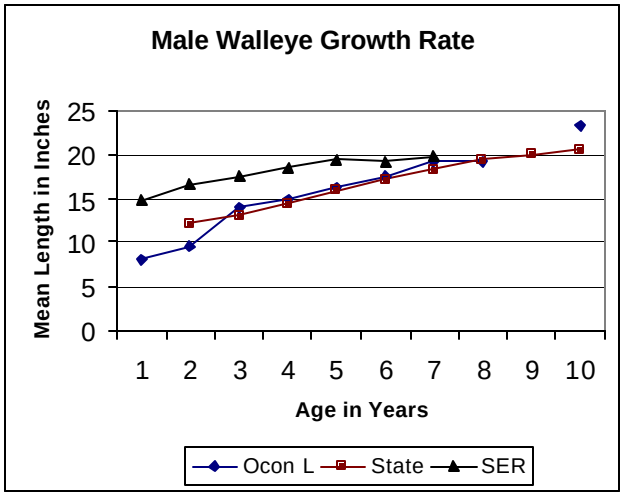


Figure 10. Mean length of each age group of male walleyes from Oconomowoc Lake (Ocon L) compared to lakes statewide (State) and in southeast Wisconsin (SER).

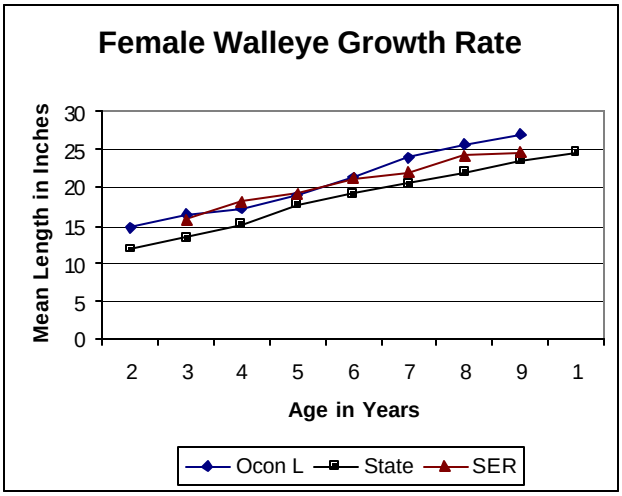


Figure 11. Mean length of each age group of female walleyes from Oconomowoc Lake (Ocon L) compared to lakes statewide (State) and in southeast Wisconsin (SER).

Catch curves were constructed for male and female walleyes (Figures 12 and 13). From these catch curves we calculated annual mortality rates. Male walleyes from age 4 through 10 have an annual mortality rate of 65 percent. Females from age 5 through 10 have annual mortality of 57 percent.

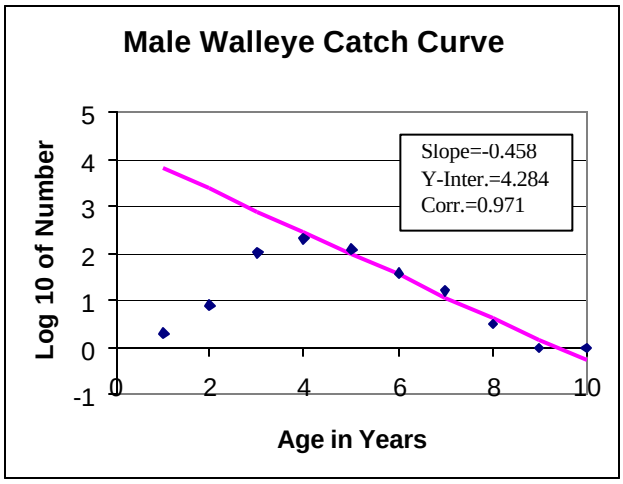


Figure 12. Catch curve for male walleyes captured by fyke net and electrofishing from Oconomowoc Lake, spring 2004. Odd-numbered ages are stocked year classes; even-numbered are from natural reproduction.

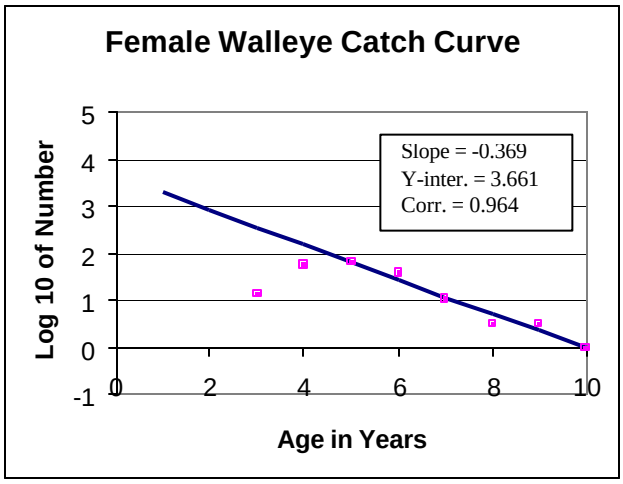


Figure 13. Catch curve for female walleyes captured by fyke net and electrofishing from Oconomowoc Lake, spring 2004. Odd-numbered ages are stocked year classes; even-numbered are from natural reproduction.

Northern Pike

We captured 105 male, 79 female and 41 immature northern pike in fyke nets (Table 7). Males averaged 16.3 inches in length, females averaged 23.4 inches and immature northerns averaged 10.8 inches in length. Mean weight for males was 1.22 lbs., for females 3.20 lbs. and for immature 0.32 lbs.

Table 7. Northern pike captured by electrofishing from Oconomowoc Lake, spring 2004. Number Captured does not include recaps. Total effort = 259 net nights. Nets were set for multiple species, not only northern pike.

Sex	Number Captured	Catch per Net Night	Mean Length	Std. Dev.	Mean Weight	Std. Dev.
Male	105	0.4	16.3	4.50	1.22	1.033
Female	81	0.3	23.4	4.34	3.20	1.759
Immature	41	0.2	10.8	1.96	0.32	0.212
Total	225	0.9				

Male northerns range from 9 to 31 inches in length. The length frequency (Figure 14) shows peaks at 13, 17 and 22 inches. Female northerns range from 14 to 33 inches in length. The length frequency for females (Figure 15) shows peaks at 18, 22, 26 and 29 inches.

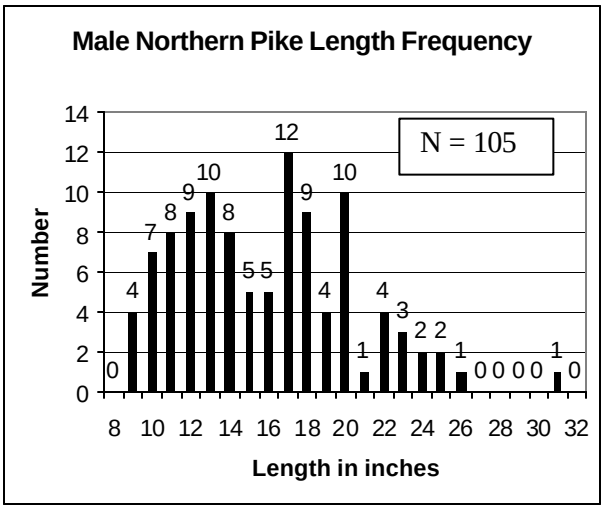


Figure 14. Length frequency for male northern pike captured by fyke net from Oconomowoc Lake, spring 2004.

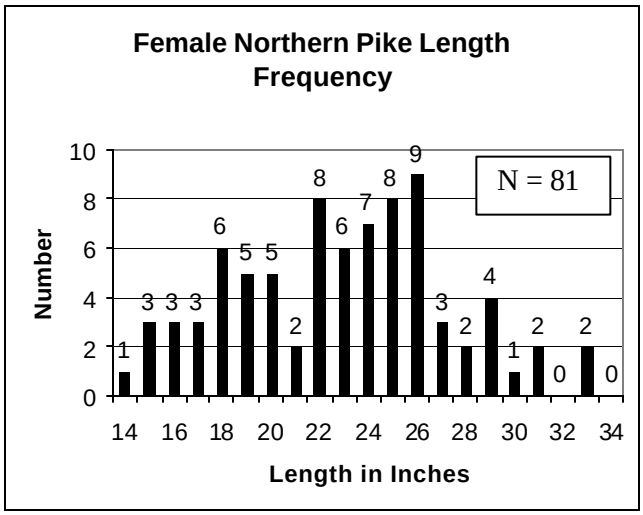


Figure 15. Length frequency for female northern pike captured by fyke net from Oconomowoc Lake, spring 2004.

We used a continuous mark and recapture method to estimate the population of male and female northern pike. During our fyke netting survey, we marked a total of 105 male northerns and recaptured 8 of them. Using the Schnabel formula $N = \frac{\sum (CtMt)}{R}$, we obtain a population estimate of 663 male northerns with a 95% confidence range of 336 to 1,559. We marked 84 female northerns and recaptured 8, resulting in a population estimate of 430 and a 95% confidence range of 218 to 1,012. This results in a density of 1.4 adult northern pike per acre. Applying the mean weight of male and female northern pike to their population estimates gives us a biomass estimate of 2,185 lbs. of adult northerns, or 2.85 lbs. per acre.

We aged male and female northern pike using scales. Five year classes of males and 6 year classes of females were found (Tables 8 and 9).

Table 8. Number, mean length and mean weight of each year class of male northern pike captured by fyke net from Oconomowoc Lake, spring 2004.

Age	Number	Mean Length	Std. Dev.	Mean Weight	Std. Dev.
I	41	12.2	1.47	0.46	0.252
II	44	17.5	2.00	1.22	0.396
III	14	22.2	2.02	2.40	0.696
IV	3	25.6	0.55	3.40	0.307
V	1	31.5	-	7.38	-
Total	103	16.3	4.49	1.22	1.033

Table 9. Number, mean length and mean weight of each year class of female northern pike captured by fyke net from Oconomowoc Lake, spring 2004.					
Age	**Number**	**Mean Length**	**Std. Dev.**	**Mean Weight**	**Std. Dev.**
I	1	14.2	-	0.63	-
II	25	19.2	1.61	1.57	0.471
III	34	23.9	2.47	3.27	1.278
IV	14	26.9	2.45	4.43	1.409
V	4	28.9	1.41	6.01	1.173
VI	3	32.4	1.41	6.28	0.311
Total	81	23.4	4.31	3.20	1.759

We graphed the growth rate (mean length at age) of male and female northern pike against statewide and Southeast Wisconsin averages (Figures 16 and 17). Both male and female northerns from Oconomowoc Lake are comparable to southeast Wisconsin averages, and above statewide average growth.

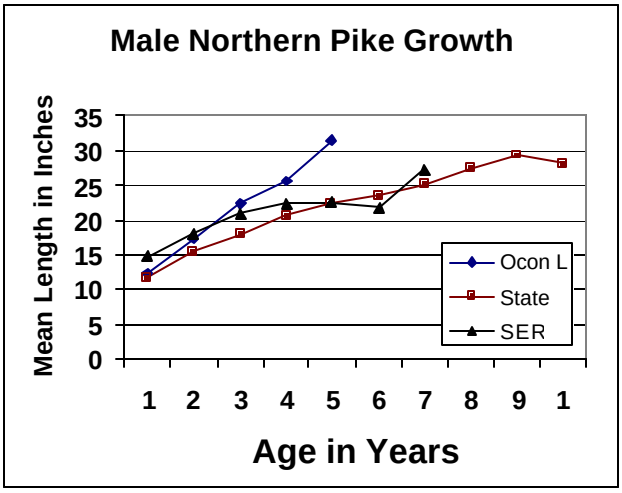


Figure 16. Mean length of each age group for male northern pike from Oconomowoc Lake compared to statewide and southeast Wisconsin averages.

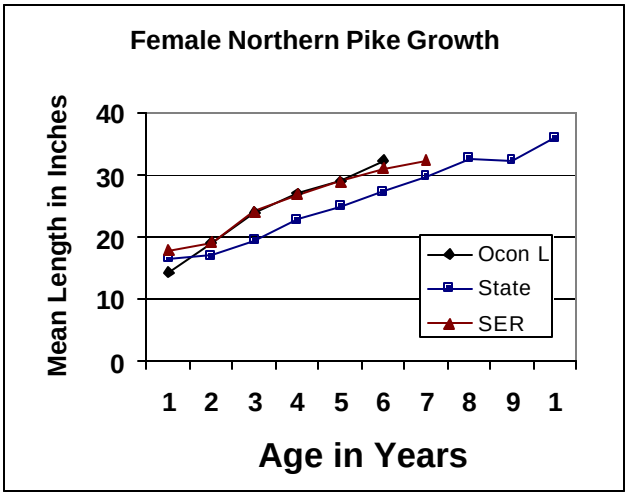


Figure 17. Mean length of each age group for female northern pike from Oconomowoc Lake compared to statewide and southeast Wisconsin averages.

We constructed catch curves for male and female northerns, using our aging data (Figures 18 and 19). Annual mortality rate calculated from the catch curves is 72 percent for male northern pike age 2 through 5. Female annual mortality, age 3 through 6, is 57 percent.

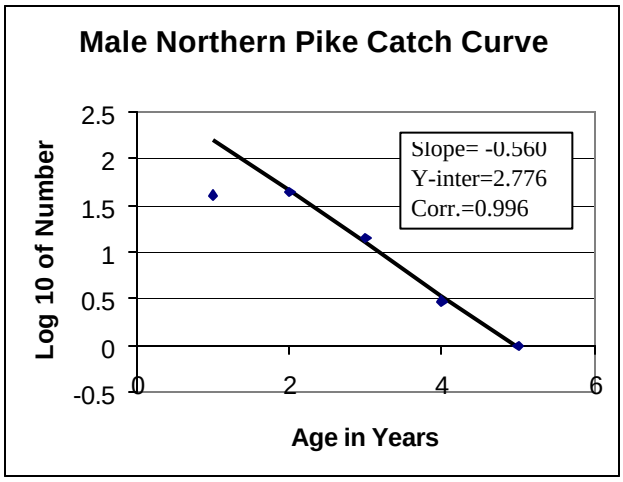


Figure 18. Catch curve for male northern pike captured by fyke net from Oconomowoc Lake, spring 2004.

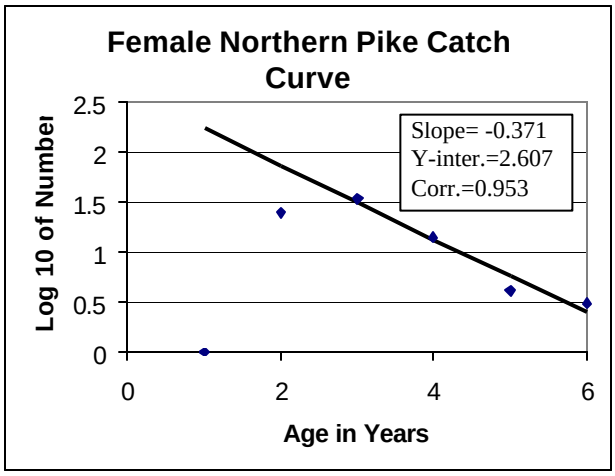


Figure 19. Catch curve for female northern pike captured by fyke net from Oconomowoc Lake, spring 2004.

Largemouth and Smallmouth Bass

We captured 336 smallmouth bass and 80 largemouth bass during electrofishing in late April and early May (Table 10). Smallmouth averaged 12.9 inches in length with an average weight of 1.32 lbs. Largemouth bass averaged 11.7 inches and 1.04 lbs.

Table 10. Smallmouth and largemouth bass captured by electrofishing from Oconomowoc Lake, spring 2004.

Species	Number	Mean Length	Std. Dev.	Mean Weight	Std. Dev.
Smallmouth Bass	336	12.9	2.72	1.32	0.849
Largemouth Bass	80	11.7	2.90	1.04	0.886

Smallmouth bass ranged from 7 to 20 inches in length. A strong peak in the length frequency appears at 12 inches (Figure 20). Lesser peaks occur at 8 and 16 inches. Proportional stock density (PSD) for smallmouth using a stock length of 7 inches and a quality length of 11 inches is an outstanding 82 percent. Relative stock density using a 15-inch quality length (RSD-15) is 24 percent.

Largemouth bass range from 3 to 21 inches in length (Figure 21). Strong peaks at 9 and 12 inches are also present. PSD for largemouth, using a stock length of 8 inches and a quality length of 12 inches is 44 percent. RSD-15 is 14 percent.

According to Anderson (1980), a balanced bass population will have PSD values between 40 and 70 percent and RSD-15 values between 10 and 25 percent. Smallmouth PSD is higher than this target range and smallmouth RSD-15 is also near the top of the range. This may indicate that we did not adequately sample small bass. Largemouth PSD and RSD-15 are in Anderson's recommended range for these structural indices.

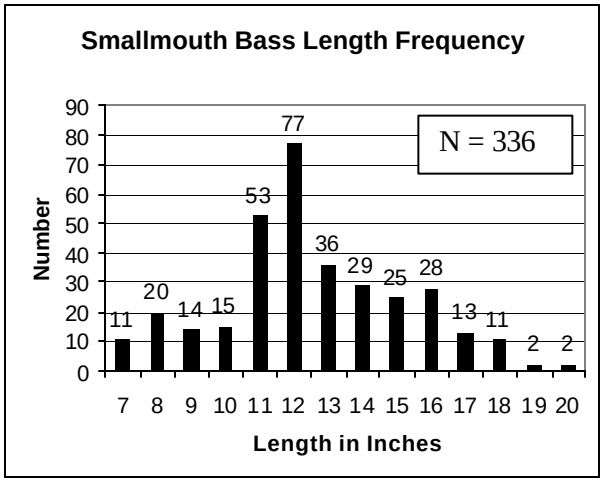


Figure 20. Length frequency of smallmouth bass captured by electrofishing from Oconomowoc Lake, spring 2004

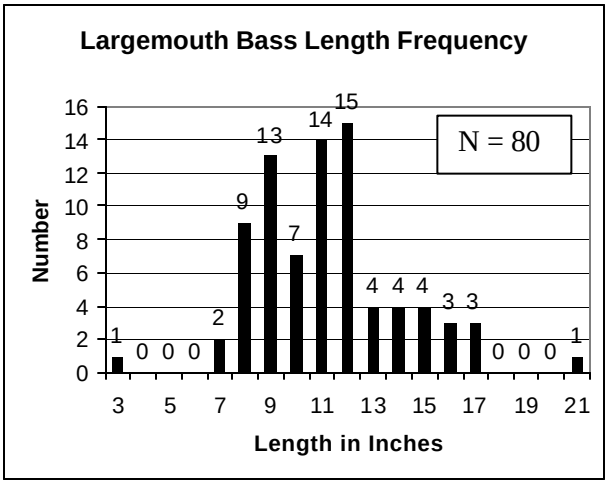


Figure 21. Length frequency of largemouth bass captured by electrofishing from Oconomowoc Lake, spring 2004

To obtain population estimates for largemouth and smallmouth bass, all bass were marked from our electrofishing runs on April 19 and 21. The May 19 electrofishing survey was the recap run.

We marked 235 smallmouth bass on the first two nights. Of the 107 smallmouth captured on the third night, 6 were recaps. Using the Chapman single census formula we obtain a population estimate of 3,641 smallmouth bass (95% confidence range of 1,808 to 7,965), or 4.7 per acre. Applying the mean weight for smallmouth in our sample yields an estimated biomass of 4,806 lbs., or 6.27 lbs. per acre.

Fifty-one largemouth bass were marked in the marking runs. In the recap run, we captured 30 largemouth, of which 1 was a recap. Again, using the Chapman formula we obtain a population estimate of 806 largemouth bass (95% confidence range of 244 to 1,466). Applying the mean weight to the population estimate gives us an estimated biomass of 838 lbs., or 1.09 lbs. per acre.

We aged smallmouth and largemouth bass using scale samples. Mean length and mean weight for each year class was calculated (Tables 11 and 12)

Table 11. Number, mean length and mean weight of each year class of smallmouth bass captured by electrofishing from Oconomowoc Lake, spring 2004.

Age	Number	Mean Length	Std. Dev.	Mean Weight	Std. Dev.
II	42	8.5	0.80	0.33	0.121
III	146	11.9	0.94	0.90	0.238
IV	76	13.9	1.25	1.48	0.425
V	52	16.3	1.21	2.30	0.592
VI	12	17.8	0.92	3.09	0.636
VII	5	18.8	1.44	3.81	0.839
VIII	1	20.1	-	4.94	-
Total	334				

Table 12. Number, mean length and mean weight of each year class of largemouth bass captured by electrofishing from Oconomowoc Lake, spring 2004.

Age	Number	Mean Length	Std. Dev.	Mean Weight	Std. Dev.
I	1	3.1	-	0.06	-
II	17	8.1	1.11	0.38	0.146
III	31	11.0	1.43	0.73	0.262
IV	18	12.6	1.08	1.09	0.273
V	8	15.3	1.22	2.00	0.353
VI	2	17.4	0.50	3.06	0.345
VII	2	17.4	0.35	2.76	0.177
VIII	0	-	-	-	-
IX	1	21.5	-	6.06	-
Total					

We graphed the mean length at age of smallmouth and largemouth bass against the southeast Wisconsin and statewide averages (Figures 22 and 23). Oconomowoc Lake smallmouth bass growth rate is higher than both southeast Wisconsin and statewide. Largemouth bass growth rate is slightly higher than that seen in southeast Wisconsin and statewide.

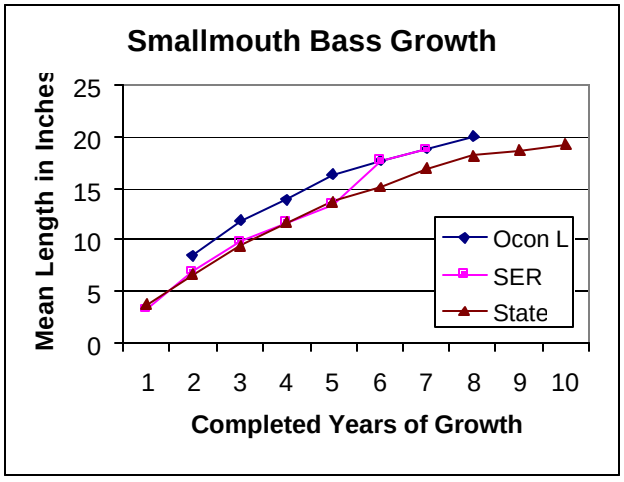


Figure 22. Growth rate, measured as mean length at age, of smallmouth bass from Oconomowoc Lake compared to the statewide and southeast Wisconsin average.

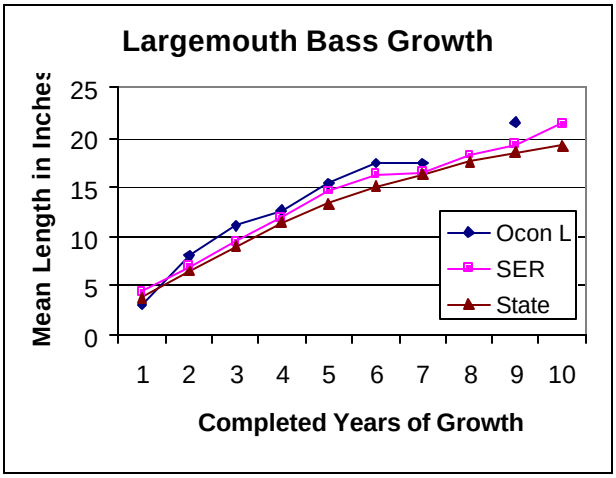
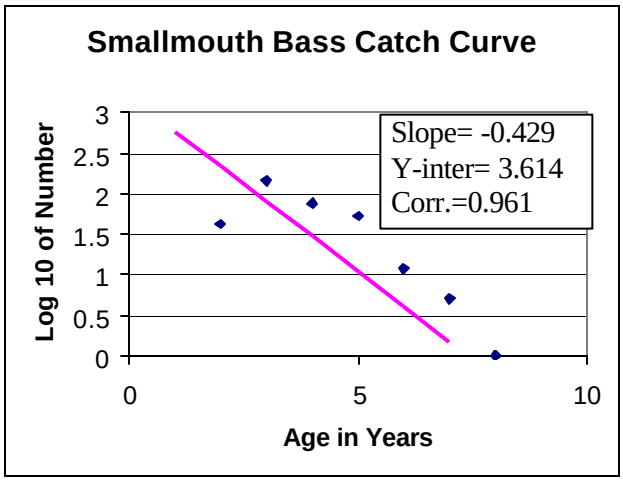
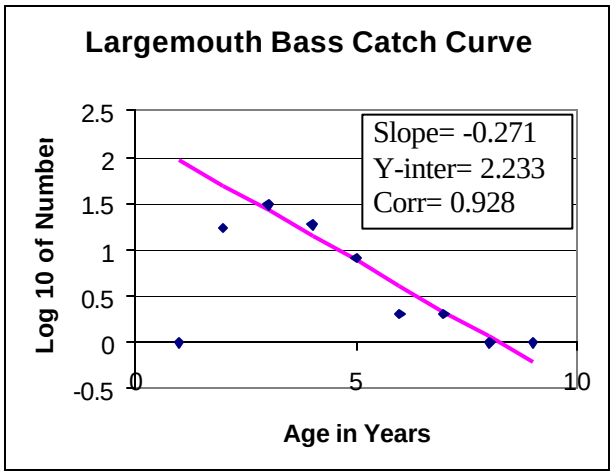


Figure 23. Growth rate, measured as mean length at age, of largemouth bass from Oconomowoc Lake compared to the statewide and southeast Wisconsin average.

We constructed catch curves for smallmouth (Figure 24) and largemouth bass (Figure 25), and calculated annual mortality for each species. Annual mortality for smallmouth bass age 3 through 8 is 46 percent. Annual mortality of largemouth bass age 3 through 9 is 63 percent.





Bluegills and Panfish

Bluegills and rockbass dominated our panfish sample (Table 12). Seven other species of panfish and non-game fish were captured in the fyke nets, but only a few of each. We measured 606 bluegills from our sample. They averaged 5.3 inches in length. The 258 rockbass that were measured averaged 6.3 inches.

Table 12. Summary of panfish and non-game fish captured by fyke net from Oconomowoc Lake, March 25 through April 2, 2004. Total effort = 95 net nights. Nets were set for multiple species and did not target panfish.

Species	Number	Catch per Net Night	Mean Length	Std. Dev.
Bluegill	3,029	31.9	5.3	1.38
Rockbass	1,839	19.4	6.3	1.71
Green Sunfish	23	0.2	4.9	1.65
Black Crappie	9	0.1	7.7	0.40
Pumpkinseed	10	0.1		
Yellow Perch	12	0.1		
Yellow Bullhead	10	0.1		
White Sucker	6	0.1		
Bowfin	5	0.1		

Most bluegills were between 4 and 6.9 inches in length. A few up to 8.9 inches were seen (Figure 26). Rockbass ranged from 2 to 10.9 inches, but most fell between 4 and 7.9 inches in length (Figure 27).

Nets set in the smaller eastern basin of the lake and near the inlet from the Oconomowoc River caught the most panfish. These are the areas where most of the aquatic plants are located. The north and south shores of the west basin offer little bluegill habitat, but are broad flats of sand, marl and gravel.

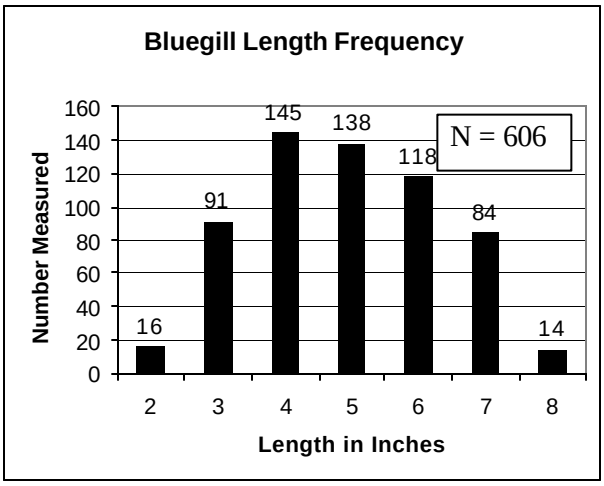


Figure 26. Length frequency of bluegills captured in fyke nets from Oconomowoc Lake, spring 2004.

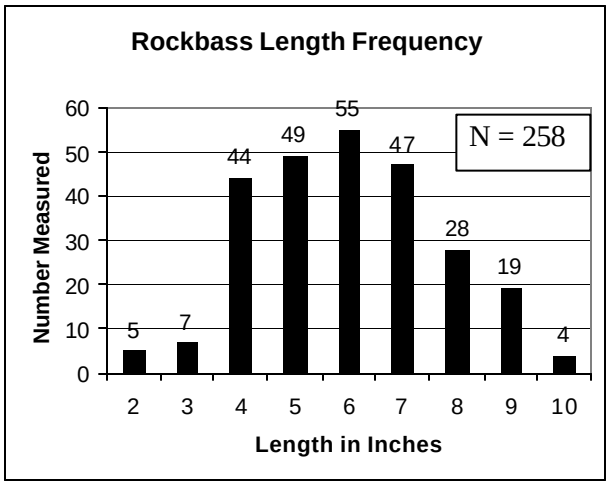


Figure 27. Length frequency of rockbass captured in fyke nets from Oconomowoc Lake, spring 2004.

Proportional stock density for bluegills, using a 3-inch stock length and a 6-inch quality length is 37 percent. Relative stock density using 8-inch quality length is 2 percent. PSD is well within the 20 to 60 percent range recommended by Anderson (1980), but RSD-8 is below the 5 to 20 percent target.

We aged bluegills using scales. Bluegills from age 2 to age 7 were found (Table 13). Mean length of each age group was calculated.

Table 13. Number and mean length of each age group of bluegills captured by fyke net from Oconomowoc Lake, spring 2004.

Age	Number	Mean Length	Std. Dev.
2	22	2.8	0.32
3	208	3.9	0.54
4	161	5.6	0.76
5	169	6.8	0.72
6	42	7.7	0.66
7	4	8.1	1.13

We graphed Oconomowoc Lake bluegill mean length at age against the statewide and southeast Wisconsin average (Figure 28). Oconomowoc Lake bluegills appear to be slightly below southeast Wisconsin and statewide average through age 3, then fall between the two averages from age 4 through 8.

We constructed a catch curve for bluegills (Figure 29) and calculated annual mortality from the results. Annual mortality for bluegills age 3 through 7 was 60 percent.

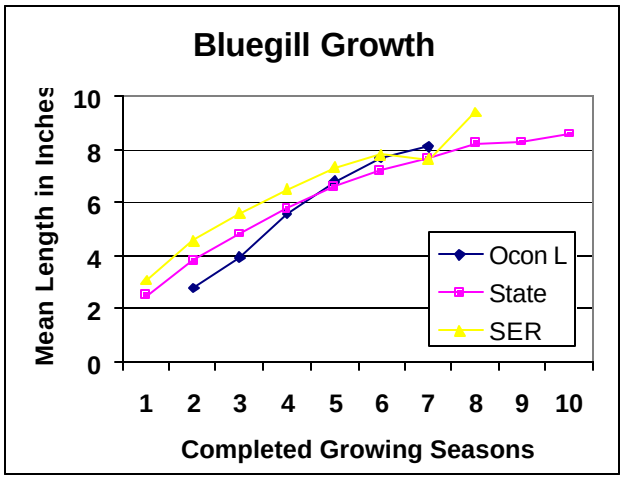


Figure 28. Mean length at age of Oconomowoc Lake bluegills compared to statewide and southeast Wisconsin.

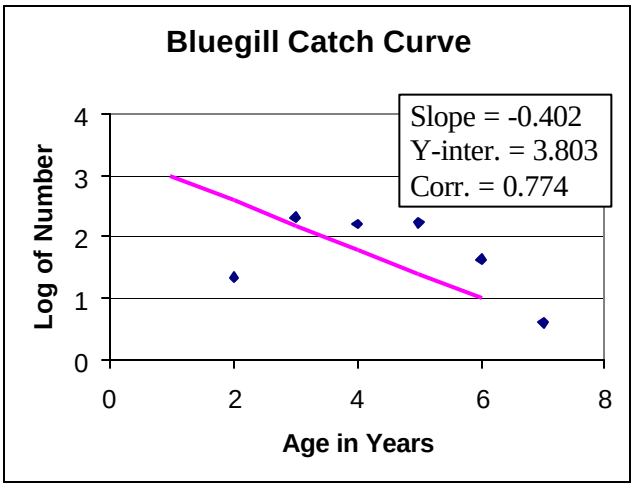


Figure 29. Catch curve for bluegills captured by fyke net from Oconomowoc Lake, spring 2004.

DISCUSSION

Our current estimated population of 158 adult muskies is 80 percent higher than the estimate of 88 we obtained in spring, 1994 (Schumacher and Beyler, 1995). Mean length of male and female muskies has increased slightly. Growth rates are essentially the same.

Oconomowoc Lake's adult musky density of 0.21 per acre is now nearly as high as the 0.23 per acre seen on Okauchee Lake in 2002 (Beyler, 2003), and is about 40 percent of the 0.52 per acre of Pewaukee Lake based on a 1998 comprehensive survey (Beyler, 2000). A comparison of 9 northern Wisconsin class A muskellunge lakes done by Hanson (1993) found adult musky density ranging from 0.09 to 0.61, with an average of 0.33 per acre. Oconomowoc Lake achieves a density well within that range without direct stocking. These muskies are fish that were stocked in Okauchee Lake and migrated downstream. As with Okauchee and Pewaukee Lake, significant natural reproduction is unlikely.

Oconomowoc Lake's 49 percent annual mortality rate for male muskies is somewhat higher than that seen in Okauchee Lake in 2002 (41 percent) and in Pewaukee Lake in 1998 (46 percent). We aged too few muskies in Oconomowoc Lake in 1994 to do a catch curve. The 6 percent annual mortality for female muskies is probably too low, due to inadequate sample size. We found a similarly low mortality rate for our small sample of female muskies in Okauchee Lake (12 percent), but found 49 percent annual mortality rate for females in Pewaukee Lake. The Pewaukee Lake musky samples were much larger, and are therefore more reliable. We can assume that the actual mortality rate for female muskies is similar to Pewaukee Lake's. Angler harvest rates, from the 1994 creel census, were extremely low compared to harvest rates for other gamefish species. Therefore, we can assume that little of the total annual mortality rate is due to angler harvest.

The walleye population in Oconomowoc Lake increased 133 percent in number, and 80 percent in biomass since our 1994 survey. Mean length of males from fyke nets and electrofishing, combined, declined 10 percent, from 17.0 to 15.3 inches. Mean length of females declined 12 percent, from 19.7 to 17.4 inches. In the length frequencies, the maximum length of male and female walleyes has increased by

2 to 3 inches, but the bulk of the increase in numbers of walleyes has been fish between 15 and 18 inches in length.

Annual mortality rate for male walleyes in the current survey is 65 percent, for males age 4 through 10. Our 1994 survey, which was done just after the public access opened and before walleye stocking began, was 34 percent for males age 4 through 13. Female annual mortality rate has gone up similarly, from 30 percent for females age 6 through 12 in 1994 to 57 percent for females age 5 through 10 in 2004. Our 1994 Oconomowoc Lake creel survey showed that walleye was the number one fish sought by anglers, and comprised 28 percent of the total angling effort and 42 percent of the effort aimed at catching gamefish species. Walleye was also the most frequently harvested gamefish, accounting for half of all gamefish that were kept by anglers in 1994.

Approximately 70,000 2-inch walleye fingerlings have been stocked every two years beginning in 1995 to supplement natural reproduction in response to the high angling pressure. The minimum length limit was raised from 15 to 18 inches on Oconomowoc Lake in 1997 to protect spawning females. The length limit, combined with stocking, appears to be accomplishing the goal of increased recruitment without negatively impacting the population size structure. Unstocked year classes are comparable in strength to stocked years due to the excellent success of walleye natural reproduction.

Our current population estimate of northern pike is 63 percent higher than that seen in 1994. In 1995, a statewide 26-inch minimum length limit went into effect. In addition to more northerns, the maximum length and the size structure have improved under this "new" regulation. The 1994 creel survey showed more than half of the northerns harvested were less than 26 inches long. This was an open water season creel, and does not account for harvest through the ice, which is usually higher.

Smallmouth bass continue to expand in this lake. Our 1994 survey report noted an increase in fall electrofishing catch rate from 1991 through 1994. We now see our spring population estimate has more than tripled since 1994. The 14-inch minimum length limit on largemouth and smallmouth bass, in effect since 1988, has resulted in an increase in smallmouth bass on many of our area lakes. Mean length of the smallmouth sampled increased by nearly 2 inches. However, standing stock of smallmouth is nearly 4 times as high as that seen in 1994.

Largemouth bass are also more numerous than in 1994. We were unable to obtain a population estimate in 1994 to compare to our current survey. However, catch rate (catch per hour) in 2004 is about 30 percent higher than in 1994. Mean length of largemouth in our samples is about 3 inches lower in 2004 compared to 1994. This is due mainly to the higher number of small largemouth seen in 2004. We saw only 1 largemouth less than 10 inches long in 1994. In 2004, nearly one-third of largemouth sampled were less than 10 inches in length. Hopefully, this indicates an improvement in largemouth spawning success and recruitment.

Our catch rate of bluegills increased dramatically between 1994 and 2004, from 7.8 to 31.9 per net night. Interestingly, mean length of the sample stayed the same, at about 5.3 inches. Growth rate of bluegills appears to be slightly lower now than in 1994, especially in the early years. In 1994 we estimated the bluegill population at only 1.6 per acre of bluegills 6 inches or longer. We were unable to estimate the bluegill population in 2004 because of a lack of recaptured fish. Total annual mortality for bluegills was identical in the two surveys, being 60 percent for bluegills age 3 through 7. In 1997, angling mortality was calculated at 57 percent. Angler harvest was low, commensurate with the low population density.

MANAGEMENT RECOMMENDATIONS

Based on the information contained in this survey report, the following management recommendations are forwarded:

Muskies: The musky population, at its current level, does not appear to be negatively impacting the gamefish populations on Oconomowoc Lake. In fact, walleyes, northern pike, largemouth, smallmouth and bluegills all appear to have expanded or improved their populations concurrent with the increase in the musky population. Although I do not intend to add Oconomowoc Lake to the musky stocking quota because it does not seem to need direct stocking, private stocking of muskies by groups such as Muskies, Inc. could be permitted.

Northern Pike: Although the Oconomowoc Lake survey was not part of the northern pike 26-inch size limit evaluation, there is evidence to show that the size limit has had a positive impact on the northern pike population in this lake. The size limit went into effect right after the 1994 comprehensive and creel survey. In addition, northern pike fingerlings were stocked at the rate of 5 fingerlings per acre in 4 of the past 10 years (1998, 2000, 2001 and 2002). The current survey documents an increase in the number of northern pike and in the number of pike over 26 inches in length. We cannot separate the influence of stocking from the length regulation, but the two combined appear to be helping northern pike remain a viable part of the fishery. We should continue to stock northern pike fingerlings, at 5 per acre, when they are available to offset the loss of habitat on Oconomowoc Lake. Also, the 26-inch minimum length regulation should be maintained to provide needed protection.

Largemouth and Smallmouth Bass: Continue to protect spawning habitat on this heavily developed lake. The 14-inch minimum size limit appears to be enhancing the bass population, particularly for smallmouth. At this time, no other management activities are suggested.

Bluegills: One of the brightest spots seen in this survey is the reappearance of the bluegill population. The 1994 survey notes that bluegills were very scarce. Although 1994 was our first survey on Oconomowoc Lake for many years and no baseline data existed, anecdotal reports of very good bluegill fishing in the 1980's lead us to believe that high angler exploitation was the cause. Oconomowoc Lake has the characteristics of a marl lake, with low productivity and few aquatic plant beds. Clear water makes spawning bluegills particularly vulnerable (most walleye anglers fish at night because of the clear water). This lake would benefit from a reduced bag limit for bluegills. Such a proposal is being investigated by the statewide committee and by other DNR fisheries biologists. We will follow the progress of these proposals and how they might apply to Oconomowoc Lake.

Approved: _____

Edward R. Schumacher – Fisheries Supervisor

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