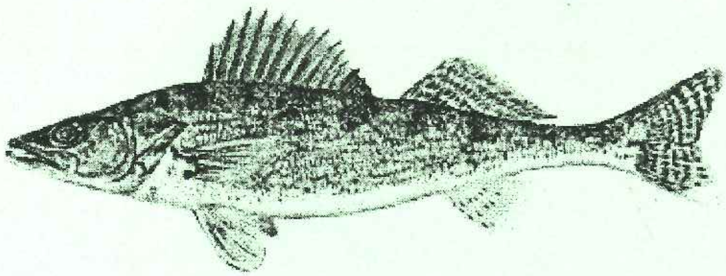
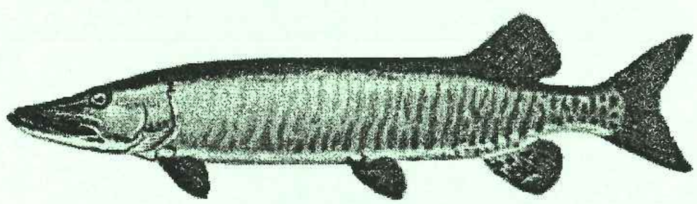


Wisconsin Department of Natural Resources

1997 Ceded Territory

Fishery Assessment Report



Andrew H. Fayram

Administrative Report #48

Treaty Fisheries Assessment Unit
Bureau of Fisheries Management and Habitat Protection
Madison, Wisconsin
March, 2000

Walleye illustration Virgil Beck

Table of Contents

List of Tables

List of Figures

List of Appendices

Appendix

INTRODUCTION

In 1983, the United States Court of Appeals for the Seventh Circuit ruled that the Chippewa Tribes had reserved off-reservation fishing rights in the ceded territory of Wisconsin as determined by the Treaty of 1837 and the Treaty of 1842. Since then, the Wisconsin Department of Natural Resources (WDNR) has worked to accommodate tribal harvest opportunities into existing sports fisheries in the ceded territory. In addition, the WDNR works with the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) to establish safe harvest numbers for walleyes and muskellunge on the lakes and waters of the ceded territory and to census and monitor the combined fisheries.

In order to incorporate tribal harvest into existing recreational fisheries, an intensive data collection and analysis effort began. This effort has evolved over time as knowledge in fisheries science has advanced and as unique aspects of the ceded territory fisheries have been addressed. The primary goal is to collect the necessary information to protect the ceded territory fish populations from overexploitation by the combined tribal and recreational fisheries.

Walleye *Stizostedion vitreum* and muskellunge *Esox masquinongy* are tremendously popular with anglers and are very important economically. Chippewa tribal members rely on these fisheries for preservation of their cultural heritage and as a food source. The majority of the tribal harvest occurs during a spring spearing effort while the walleyes and muskellunge are in shallow water during spawning. A smaller number are harvested throughout the remainder of the year with a variety of capture methods including spearing, gillnetting, fykenetting, setlining, and angling. Netting and spearing are highly efficient methods and, unlike low efficiency methods such as angling, are not self-regulating (Beard et al. 1997, Hansen et al. 2000). Therefore, overexploitation is a strong possibility in the absence of intensive management. Overexploitation of any population would result in long lasting and potentially irreversible damage to the resource. Due to the popularity and economic importance of walleye and muskellunge fisheries, it is imperative to understand these populations to the best of our ability.

The WDNR assesses walleye populations using three primary methods: spring adult and total population estimates, fall young of the year relative density estimates, and creel surveys of angler catch and harvest. The GLIFWC and the United States Fish and Wildlife Service conduct population estimate and young of the year surveys on additional lakes each year. In addition, the GLIFWC monitors all tribal harvest which occurs. These methods provide information on the current harvestable population, an indication of the future harvestable population, and the degree of exploitation.

POPULATION ESTIMATES

INTRODUCTION

Population estimates are critical to the management of ceded territory lakes. Accurate population estimates allow fisheries biologists to calculate the number of fish that can be safely harvested from a given population based on knowledge of the fishery and the biology of the species in question. This allows utilization of the resource without jeopardizing future abundance or presence of walleyes and muskellunge.

It is logistically impossible to obtain accurate population estimates from all harvested lakes in the ceded territory each year. Random subsamples of lakes are selected each year for walleye population estimates and nine-month creel surveys. Fish populations in general, and walleye populations in particular, are extremely variable and can change drastically from year to year. A continuing randomized survey of lakes provides information on trends occurring in these populations.

Safe harvest levels are set on individual lakes using the most accurate population estimate available. The most reliable estimate is from mark-recapture estimates performed in the same year in which the safe harvest level is set. This population estimate can also be used to estimate abundance in successive years. Additional safety factors are incorporated to account for the largest decrease expected between years. Given the variability associated with all fish populations, these estimates are not as accurate as current year population estimates. If there have been no historic mark-recapture estimates or the population estimate is greater than two years old in a given lake, then an estimate is calculated from a regression model based on lake acreage as an indicator of population abundance (Hansen 1989). Three different regression models are used depending on the primary source of walleye recruitment in the lake including models for 1) lakes sustained primarily by natural reproduction, 2) lakes sustained primarily through stocking efforts, and 3) lakes with low density populations maintained through very intermittent natural reproduction. Each year, new population estimates from current surveys are incorporated into the appropriate regression model used to predict abundance. These regression models are used to predict abundances for the majority of the walleye lakes in the ceded territory each year.

METHODS

The lakes to be sampled by the WDNR are chosen using a stratified random design with removal. The pool of lakes considered for population estimate surveys in the current survey design are the 179 lakes that have experienced tribal harvest at least three times between 1985 and 1994. This focuses data collection efforts on lakes that receive high fishing effort and represent the core lakes of the joint fishery. All of these lakes are scheduled to be surveyed once in a seven-year period. In addition, one of the large lake chains is surveyed each year. The calculation of population estimates on these lakes allows the WDNR to update the population status of each lake and to have at least one direct measure of exploitation roughly once per generation time of walleye.

In 1997, total and adult walleye population estimates were calculated for 23 lakes ranging in size from 97 to 13,545 acres and encompassing a wide range of angler regulations. This included 10 lakes with a 15-inch length restriction for walleyes, two lakes with a 14-18 inch slot limit where only one walleye greater than 18 inches could be retained, eight lakes had a modified bag limit allowing only one walleye over 14 inches to be harvested per angler each day, and three lakes with no length restriction (Table 1).

Walleyes were captured with fyke nets in the spring shortly after ice out. Each fish was measured and received a permanent mark (fin clip, floy or jaw tag). In addition, the sex of each fish was determined. All walleyes whose sex could be determined or were greater than or equal to 15 inches were considered to be part of the adult population and were given a specific mark that varied by lake. Walleyes of unknown sex and less than 15 inches in length were classified as juveniles and were marked with a different lake specific fin clip. Marking effort was apportioned based on a goal for total marks of 10% of the anticipated spawning population estimate. The marking continued until this target number was reached or spawned out females began appearing in the fyke nets.

To minimize bias, the first recapture effort was accomplished with the use of electrofishing equipment. The entire shoreline of each lake, including islands, was electrofished. This recapture effort was used to calculate an adult walleye population estimate for the lake. All walleyes were measured and examined for marks. In addition, all unmarked walleyes were measured and given the appropriate mark so that a total population estimate could be calculated. The shoreline of each lake was electrofished a second time approximately two weeks later in order to calculate a total population estimate (juvenile fish + adult fish) using a similar approach to the adult population estimate.

Table 1. 1997 Walleye population estimate data.

Lake Name	County	Acres	1997 Size Limit	1997 Recruitment Type	Adult Male Population Estimate	Adult Female Population Estimate	Total Adult Population Estimate	Lower 95% Confidence Limit	Adult Densities 0-11.9" per acre	12.0-14.9" per acre	15.0-19.9" per acre	≥ 20" per acre	Adults per acre	Total Population Estimate	Total per acre	1997 Safe Harvest
Clam River Flowage	Burnett	359	15	Natural	597	125	743	449	0.01	0.85	0.96	0.25	2.07	1600	4.46	157
Lipsett	Burnett	393	15	Stocked	365	80	420	352	0.01	0.37	0.58	0.12	1.07	928	2.36	123
Poquettes	Burnett	97	15	Stocked	80	23	100	89	0.01	0.29	0.56	0.19	1.03	105	1.08	31
Upper St. Croix	Douglas	855	15	Natural	1937	704	2468	2132	0.07	0.89	1.75	0.18	2.89	5399	6.31	746
Keyes	Florence	202	15	Natural	93	67	196	151	0.02	0.14	0.60	0.21	0.97	568	2.81	53
Butternut	Forest	1292	14-18 slot; 1>18	Natural	3114	4636	6525	3917	1.07	0.28	1.80	1.90	5.05	12163	9.41	1371
Franklin	Forest	892	14-18 slot; 1>18	Natural	1346	500	1834	1581	0.40	0.63	0.77	0.27	2.06	67924	76.15	553
Trude	Iron	781	none	Natural	2931	737	3495	3192	1.70	1.76	0.90	0.11	4.48	24078	30.83	1117
Turtle Flambeau	Iron	13545	none	Natural	45777	18003	54758	52400	1.08	1.77	1.10	0.10	4.04	186443	13.76	18340
Chain	Oneida	219	1>14	Natural	257	58	309	223	0.59	0.38	0.25	0.19	1.41	1730	7.90	78
Dam	Oneida	744	1>14	Natural	2271	262	2556	2264	2.41	0.59	0.05	0.00	3.05	11999	16.13	792
Lower Nine Mile	Oneida	646	15	Stocked	122	33	158	94	0.00	0.07	0.12	0.06	0.24	868	1.34	33
Sand	Oneida	540	1>14	Natural	887	196	1166	1045	0.75	0.72	0.54	0.16	2.16	9343	17.30	366
Sevenmile	Oneida	503	1>14	Natural	1054	440	1342	1171	0.38	1.26	0.87	0.15	2.67	3619	7.19	410
Stone	Oneida	188	1>14	Natural	28	22	50	37	0.05	0.05	0.13	0.04	0.27	242	1.29	13
Big Round	Polk	1015	15	Stocked	3129	1090	3796	3096	0.00	0.63	2.80	0.30	3.74	5138	5.06	1084
Chetac	Sawyer	1920	15	Stocked	2476	969	3336	2750	0.04	0.46	0.74	0.50	1.74	15890	8.28	963
Sissabgama	Sawyer	719	none	Natural	3470	1109	4617	3396	1.98	2.60	1.59	0.26	6.42	21108	29.36	1189
Birch	Vilas	528	1>14	Natural	222	103	478	199	0.22	0.16	0.41	0.11	0.91	10997	20.83	70
Harris	Vilas	507	1>14	Natural	979	794	1913	1419	0.06	1.50	1.23	0.99	3.77	8014	15.81	497
Little St. Germain	Vilas	980	15	Stocked	1261	759	2212	1391	0.03	0.50	0.82	0.91	2.26	5695	5.81	487
Papoose	Vilas	428	15	Natural	541	328	819	692	0.26	0.99	0.56	0.11	1.91	4437	10.37	242
Star	Vilas	1206	1>14	Natural	4137	1769	5474	4607	0.84	2.27	1.40	0.03	4.54	29438	24.41	1612

Population estimates were calculated with the Chapman modification of a Petersen Population Estimate using the equation:

$$N = (M+1)(C+1)/(R+1)$$

where N is the population estimate, M is the total number of marked fish in the lake, C is the total number of fish captured, and R is the total number of marked fish captured. This method is used because simple Petersen Estimates tend to overestimate population sizes when R is relatively small (Ricker 1975).

Tribal spearing exploitation estimates were calculated for 1997. Tribal exploitation is simply the number of speared walleyes divided by the adult population estimate in each lake. A mean tribal exploitation value for the years 1990-1996 was also calculated. Marking effort, recapture effort, and tribal spearing focus almost exclusively on sexually mature walleyes so exploitation rates are calculated for this subset of the walleye populations. Angler exploitation rates are calculated using creel survey data. Results and discussion of exploitation rates are included in the creel survey section of this report.

RESULTS

Population densities were separated into length intervals of 0.0-11.9 inches, 12.0-14.9 inches, 15.0-19.9 inches, and greater than or equal to 20.0 inches. Length specific population densities are shown for lakes sustained primarily through natural reproduction in Figure 1 and lakes sustained primarily through stocking efforts in Figure 2. The lakes were categorized as 1) stocked, 2) natural, and 3) other. The "other" category included lakes with unknown walleye populations, lakes where stocking had been discontinued and the walleye population was expected to disappear, and stocked waters where the population had not established a reasonable density.

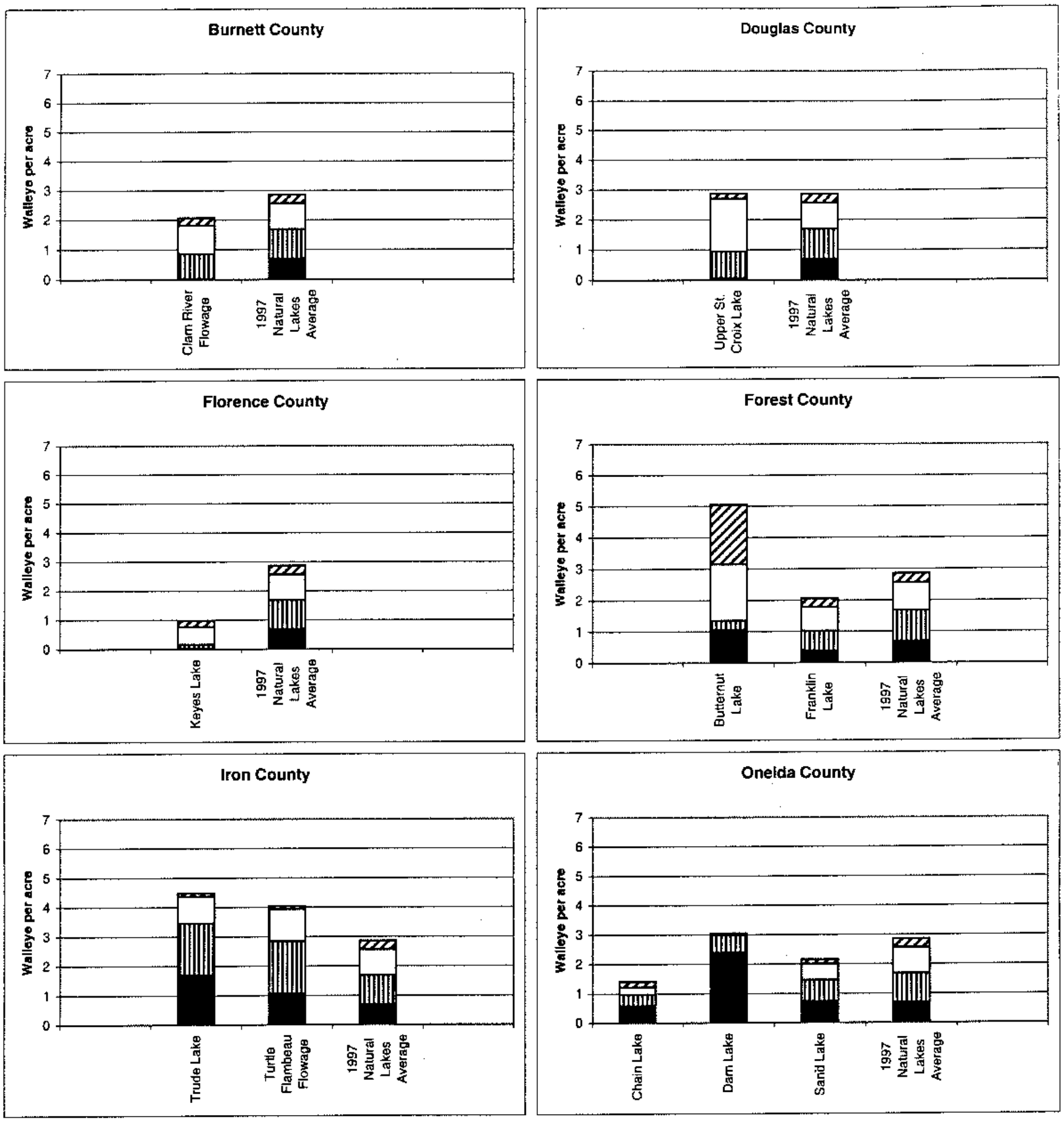


Figure 1. Population estimates by length class and 1997 statewide average of lakes classified as naturally reproducing waters.

■ = 0-11.9 inches, ▥ = 12.0-14.9 inches, □ = 15.0-19.9 inches, and ▨ = 20.0+ inches.

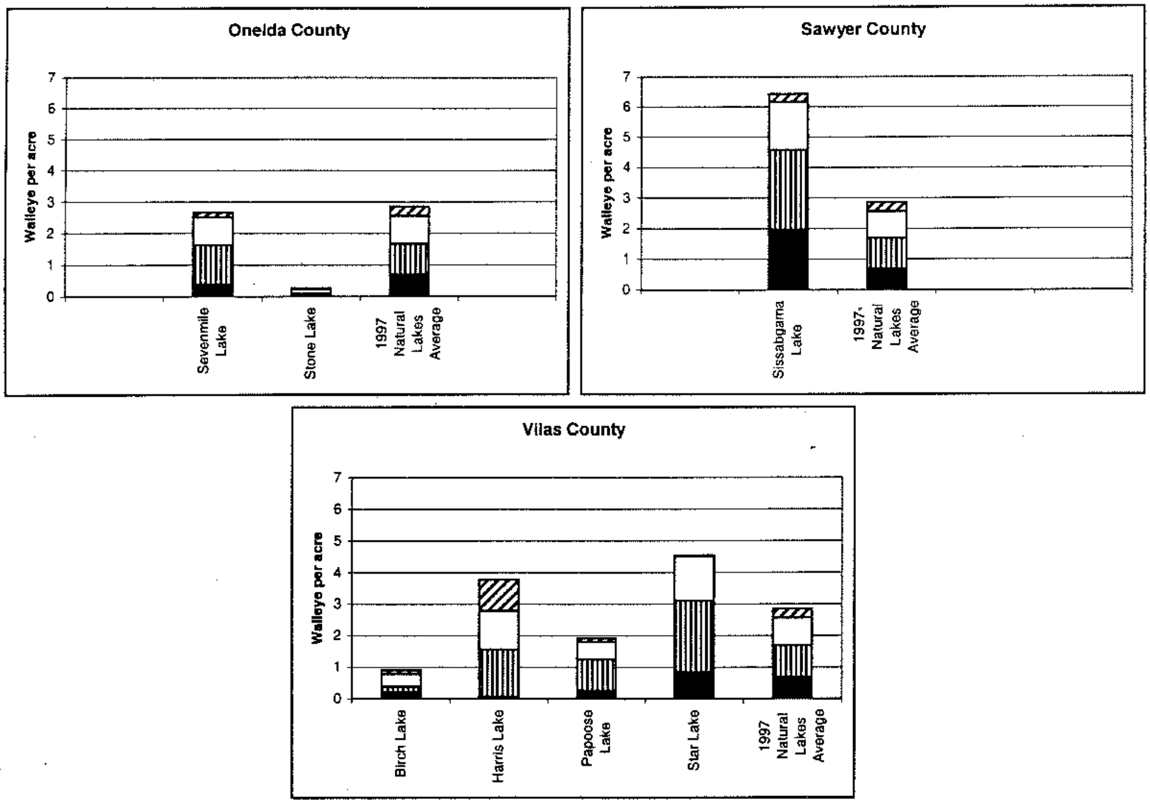


Figure 1. Continued.

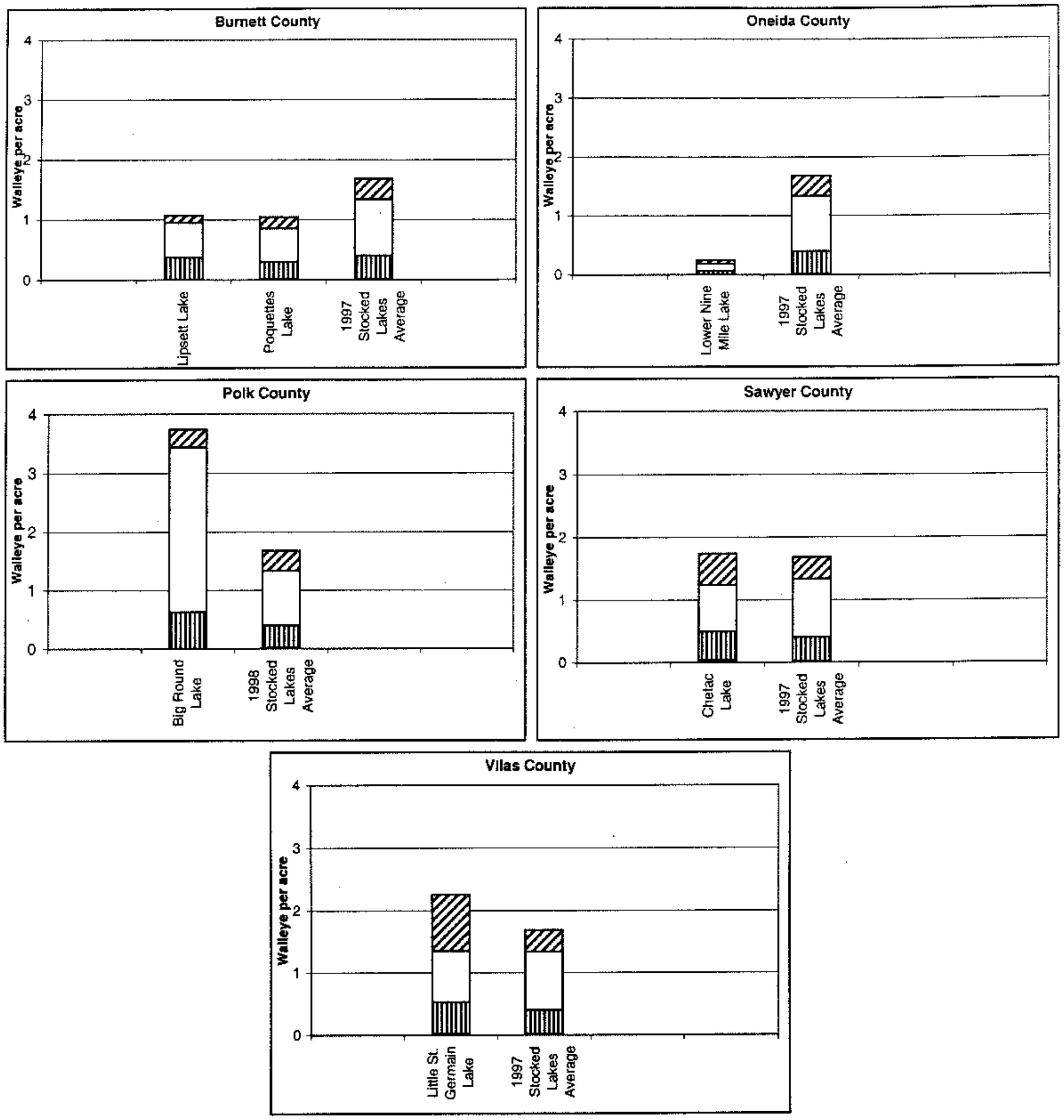


Figure 2. Population estimates by length class and 1997 statewide average of lakes classified as stocked waters.

■ = 0-11.9 inches, ◫ = 12.0-14.9 inches, □ = 15.0-19.9 inches, and ◩ = 20.0+ inches.

Lakes surveyed in 1997 with historical population estimates are included in Appendix 1. The total number of adult marks in lakes surveyed in 1997 ranged from 20.6% to 82.0% of the calculated adult population estimate, with a mean value of 47.1%. The total number of marked fish, including immature fish, ranged from 1.4% to 85.7% of the calculated total population estimate with a mean value of 17.7%. The goal of marking at least 10% of the estimated adult population was exceeded in all surveys in 1997. In general, adult walleye populations in surveyed lakes with previous population estimates have decreased slightly from higher levels in the late 1980's and early 1990's. Although there have been apparent decreases in walleye abundance, for the most part these declines are not dramatic or greater than declines expected in natural populations (Kempinger and Carline 1977).

Lakes classified as "stocked" waters had a lower average density (1.68 walleyes per acre) than did lakes classified as "natural" waters (2.86 walleyes per acre) (Figures 1 and 2). This has been the case historically as well (Hewett and Simonson 1998). As one would expect, the lakes best suited for walleyes in terms of physical, chemical, and biological factors generally support natural reproduction and therefore have relatively high densities. Walleye populations in lakes with marginal walleye habitat are sustained through stocking and therefore have lower densities.

There were relatively substantial declines in adult walleye population densities between 1997 and historic population densities measured since 1990 in Chain Lake (Oneida) and Sissabagama Lake (Sawyer)(Appendix 1). Although the Chain Lake walleye population has decreased considerably and is currently relatively low, it is comprised of a mix of smaller, mid-sized, and larger adults suggesting that further substantial decreases may be unlikely in the near future (Figure 1). The decrease in the adult walleye population in Sissabagama Lake was substantial but the density of adult fish was much higher than the 1997 mean density of surveyed lakes. In addition, the walleye population in this lake was well balanced with small, mid-sized, and larger adults all represented in the population. Therefore, there is little reason for this decrease to cause concern (Figure 1).

There were relatively low adult walleye densities in Keyes Lake (Florence), Lower Nine Mile Lake (Oneida), Stone Lake (Oneida), and Birch Lake (Vilas) in 1997 (Figures 1 and 2). The low density of adult walleyes in Keyes Lake is similar to levels seen in the 1990's. However, this is a dramatic change from levels seen in the 1980's when adult walleye densities were considerably higher. Some unknown factor has apparently decreased adult population densities and recruitment in this lake. Given the low population density seen in 1997 and the absence of smaller walleyes, it is unlikely that this population will increase dramatically in the near future (R. E. Heizer, Wisconsin Department of Natural Resources, personal communication). Lower Nine Mile Lake is supported by stocking and does not have an abundance of optimum walleye habitat (S. J. Gilbert, Wisconsin Department of Natural Resources, personal communication). Therefore, this low abundance is not unusual and increased population levels will depend on future stocking practices. The low population density in Stone Lake is most likely due to the fact that this lake is part of the Sugar Camp Chain and the majority of spawning habitat in this chain exists in other lakes (S. J. Gilbert, Wisconsin Department of Natural Resources, personal communication). Therefore, few adult walleyes are present in Stone Lake during population estimate sampling, and low adult walleye population density in this lake is not necessarily indicative of a population in need of additional management actions. Although Birch Lake had a low adult walleye density, it is similar to the population density calculated for this lake in 1990 (Appendix 1). In addition, there were at least a small number of walleyes less than 12 inches present in the 1997 surveys. These two facts indicate that while the walleye population in Birch Lake is relatively low, further declines in the walleye population may be unlikely.

Dam Lake (Oneida) had a relatively high density of walleyes less than 12 inches (Figure 1). This bodes well for the future walleye fisheries in this lake. Butternut Lake (Forest), Harris Lake (Vilas), and Little St. Germain Lake (Vilas) all had relatively high densities of walleyes greater than 20 inches in length. These lakes should provide quality fishing opportunities for larger walleyes (Figures 1 and 2).

YOUNG OF THE YEAR SURVEYS

INTRODUCTION

Young of the year (YOY) surveys provide an index of the abundance and survival of the current year class of walleyes from hatching or stocking to their first fall. Young age classes form the basis of future adult populations. Therefore, YOY surveys provide fisheries managers insight into potential adult population changes in the near future. Early indication of these potential changes allows fisheries managers to develop management strategies to accommodate expected changes in adult populations. Although YOY relative abundances give some indication of possible future adult abundances, they do not necessarily correspond directly, as survival to adulthood can be variable (Hansen et al. 1998).

METHODS

Young of the year surveys were completed on 108 lakes by the WDNR in 1997, including four surveys which were completed as joint surveys with the GLIFWC. Electrofishing for YOY walleyes was done during early fall, generally when the water temperature had fallen below 70° F. The entire shoreline of a lake was electrofished and all walleyes were examined and measured. Serns (1982) established a relationship between the number of YOY walleyes collected per mile of shoreline electrofished and the density of YOY walleyes/acre. This in turn can be used to estimate YOY walleye abundance. This relationship between the number of YOY walleyes caught per mile and the density of YOY walleye is:

$$\text{Density} = 0.234 * \text{Catch per mile}$$

where density is estimated as number of YOY walleyes per acre. Abundance is then estimated by multiplying the estimated density by the number of acres in a given lake.

T tests were used to compare 1997 data to 1990-1996 data. The level of significance used for all tests was $\alpha = 0.05$.

RESULTS

Lake temperatures during 1997 surveys ranged from 42°F-72°F with a mean water temperature of 63°F. Young of the year data were separated by the dominant recruitment type for each lake: 1) stocked, 2) natural, and 3) other.

The 1997 means for young of the year per mile were 32.6 (range = 0.0 – 314.4) for natural lakes, 6.9 (range = 0.00 – 71.9) for stocked lakes, and 1.0 (range = 0.0 – 8.3) for "other" lakes (Table 2, Appendices 2, 3, 4). The 1997 natural lake mean was slightly but not significantly lower than the seven-year mean of 34.2 ($p = 0.81$)(Table 2). Similarly, the 1997 stocked lake mean was slightly but not significantly lower than the seven-year mean of 9.8 ($p = 0.51$)(Table 2). No seven-year mean value was calculated for "other" lakes, as this value varies widely depending on the number of surveyed lakes which were stocked but lacked an established adult population. 17.6% of lakes in the natural category (9 of 51) showed indexes of less than 1 YOY walleye per mile (Appendix 2). 47.1% of lakes in the stocked category (16 of 34) had young of the year walleye indexes of less than 1 per mile. Number of lakes stocked in a year has a dramatic effect of YOY walleye densities in lakes sustained though stocking. Among the stocked lakes surveyed, 13 were stocked with walleye juveniles in 1997 (Appendix 3).

Table 2. Mean young of the year walleye data for three categories of lakes.

	Natural	Stocked	Other
Mean 1997 young of the year walleyes per mile	32.6	6.9	1.0
1990-1996 mean young of the year walleyes per mile	34.2	9.8	

The 1997 mean Sern's index for estimated number of YOY walleyes per acre was 7.6 for natural lakes, 1.6 for stocked lakes, and 0.2 for other lakes. Sern's estimates of YOY walleyes per acre ranged from 0 to 73.6 in natural waters, 0 to 16.8 in stocked waters, and 0 to 1.9 in other lakes (Appendices 2, 3, and 4).

The percentage of lakes with greater than 25 YOY walleyes per mile and greater than 100 YOY walleyes per mile may give a better indication of the overall success rate of year class production, because unlike the mean number per mile, these values are unaffected by very large values in a single lake. In stocked waters in 1997, 8.8% of the surveyed lakes contained greater than 25 YOY walleyes per mile which was similar to the 1990-1996 mean value of 9.7 ($p = 0.66$) (Figure 3). No lakes surveyed in 1997 had greater than 100 YOY walleyes per mile. This was similar to the seven-year mean value of 1.6% ($p = 0.19$) (Figure 3). In waters with some degree of natural reproduction, 35.3% of the surveyed lakes had greater than 25 YOY walleyes per mile which was similar to the seven-year mean value of 38.2% ($p = 0.674$) (Figure 4). 5.9% of naturally reproducing lakes had greater than 100 YOY walleyes per mile which was similar to the seven-year mean value of 7.1% ($p = 0.623$) (Figure 4).

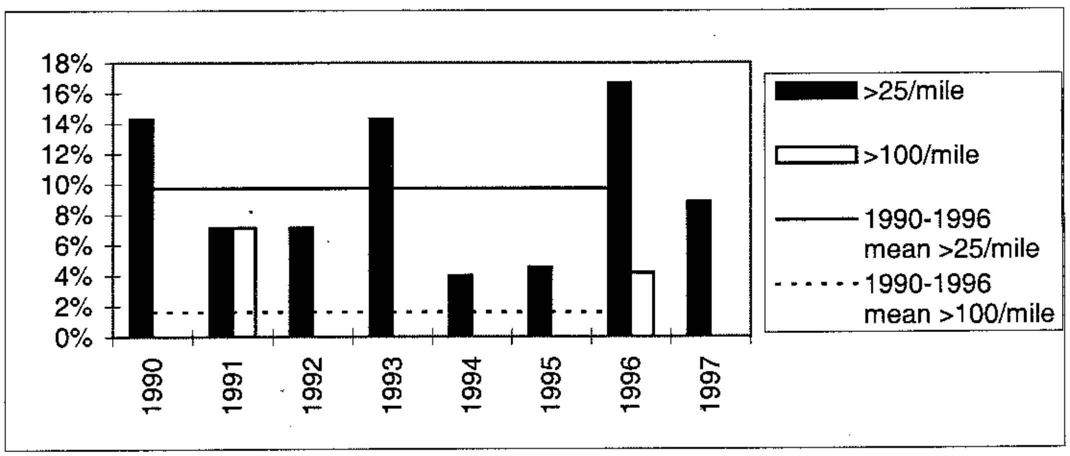


Figure 3. Percentages of stocked surveyed lakes with high densities of young of the year walleye.

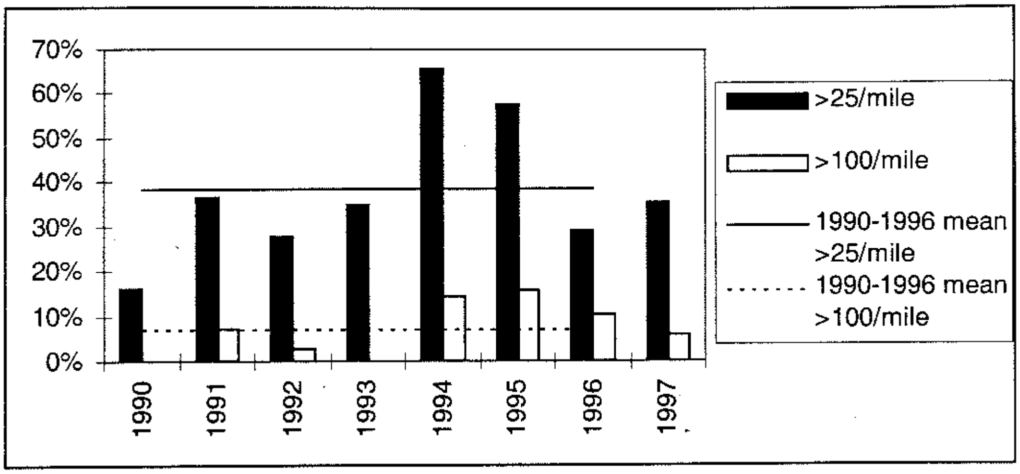


Figure 4. Percentage of surveyed lakes classified as having natural reproduction with high densities of young of the year walleye.

Sporadic recruitment is characteristic of walleye populations both within and among individual lakes. It is common to have almost a total lack of recruitment in 25% or more of lakes with natural reproduction. Even higher percentages are common among lakes whose walleye populations are sustained through stocking. Generally, successful recruitment occurs in a given lake every 3-4 years. Sporadic recruitment appears to reduce competition between year classes of walleye (Li et al. 1996). Therefore, lack of recruitment in a given lake for one or more years is a natural and expected occurrence and is generally not a cause for concern. Overall, 1997 represented an average year for young of the year survival.

CREEL SURVEYS

INTRODUCTION

Creel surveys provide information on angler effort, exploitation, harvest, and catch on surveyed waters. Information on both released and retained fish is recorded. Trends in total catch and harvest, hours fished for a given species, and success rates can be determined from creel survey data. Information collected for walleye, muskellunge, northern pike, largemouth bass, and smallmouth bass are presented here. Creel surveys are generally conducted on the same lakes for which population estimates are calculated. This allows the calculation of exploitation rates of walleye populations and comparisons of catch and harvest rates on a cross section of walleye lakes in the ceded territory each year.

METHODS

Creel surveys were conducted on 21 lakes where population estimates were conducted in the spring of 1997. Wisconsin creel surveys use a random stratified roving access design (Beard et al. 1997, Rasmussen et al. 1998). The surveys were stratified by month and day type (weekend and holiday or weekday), and creel clerks conducted their interviews at random within these strata. Surveys were conducted on all weekends and holidays and a randomly chosen three of five weekdays. Only completed trip interview information was used in the analysis. Information recorded during the course of interviews included harvest, catch, lengths and marks of harvested fish, fishing effort, and species targeted.

The surveys began May 3rd 1997 and generally continued through March 1st 1998. The month of November was excluded due to extremely low effort. Information from these interviews was then expanded over the appropriate strata in order to provide an estimate of total effort, catch, and harvest of each species in each lake for the year.

Creel surveys used in conjunction with population estimates also allow estimates of angler exploitation of walleye populations to be calculated. Angler exploitation rates were calculated by dividing the estimated number of marked harvested adult walleye by the total number of the adult marked walleye present in the lake. Although anglers are able to harvest immature fish in some waters, exploitation rates were calculated to represent adult exploitation in order to allow comparison with tribal exploitation rates and to calculate an estimated total exploitation rate of adult walleyes. Mean exploitation values both for 1997 and 1993-1996 were calculated only for lakes with complete creel surveys. All fish marked in 1990-1992 received the same fin clip and therefore it was not possible to calculate adult exploitation rates for lakes surveyed in these years.

Creel surveys were conducted on Trude Lake (Iron), Stone Lake (Oneida), and Birch Lake (Washburn) in 1997; however, these surveys only continued through the open water period. Since creel information was not collected from ice anglers, data from these surveys were not included in mean value calculations. Tribal exploitation rates were only calculated where adult population estimates were available. Total exploitation was only calculated where both tribal and angler exploitation rates were available.

T tests were used to compare 1997 data to 1990-1996 (1993-1996 for exploitation rates) data. T tests were also used to compare lakes of different sizes and regulation types. The level of significance used for all tests was $\alpha = 0.05$.

RESULTS

Creel data were summarized for all lakes, lakes less than 500 acres, and lakes 500 acres or larger. In addition, walleye creel data were grouped based on length regulation and population recruitment code. Species specific creel data were extrapolated only over lakes containing a given species (based on past WDNR surveys).

Catch (fish/acre) and harvest (hours/fish) rates were calculated for all species. Number of hours to catch and harvest a fish give an indication of the success of an average angler and provide an estimate of walleye production on a given lake or group of lakes. Specific catch and harvest rates are calculated only for hours spent fishing in which a specific fish species was targeted. General catch and harvest rates reflect total hours spent fishing by all anglers.

The mean total effort per acre in 1997 was higher in lakes 500 acres or larger (35.6 hours/acre) than in those less than 500 acres (26.2 hours/acre) although this difference was not significant ($p = 0.51$).

Walleye

Complete creel surveys were conducted on a total of 18 walleye lakes in 1997. Eleven of these lakes had an "exempt" length limit classification meaning there was no minimum length limit for walleyes. Of the 11 exempt lakes, seven had a modified bag limit allowing only one walleye over 14 inches to be harvested per angler each day, and two had a slot limit restriction where walleyes between 14 and 18 inches could not be kept and only one walleye over 18 inches could be retained. The remaining seven lakes had a minimum length restriction of 15 inches. Fourteen of the surveyed lakes were 500 acres or larger and the remaining 4 were less than 500 acres. Fourteen of the lakes were classified as having substantial natural reproduction. Walleye populations in the remaining four lakes were sustained through stocking (Table 3).

It took significantly fewer hours for anglers targeting walleyes to catch a walleye in exempt lakes than in lakes with the 15-inch length limit (2.8 vs. 5.6 hours/walleye)($p = 0.05$). In addition, the mean density of adult walleye was greater, although not significantly so, in exempt lakes than in lakes with the 15-inch length limit (3.3 vs. 2.2 walleyes/acre, $p = 0.14$). It took significantly longer for anglers targeting walleyes to harvest a walleye in lakes with the 15-inch length limit (25.7 hours) than in exempt waters (8.1

Table 3. 1997 walleye creel survey data. 1990-1996 mean values were calculated using only lakes with complete population estimate and creel information. Specific and general catch and harvest rates are measured in number of hours per fish caught or harvested. All lakes without a 15-inch length limit are included in the 1990-1997 means for exempt waters

			N	Lake Acres	Adult PE/Acre	Angler Catch /Acre	Angler Harvest /Acre	Specific Catch Rate	Specific Harvest Rate	Mean Length (inches)	General Catch Rate	General Harvest Rate	Directed Effort /Acre	Total Effort /Acre
1997		All lakes	18	1480.28	2.90	3.60	1.10	3.4	11.0	15.4	7.0	22.3	11.7	33.5
	Means	Exempt	11	1881.36	3.31	4.52	1.52	2.8	8.1	13.9	5.4	15.6	12.2	25.0
	by regulation type	15" size limit	7	850.00	2.24	2.14	0.43	5.6	25.7	17.8	13.0	67.2	10.8	47.0
	and lake size	Exempt <500 acres	1	219.00	1.41	7.53	1.13	2.0	13.8	13.7	3.4	22.9	14.7	26.2
		Exempt ≥500 acres	10	2047.60	3.51	4.22	1.56	2.9	7.8	13.9	5.7	15.2	11.9	24.8
		15" <500 acres	3	393.33	1.68	1.65	0.33	5.1	26.3	17.5	12.4	78.3	8.8	26.2
		15"≥500 acres	4	1192.50	2.66	2.50	0.51	5.9	25.3	18.1	13.5	60.8	12.4	62.6
1997		Natural	14	1595.50	3.10	4.18	1.30	2.9	9.3	14.5	5.6	18.0	11.7	23.8
	Means by	Stocked	4	1077.00	2.20	1.54	0.37	10.9	31.6	18.4	44.8	139.4	11.5	67.5
	recruitment type	Natural 15-inch	3	547.33	2.29	2.93	0.51	3.4	20.6	17.0	6.7	39.8	10.0	19.7
	and regulation type	Natural Exempt	11	1881.36	3.31	4.52	1.52	2.8	8.1	13.9	5.4	15.6	12.2	25.0
		Stocked 15-inch	4	1077.00	2.20	1.54	0.37	10.9	31.6	18.4	44.8	139.4	11.5	67.5
		Stocked Exempt	0											
1990-1996		All lakes	191	1170	3.58	3.71	0.78	0.2	0.1	16.5	0.1	0.0	13.4	33.7
	Means by	Exempt	59	1399	3.57	3.52	1.42	0.3	0.1	13.9	0.1	0.1	16.1	35.0
	by regulation type	15" length limit	132	1068	3.58	3.79	0.48	0.2	0.0	17.6	0.1	0.0	12.2	33.2
	and lake size	Exempt <500 acres	21	261	3.16	3.27	1.29	0.2	0.1	14.1	0.1	0.0	21.6	49.3
		Exempt ≥500 acres	38	2027	3.78	3.65	1.50	0.3	0.1	13.8	0.1	0.1	13.1	27.1
		15" <500 acres	51	290	3.84	4.31	0.48	0.3	0.0	17.7	0.1	0.0	12.7	37.1
		15" ≥500 acres	81	1558	3.43	3.46	0.48	0.2	0.0	17.6	0.1	0.0	11.8	30.6
1990-1996		Natural	151	1292	3.98	4.46	0.92	0.3	0.1	15.9	0.2	0.0	15.0	34.2
	Means by	Stocked	37	754	1.95	0.97	0.24	0.1	0.0	18.7	0.0	0.0	7.8	32.6
	recruitment type	Natural 15-inch	92	1223	4.23	5.08	0.60	0.3	0.0	17.1	0.2	0.0	14.3	33.8
	and regulation type	Natural Exempt	59	1399	3.57	3.52	1.42	0.3	0.1	13.9	0.1	0.1	16.1	35.0
		Stocked 15-inch	37	754	1.95	0.97	0.24	0.1	0.0	18.7	0.0	0.0	7.8	32.6
		Stocked Exempt	0	0	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0

hours, $p = 0.01$). This is likely due to the fact that there are generally fewer walleyes available for harvest in lakes with the 15-inch length limit, as a large proportion of the populations is comprised of individuals under 15 inches in length. In exempt lakes, the mean number of hours spent by anglers targeting walleyes to catch a fish was higher in lakes 500 acres or larger (2.9 hours) than in smaller lakes (2.0 hours), but this difference was not significant ($p = 0.48$). Similarly, among lakes with the 15-inch length limit, the mean number of hours spent by anglers targeting walleyes to catch a walleye was higher in larger lakes (5.9 hours) than in smaller lakes (5.1 hours), although again this difference was not significant ($p = 0.84$). As expected, mean length of harvested walleyes was significantly higher in lakes with the 15-inch length limit than in exempt lakes (17.8 inches vs. 13.9 inches, $p < 0.01$).

In 1997, anglers appeared to have greater success on lakes sustained through natural reproduction (Table 3). General anglers took significantly longer to catch a walleye in lakes sustained through stocking efforts than in waters with natural reproduction (44.8 vs. 5.6 hours)($p = 0.01$). Similarly, anglers targeting walleyes took an average of 2.9 hours to catch a walleye in lakes with natural reproduction while spending an average of 10.9 hours to catch a walleye in lakes sustained through stocking efforts ($p = 0.02$). Mean length of harvested walleyes was smaller in natural waters than in lakes sustained by stocking (15.4 vs. 18.4 inches, $p < 0.01$). This is primarily due to the fact that all lakes surveyed in 1997 which were sustained through stocking also had the 15-inch minimum length restriction.

The mean adult walleye density was 2.9 walleyes/acre in 1997 compared to the 1990-1996 mean value of 3.6 walleye/acre ($p = 0.34$). Anglers targeting walleyes spent an average of 11.7 hours/acre in 1997 while the 1990-1996 mean value was 13.4 hours/acre ($p = 0.50$). Angler success, in terms of average number of hours spent to catch and harvest a walleye, was higher in 1997 than the 1990-1996 mean values. Anglers targeting walleyes spent an average of 3.4 hours to catch a walleye in 1997 compared to 4.0 hours for the 1990-1996 mean value ($p = 0.50$). These same anglers spent an average of 11.0 hours to harvest a walleye in 1997 compared to 17.6 hours for the 1990-1996 mean value ($p = 0.01$).

Effort directed at walleyes appeared to be concentrated on lakes with natural reproduction and lakes with exempt length restrictions during the 1990-1996 time period (Table 3). In 1997, effort directed at walleyes was similar between lakes with natural reproduction and those supported by stocking ($p = 0.90$) and among lakes with the 15-inch minimum length restriction and exempt lakes ($p = 0.38$) (Table 3).

Smaller more abundant walleyes are often harvested from exempt lakes reducing the average length of the harvested fish. However, the population sizes in these lakes do not seem to be adversely affected, as there was no significant difference in the number of adult walleyes/acre between lakes with the 15-inch length limit and exempt lakes.

Exploitation rates were calculated for 18 lakes in 1997. Total angler exploitation rates of adult walleyes in 1997 ranged from 1.6% - 23.2%. Angler exploitation of adult walleyes greater than or equal to 14 inches ranged from 2.3% - 28.6%. Angler exploitation of adult walleyes greater than or equal to 20 inches ranged from 0.0% - 67.3%. Tribal exploitation of adult walleyes ranged from 0.0% - 11.6%. Combined total exploitation estimates (tribal exploitation + angler exploitation) ranged from 4.8% to 31.2% for lakes surveyed in 1997. Mean total angler exploitation, angler exploitation of adult walleyes greater than or equal to 14 inches, angler exploitation of adult walleyes greater than or equal to 20 inches, and total exploitation were slightly higher in 1997 than the 1993-1996 mean values although none of these differences were significant (11.3% vs. 8.6%, p = 0.31; 12.2% vs. 12.2%, p = 0.98; 15.6% vs. 13.2%, p = 0.75; and 15.6% vs. 13.5%, p = 0.62 respectively). Mean tribal exploitation of adult walleyes was lower in 1997 than the 1993-1996 mean value but this difference was also not significant (4.3% vs. 4.9% p = 0.86) (Table 4).

Table 4. 1997 adult walleye exploitation rates and 1993-1996 mean exploitation rates. Tribal harvest data used to calculate tribal exploitation provided by the Great Lakes Indian Fish and Wildlife Commission (Ngu 1994, Ngu 1995, Ngu 1996, Krueger 1997, Krueger 1998).

Lake	County	Acres	Total Angler Exploitation of Adult Walleye	Angler Exploitation ≥ 14 inches	Angler Exploitation ≥ 20 inches	Tribal Exploitation of Adult Walleye	Total Exploitation of Adult Walleye
Clam River Flowage	Burnett	359	4.8%	6.1%	8.9%	0.0%	4.8%
Lipsett Lake	Burnett	393	18.4%	20.5%	45.0%	0.0%	18.4%
Upper St. Croix Lake	Douglas	855	23.2%	28.6%	21.2%	8.0%	31.2%
Butternut Lake	Forest	1292	12.7%	15.3%	40.7%	4.5%	17.2%
Franklin Lake	Forest	892	5.7%	7.1%	18.3%	11.3%	17.1%
Turtle-Flambeau Flowage	Iron	13545	20.0%	16.6%	7.1%	4.0%	23.9%
Chain Lake	Oneida	219	17.5%	15.1%	0.0%	0.0%	17.5%
Dam Lake	Oneida	744	7.5%	9.9%	11.1%	6.1%	13.7%
Sugar Camp Chain	Oneida	1691	7.6%	6.4%	7.6%	4.8%	12.4%
Sand Lake	Oneida	540	5.6%	2.3%	10.2%	3.3%	8.9%
Sevenmile Lake	Oneida	503	8.6%	9.8%	11.8%	8.4%	17.1%
Big Round Lake	Polk	1015	5.9%	6.5%	5.8%	0.0%	5.9%
Lake Chetac	Sawyer	1920	2.4%	2.9%	5.1%	4.6%	7.1%
Sissabagama Lake	Sawyer	719	17.4%	16.2%	6.7%	1.9%	19.3%
Harris Lake	Vilas	507	7.5%	9.8%	2.9%	4.7%	12.1%
Little St. Germain Lake	Vilas	980	14.4%	16.8%	11.6%	0.4%	14.8%
Papoose Lake	Vilas	428	1.6%	3.2%	0.0%	11.6%	13.2%
Star Lake	Vilas	1206	23.2%	25.8%	67.3%	3.6%	26.8%
1997 Mean Values⁺			11.3%	12.2%	15.6%	4.3%	15.6%
1993-1996 Mean Values*			8.6%	12.2%	13.2%	4.9%	13.5%

⁺ N = 18 for 1997 means.

* N = 93 for "Total", "≥ 14 inches", and "≥ 20 inches" angler exploitation of adult walleyes 1993-1996 means. N = 92 for "Tribal" and "Total" exploitation of adult walleyes 1993-1996 means.

Although calculated exploitation of walleyes greater than or equal to 20 inches provides an estimate of exploitation for this segment of the population, the estimates have a high degree of variability. This is due to both the relatively low number of marked fish of this length and the small number of fish of this length recorded in the creel surveys. Number of walleyes greater than or equal to 20 inches which received marks ranged from 9-500 and the number of recaptures ranged from 0-35, with five lakes recording zero recaptures of this length. Therefore, small changes in the number of fish of this size recorded in a creel survey would have a relatively large effect on the associated exploitation rate and thus, the variances associated with the estimates of exploitation rates for these fish are very large.

The 1997 mean total exploitation rate was statistically similar to the 1993-1996 mean value and no individual lake had a total exploitation rate greater than 35%. These data indicate that overexploitation did not occur in these lakes. The current management practices are meeting the expected goal of preventing overexploitation in ceded territory walleye populations.

Muskellunge

Complete creel surveys were collected from a total of 14 lakes classified as muskellunge waters in 1997. Eleven of the surveyed lakes were 500 acres or larger and three were less than 500 acres. 1997 and 1990-1996 mean values of measured parameters are shown in Table 5.

Total catch was higher in lakes 500 acres or larger. There was a relatively large difference in specific harvest rate between the 1997 mean value of 1359.2 hours and the 1990-1996 mean value of 398.9 hours, however, this difference was not significant ($p = 0.18$). The difference in the mean specific catch rate between 1997 (37.0 hours) and the 1990-1996 mean value (26.4 hours) was substantial but again was not significant ($p = 0.20$) (Table 5).

Table 5. 1997 and 1990-1996 mean muskellunge creel survey data. Specific and general catch and harvest rates are shown in number of hours per fish caught or harvested.

			N	Lake Acres	Angler Catch /Acre	Angler Harvest/ Acre	Specific Catch Rate*	Specific Harvest Rate*	Mean Length	General Catch Rate	General Harvest Rate	Directed Effort /Acre	Total Effort /Acre
1997		All lakes	14	1584	0.32	0.011	37.0	1359.2	39.1	86.7	2978.7	7.7	31.1
	Means	< 500 acres	3	347	0.18	0.012	69.4			106.4	2142.9	5.1	28.0
		≥ 500 acres	11	1922	0.35	0.011	32.8	1068.0	39.1	82.6	3333.3	8.4	31.9
1990-1996		All lakes	165	1171	0.48	0.028	26.4	398.9	37.7	66.9	1131.0	10.2	34.8
	Means	< 500 acres	63	273	0.59	0.034	24.0	379.0	36.6	62.3	1050.0	11.5	42.6
		≥ 500 acres	102	1726	0.41	0.024	28.1	411.2	38.1	70.2	1188.2	9.3	30.0

*1990-1996 mean specific catch and harvest rates n = 157 for all lakes, n = 57 for lakes <500 acres, and n = 100 for lakes ≥500 acres.

Northern Pike

Complete creel surveys were collected from a total of 18 lakes classified as northern pike waters in 1997. Fourteen of the surveyed lakes were 500 acres or larger and four were less than 500 acres. 1997 and 1990-1996 mean values of measured parameters are shown in Table 6. Mean values for lakes <500 acres were all similar to lakes ≥500 acres.

Catch/acre and harvest/acre were significantly higher in 1997 than the 1990-1996 mean values (4.44 vs. 1.70 northern pike/acre for catch, $p < 0.01$; 0.74 vs. 0.40 northern pike/acre for harvest, $p = 0.04$). Also, both specific and general catch rates were significantly lower in 1997 than the 1990-1996 mean values (3.8 vs. 6.0 hours for specific catch, $p = 0.03$; 8.9 hours vs. 17.5 hours for general catch, $p < 0.01$) (Table 6).

Table 6. 1997 and 1990-1996 mean northern pike creel data. Specific and general catch and harvest rates are shown in number of hours per fish caught or harvested.

			N	Lake Acres	Angler Catch /Acre	Angler Harvest/ Acre	Specific Catch Rate*	Specific Harvest Rate*	Mean Length	General Catch Rate	General Harvest Rate	Directed Effort /Acre	Total Effort /Acre
1997		All lakes	18	1480	4.44	0.74	3.8	18.2	22.4	8.9	59.5	6.9	33.5
	Means	< 500 acres	4	350	4.47	0.68	3.3	14.4	21.2	6.7	43.1	7.3	26.2
		≥ 500 acres	14	1803	4.43	0.76	4.0	19.7	22.8	9.7	66.9	6.8	35.6
1990-1996		All lakes	175	1170	1.70	0.40	6.0	18.4	22.2	17.5	74.8	8.9	34.5
	Means	< 500 acres	64	281	2.10	0.46	5.3	15.0	22.1	15.0	65.2	7.6	43.4
		≥ 500 acres	111	1683	1.48	0.36	6.4	21.2	22.4	19.3	81.7	9.6	29.5

*1990-1996 mean specific catch and harvest rates n = 168 for all lakes, n = 61 for lakes <500 acres, n = 107 for lakes ≥500 acres.

Smallmouth bass

Complete creel surveys were collected from a total of 17 lakes classified as smallmouth bass waters in 1997. Thirteen of the surveyed lakes were 500 acres or larger and four were less than 500 acres. 1997 and 1990-1996 mean values of measured parameters are shown in Table 7.

In general, parameter values in lakes larger and smaller than 500 acres were similar in 1997. While the angler catch/acre was higher in larger lakes in 1997 (1.90 vs. 0.61 smallmouth bass/acre) it was not significantly so ($p = 0.37$). Mean angler catch/acre was higher in 1997 than the 1990-1996 mean value (1.60 vs. 0.91), although this difference was not significant ($p = 0.15$). Mean specific harvest rate was also higher in 1997 than the 1990-1996 mean values (39.7 vs. 29.3 hours) although this difference was not significant ($p = 0.64$).

Table 7. 1997 and 1990-1996 mean smallmouth bass creel data. Specific and general catch and harvest rates are shown in number of hours per fish caught or harvested.

			N	Lake Acres	Angler Catch /Acre	Angler Harvest/ Acre	Specific Catch Rate*	Specific Harvest Rate*	Mean Length	General Catch Rate	General Harvest Rate	Directed Effort /Acre	Total Effort /Acre
1997	Means	All lakes	17	1508	1.60	0.11	3.9	39.7	14.4	13.0	180.1	2.8	33.1
		< 500 acres	4	350	0.61	0.08	4.3	32.5	13.4	10.1	166.7	1.4	26.2
		≥ 500 acres	13	1864	1.90	0.12	3.8	42.6	14.6	14.2	184.7	3.3	35.2
1990-1996	Means	All lakes	177	1203	0.91	0.10	3.6	29.3	14.7	20.4	203.3	3.9	34.6
		< 500 acres	63	287	1.20	0.11	5.5	47.5	14.9	18.2	195.0	3.2	43.4
		≥ 500 acres	114	1709	0.75	0.09	3.0	24.3	14.7	21.8	208.2	4.3	29.6

*1990-1996 Mean specific catch and harvest rates n = 162, n = 56 for lakes <500 acres, and n = 106 for lakes ≥500 acres.

Largemouth bass

Complete creel surveys were collected from a total of 18 lakes classified as largemouth bass waters in 1997. Fourteen of the surveyed lakes were 500 acres or larger and four were less than 500 acres. 1997 and 1990-1996 mean values of measured parameters are shown in Table 8.

Although there were relatively large differences in 1997 between lakes less than 500 acres and lakes 500 acres or larger in mean catch/acre (1.98 vs. 2.80 largemouth bass/acre) and specific harvest/hour (45.0 hours vs. 62.6 hours) in 1997, neither of these differences were significant (p = 0.85 and p = 0.77).

There were also relatively large differences between the 1997 mean values and the 1990-1996 means for catch/acre (2.62 vs. 1.25 largemouth bass/acre), harvest/acre (0.22 vs. 0.12 largemouth bass/acre), and specific harvest rate (57.8 hours vs. 37.3 hours), but again, none of these differences were significant (p = 0.16, p = 0.14, and p = 0.42).

Table 8. 1997 and 1990-1996 mean largemouth bass creel data. Specific and general catch and harvest rates are measured in number of hours per fish caught or harvested.

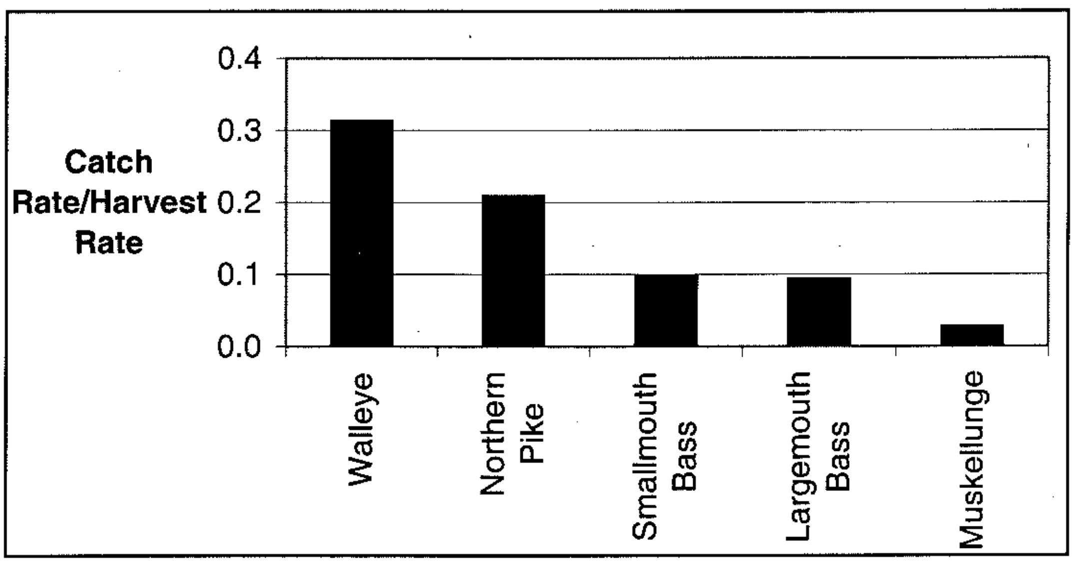
			N	Lake Acres	Angler Catch /Acre	Angler Harvest/ Acre	Specific Catch Rate*	Specific Harvest Rate*	Mean Length	General Catch Rate	General Harvest Rate	Directed Effort /Acre	Total Effort /Acre
1997		All lakes	18	1480	2.62	0.22	5.4	57.8	14.8	16.4	200.4	3.4	33.5
	Means	< 500 acres	4	350	1.98	0.25	6.4	45.0	14.1	17.3	158.7	3.8	26.2
		≥ 500 acres	14	1803	2.80	0.21	5.2	62.6	15.1	16.2	216.7	3.2	35.6
1990-1996		All lakes	188	1097	1.25	0.12	6.1	37.3	14.3	26.1	211.5	4.7	34.7
	Means	< 500 acres	72	279	1.69	0.16	6.9	44.5	14.2	23.2	213.6	4.8	43.1
		≥ 500 acres	116	1605	0.99	0.09	5.7	33.8	14.4	28.3	210.2	4.6	29.5

*1990-1996 mean specific catch and harvest rates n = 170, n = 66 for lakes <500 acres, and n = 104 for lakes ≥500 acres.

Catch and Harvest Rates

Comparing catch and harvest rates among species indicates both the importance of catch and release to a given fishery as well as the relative difficulty of capturing a given species. This information is presented in Figure 5 as the ratio of the mean number of hours of directed effort to catch a particular species of fish to the mean number of hours spent to harvest a fish of the same species. Muskellunge were the most difficult species to catch and to harvest due to the relatively low densities dictated by the biology and habitat requirement of this large species. In addition, muskellunge had the lowest catch rate to harvest rate ratio due to the emphasis placed on catch and release in this fishery (Figure 5). Interestingly, northern pike, walleye, largemouth bass, and smallmouth bass, all required approximately the same amount of directed effort to catch, although their harvest rates differed substantially. Walleye are highly valued for purposes of consumption; thus the ratio of hours spent to catch a walleye to hours to harvest a walleye is high compared to other species. Increased emphasis on catch and release fishing, along with minimum length limit regulations may account for the lower catch to harvest rate ratios for northern pike, smallmouth bass, and largemouth bass.

Figure 5. 1997 species specific catch/harvest rate ratios.



SUMMARY

These surveys completed by the WDNR protect of fish populations in Northern Wisconsin by providing the necessary biological information to manage harvest of these populations. Population estimates and creel surveys allow fisheries biologists to monitor harvest and exploitation levels and determine the number of fish that can be safely harvested. Total harvests are generally kept at or below this number in each lake through direct regulation of high efficiency methods, such as spearing, and indirect regulation of low efficiency methods, such as angling.

The maximum sustainable exploitation rate for adult walleye in Northern Wisconsin was determined to be 35% (Staggs 1990). Similarly, the maximum sustainable exploitation rate of adult muskellunge was estimated to be 27%. The federal court mandated that exploitation levels not exceed these levels in more than 1 of 40 waters. Since there is a certain degree of uncertainty inherent in population estimates, the safe harvest level for each lake is 35% of the lower 95% confidence level of the current population estimate in a given lake. Due to the variability in fish populations over time, the reliability of a population estimate declines with time and a mark-recapture population estimate is only used to determine allowable harvest for two years. In the first year after the population estimate is calculated, the estimate is multiplied by a safety factor of 35%, as 65% is the maximum decline which can be expected in a year in a walleye population in Northern Wisconsin (Hansen et al. 1991).

Every spring each tribe makes a declaration of how many walleyes and muskellunge they intend to harvest from each lake. Angler bag limits are adjusted according to the percent of the safe harvest level which the tribes declare. The greater the percentage, the lower the daily bag limit.

The Chippewa Tribes in Wisconsin are legally able to harvest walleyes using a variety of high efficiency methods including spearing and gillnetting, but spring spearing is the most frequently utilized method. Spearing in the spring is by far the most utilized method. Nightly permits are issued to individual tribal spearers. Each permit allows a specified number of fish to be harvested, including one walleye between 20 and 24 inches and one additional walleye of any size. All fish that are taken are documented each night. The tribal spearer registers all of the fish that are speared in a given evening with a tribal clerk or warden present at each boat landing utilized in a given lake. This number is added to the total number speared from a given lake each morning during the spearing season. Once the level of declared harvest is reached in a given lake, no more permits are issued for that lake, and spearfishing ceases.

Fall young of the year surveys are currently utilized in determining the recruitment codes of lakes in the ceded territory. In concert with other data, these surveys allow fisheries managers to determine whether further management actions may be necessary in order to protect or enhance a given fish population.

As a whole, fisheries in the ceded territory continue to represent quality fishing opportunities. The vast majority of fish populations remain at acceptable densities, and there are no indications of overexploitation. The surveys and management techniques discussed in this report appear to be successful in allowing management agencies to maintain and protect fish populations in the ceded territory. The use of these techniques will help continue the success of fisheries resources in the ceded territory of Wisconsin.

REFERENCES

Beard, T. D., Jr., S. W. Hewett, Q. Yang, R. M. King, and S. J. Gilbert. 1997. Prediction of angler catch rates based on walleye population density. North American Journal of Fisheries Management 17 (4): 621-627.

Hansen, M. J. 1989. A walleye population model for setting harvest quotas. Wisconsin Department of Natural Resources Bureau of Fisheries Management, Fish Management Report 143, Madison, Wisconsin.

Hansen, M. J., M.D. Staggs, and M. H. Hoff. 1991. Derivation of safety factors for setting harvest quotas on adult walleyes from past estimates of abundance. Transactions of the American Fisheries Society 120: 620-628.

Hansen, M. J., M.A. Bozek, J. R. Newby, S. P. Newman and M. D. Staggs. 1998. Factors affecting recruitment of walleyes in Escanaba Lake, Wisconsin, 1958-1996. North American Journal of Fisheries Management 18(4): 764-774.

Hansen, M. J., T. D. Beard Jr., S. W. Hewett. 2000. Catch rates and catchability of walleyes in angling and spearing fisheries in Northern Wisconsin lakes. North American Journal of Fisheries Management 20(1): 109-118.

Hewett, S. W. and T. D. Simonson. 1998. Wisconsin's walleye management plan: moving management into the 21st century. Wisconsin Department of Natural Resources, Administrative Report #43, Bureau of Fisheries Management and Habitat Protection, Madison, Wisconsin.

Kempinger, J. J. and R. F. Carline. 1977. Dynamics of the walleye (*Stizostedion vitreum vitreum*) population in Escanaba Lake, Wisconsin, 1955-1972. Journal of the Fisheries Research Board of Canada 34: 1800-1811.

Krueger, J. 1997. Open water spearing in northern Wisconsin by Chippewa Indians during 1996. Great Lakes Indian Fish and Wildlife Commission, Administrative Report 97-02, Odanah, Wisconsin.

Krueger, J. 1998. Open water spearing in northern Wisconsin by Chippewa Indians during 1997. Great Lakes Indian Fish and Wildlife Commission, Administrative Report 98-01, Odanah, Wisconsin.

Li, J., Y. Cohen, D. H. Schupp, and I. R. Adelman. 1996. Effects of walleye stocking on year-class strength. North American Journal of Fisheries Management 16(4): 840-850.

Ngu, H. H. 1994. Open water spearing in northern Wisconsin by Chippewa Indians during 1993. Great Lakes Indian Fish and Wildlife Commission, Administrative Report 94-1, Odanah, Wisconsin.

Ngu, H. H. 1995. Open water spearing in northern Wisconsin by Chippewa Indians during 1994. Great Lakes Indian Fish and Wildlife Commission, Administrative Report 95-03, Odanah, Wisconsin.

Ngu, H. H. 1996. Open water spearing in northern Wisconsin by Chippewa Indians during 1995. Great Lakes Indian Fish and Wildlife Commission, Administrative Report 96-01, Odanah, Wisconsin.

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: 460-480.

Ricker, W. E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations. Bulletin of the Fisheries Research Board of Canada 191. Department of the Environment, Fisheries, and Marine Science, Ottawa. 382 p.

Serns, S. L. 1982. Relationship of walleye fingerling density and electrofishing catch per effort in northern Wisconsin lakes. North American Journal of Fisheries Management 2 (1): 38-44.

Staggs, M. D, R. C. Moody, M. J. Hansen, and M. H. Hoff. 1990. Spearing and sport angling for walleye in Wisconsin's ceded territory. Wisconsin Department of Natural Resources Bureau of Fisheries Management, Administrative Report 31, Madison, Wisconsin.

Appendix 1. Lakes with adult walleye population estimates calculated in 1997 and at least one historical population estimate.

County	Lake	Year	Adult Population Estimate	Adult Walleye Per Acre
Burnett	Clam River Flowage	1997	743	2.1
		1991	616	1.7
	Lipsett Lake	1997	420	1.1
		1994	153	0.4
Douglas	Upper St. Croix Lake	1997	2467	2.9
		1992	2933	3.4
Forest	Butternut Lake	1997	6525	5.1
		1992	6721	5.2
	Franklin Lake	1997	1834	2.1
		1994	2101	2.4
Iron	Trude Lake	1997	3495	4.5
		1992	3897	5.0
		1989	3985	5.1
	Turtle-Flambeau Flowage	1997	54758	4.0
		1992	58938	4.4
		1989	83619	6.2
Oneida	Chain Lake	1997	309	1.4
		1990	1060	4.8
	Dam Lake	1997	2556	3.4
		1990	2627	3.5
	Sand Lake	1997	1166	2.2
		1990	1803	3.3
	Sevenmile Lake	1997	1342	2.7
		1992	2444	4.9
	Stone Lake	1997	50	0.3
		1990	253	1.3
Polk	Big Round Lake	1997	3796	3.7
		1991	2012	2.0
		1989	3782	3.7
Sawyer	Sissabagama Lake	1997	4617	6.4
		1991	5517	7.7
		1987	9850	13.7
Vilas	Birch Lake	1997	478	0.9
		1990	584	1.1
	Harris Lake	1997	1913	3.8
		1989	1660	3.3
	Little St. Germain Lake	1997	2212	2.3
		1992	653	0.7
		1989	3187	3.3
	Papoose Lake	1997	819	1.9
		1994	1306	3.1
	Star Lake	1997	5474	4.5
		1993	7944	6.6
		1987	3366	2.8
		1986	4713	3.9

Appendix 2. Walleye young of the year per mile and Serns Index calculations of surveyed lakes with natural reproduction in 1997.

Lake	County	Acres	Total Shoreline (mi)	Shoreline Shocked (mi)	Age 0+ Walleye (#/mi)	Serns Index (YOY/acre)
Pike Lake	Price	806	10.9	10.9	23.9	5.6
Round Lake	Price	726	5.1	5.1	89.2	20.9
Spillerberg Lake	Ashland	75	1.5	1.5	24.7	5.8
Turner Lake	Price	149	2.6	2.6	7.3	1.7
Butternut Lake	Price	1006	11.2	11.2	35.7	8.4
Long Lake	Price	418	11.9	2.3	93.0	21.8
Lower Clam Lake	Sawyer	229	4.3	2.6	0.4	0.1
Middle Eau Claire Lake	Bayfield	902	11	11	28.9	6.8
Upper St. Croix Lake	Douglas	855	10	10	2.7	0.6
Whitefish Lake	Douglas	832	6.9	5.3	45.3	10.6
Wilson Lake	Price	351	9.6	3.8	28.9	6.8
Amik Lake	Price	224	5.3	5.3	5.5	1.3
Bear Lake	Ashland	204	6	2.7	8.9	2.1
Birch Lake	Vilas	528	5.6	5.6	47.9	11.2
Bolger Lake	Oneida	119	2.7	2.7	0.0	0.0
Boot Lake	Oconto	235	3.8	3.1	0.0	0.0
Buffalo Lake	Oneida	104	2.2	2.2	2.7	0.6
Butternut Lake	Forest	1292	8.2	8.2	39.3	9.2
Chain Lake	Rusk	468	7.9	4.6	4.6	1.1
Chain Lake	Oneida	219	3.4	3.4	4.7	1.1
Clam River Flowage	Burnett	359	6.4	3.6	20.8	4.9
Clear Lake	Rusk	95	1.8	1.8	0.0	0.0
Dam Lake	Oneida	744	7.7	6.8	24.0	5.6
Fireside Lakes	Rusk	302	3.8	3.8	2.1	0.5
Franklin Lake	Forest	892	6.6	6.6	9.5	2.2
Gile Flowage	Iron	3384	27.2	12.9	47.3	11.1
Harris Lake	Vilas	507	6	5.3	8.7	2.0
Hasbrook Lake	Oneida	302	4.3	4.3	83.0	19.4
Island Lake	Rusk	526	5.8	5.8	0.0	0.0
Keyes Lake	Florence	202	3.2	3.2	25.9	6.1
Lake Chippewa	Sawyer	15300	232.9	43	90.7	21.2
Lac Sault Dore Lake	Price	561	14.1	5.2	151.5	35.5
Mars Lake	Oneida	41	1.3	1.3	0.0	0.0
McCann Lake	Rusk	133	4.2	1.8	0.6	0.1
Papoose Lake	Vilas	428	7.3	7.3	9.2	2.1
Sand Lake	Oneida	540	4.9	4.9	21.4	5.0
Sevenmile Lake	Oneida	503	6.1	3.6	3.6	0.8
Sissabagama Lake	Sawyer	719	8.2	8.2	1.1	0.3
Sparkling Lake	Vilas	154	2.3	2.3	5.2	1.2
Spider Lake	Iron	352	7.3	7.3	31.9	7.5
Spider Lake	Oneida	118	2.6	2.6	0.0	0.0
Star Lake	Vilas	1206	11.7	11.7	56.2	13.1
Stone Lake	Oneida	188	4.1	3	3.7	0.9
Tainter Lake	Dunn	1752	25.7	3	160.0	37.4
Thornapple Flowage	Rusk	268	7.6	2.7	2.6	0.6
Trude Lake	Iron	781	15.1	5	314.4	73.6
Turtle-Flambeau Flowage	Iron	13545	206.3	185.7	77.5	18.1
Van Vliet Lake	Vilas	220	4.7	4.7	6.6	1.5
Windfall Lake	Sawyer	102	1.6	3.2	8.8	2.0
Cedar Lake	St. Croix	1100	6.3	4.2	0.5	0.1
Thompson Lake	Price	111	1.9	1.9	0.0	0.0
Average					32.6	7.6

Appendix 3. Walleye young of the year per mile and Serns Index calculations for surveyed lakes sustained by stocking and whether each lake was stocked with juvenile walleye in 1997.

Lake	County	Acres	Total Shoreline (mi)	Shoreline Shocked (mi)	Age 0+ Walleye (#/mi)	Serns Index (YOY/acre)	Stocked in 1997	1997 Stocking Code
English Lake	Ashland	244	4.1	3.8	0.0	0.0	N	ST
Prairie Lake	Barron	1534	25.4	8.6	28.6	6.7	Y	C-ST
Bony Lake	Bayfield	191	2.7	2.7	71.9	16.8	Y	C-ST
Lipsett Lake	Burnett	393	3.5	3.5	0.0	0.0	N	C-ST
Poquettes Lake	Burnett	97	2.1	2.1	0.0	0.0	N	ST
Nebagamon Lake	Douglas	914	10.8	10.8	35.5	8.3	Y	C-ST
Rangeline Lake	Forest	82	1.3	1.3	0.0	0.0	N	ST
Trump Lake	Forest	172	2.8	2.8	0.0	0.0	N	ST
Bearskull Lake	Iron	75	2.2	2.2	6.8	1.6	N	C-ST
Cedar Lake	Iron	193	3.6	3.6	6.1	1.4	N	C-ST
Owl Lake	Iron	129	4.2	4.2	0.0	0.0	N	C-ST
Booth Lake	Oneida	207	3.6	3.6	0.0	0.0	N	C-ST
North Nokomis Lake	Oneida	476	7.3	6.1	16.1	3.8	N	C-ST
Sweeney Lake	Oneida	187	3.3	3.3	2.4	0.6	N	ST
Thunder Lake	Oneida	1768	10.6	7.6	0.0	0.0	Y	ST
Big Round Lake	Polk	1015	5.7	5.7	0.0	0.0	Y	C-ST
Sand Lake	Rusk	262	4.8	4.8	4.0	0.9	N	C-ST
Amacoy Lake	Rusk	278	3.7	3.7	0.0	0.0	Y	ST
Lake Chetac	Sawyer	1920	17.5	17.5	19.0	4.5	N	C-ST
Ghost Lake	Sawyer	372	7.3	4.3	12.3	2.9	Y	ST
Kathryn Lake	Taylor	62	2.7	2.5	0.0	0.0	Y	ST
White Birch Lake	Vilas	112	2.3	2.3	4.8	1.1	Y	C-ST
Ballard Lake	Vilas	505	5.5	5.5	1.8	0.4	Y	ST
Found Lake	Vilas	326	3.7	3.6	0.0	0.0	N	ST
Hunter Lake	Vilas	184	3.2	3.2	6.6	1.5	N	ST
Little St. Germain Lake	Vilas	980	14.7	13.9	2.0	0.5	Y	ST
Lost Lake	Vilas	544	4.6	4.6	0.2	0.1	N	ST
Towanda Lake	Vilas	146	3.3	2.6	11.9	2.8	Y	ST
Bass Lake	Washburn	144	2.7	2.7	1.5	0.3	Y	C-ST
Lake Nancy	Washburn	772	10.9	7.3	2.2	0.5	N	C-ST
Cable Lake	Washburn	185	2.8	2.8	0.0	0.0	Y	ST
Island Lake	Washburn	276	3.6	3.6	0.8	0.2	Y	ST
Silver Lake	Washburn	188	3.2	3.2	0.0	0.0	N	ST
Stone Lake	Washburn	523	4	4	1.5	0.4	N	ST
Average					6.9	1.6		

Appendix 4. Walleye young of the year per mile and Serns Index calculations for surveyed lakes with remnant populations, unharvestable populations, unharvestable stocked populations, populations with unknown reproductive classification, and lakes with no known walleye population.

Lake	County	Acres	Total Shoreline (mi)	Shoreline Shocked (mi)	Age 0+ Walleye (#/mi)	Serns Index (YOY/acre)
Buffalo Lake	Bayfield	190	3.3	3	0.0	0.0
Burrows Lake	Oneida	156	2.4	2.4	0.0	0.0
Leisure Lake	Washburn	75	1.7	1.7	0.0	0.0
Little Sand Lake	Forest	229	2.8	2.8	0.0	0.0
McCormick Lake	Oneida	118	2.1	2.1	0.0	0.0
Richardson Lake	Forest	54	1.3	0.8	0.0	0.0
Waupee Flowage	Oconto	80	4.2	1	0.0	0.0
Shishebogama Lake	Oneida	716	10.2	10	1.4	0.3
Silver Lake	Forest	320	3.8	3.8	0.0	0.0
Antler Lake	Polk	101	3	3	0.0	0.0
Black Lake	Sawyer	129	3	2.6	0.0	0.0
Horseshoe Lake	Barron	377	8.6	6.7	0.0	0.0
Mineral Lake	Ashland	225	5.3	4.1	6.6	1.5
Potato Lake	Rusk	534	9.2	4.9	0.0	0.0
Potter Lake	Ashland	29	0.9	0.9	0.0	0.0
Ruth Lake	Bayfield	66	1.8	1.8	2.8	0.7
Slim Lake	Washburn	224	2.6	2.6	1.2	0.3
Tiger Cat Flowage	Sawyer	819	19.9	4	8.3	1.9
Viola Lake	Burnett	285	4.4	4.4	0.0	0.0
Knuteson Lake	Sawyer	70	1.5	3	1.3	0.3
Newman Lake	Price	91	2	2	0.0	0.0
Wilson Lake	Iron	162	2.9	2.9	0.3	0.1
Average					1.0	0.2

Appendix 5. 1997 walleye creel data. MWB Code is the master water body code assigned to a given lake by the Wisconsin Department of Natural Resources. Catch and harvest rates are measured in fish per hour. Lengths are measured in inches. Effort parameters are measured in hours.

Lake Name	County Name	MWB CODE	1997 Walleye Code	Bag Limit	Length Limit	Lake Acres	Adult PE	Adult PE/Acre	Angler Catch	Angler Catch /Acre	Angler Harvest	Angler Harvest/ Acre	Specific Catch Rate	Specific Harvest Rate	Number of fish Measured	Mean Length	General Catch Rate	General Harvest Rate	Angler Directed Effort	Directed Effort /Acre	Angler Total Effort	Total Effort /Acre
Clam River Flowage	Burnett	2654500	NR	2	15	359	743	2.07	545	1.52	119	0.33	0.1083	0.0256	23	17.20	0.0731	0.0160	4434	12.35	7477	20.83
Lipsett Lake	Burnett	2678100	C-ST	5	15	393	420	1.07	330	0.84	188	0.48	0.1101	0.0634	63	17.69	0.0209	0.0119	2709	6.89	15805	40.22
Upper St. Croix Lake	Douglas	2747300	C-NR	2	15	855	2468	2.89	3989	4.67	859	1.00	0.4171	0.0949	182	16.45	0.2278	0.0490	9050	10.58	17509	20.48
Butternut Lake	Forest	692400	NR	2	slot	1292	6525	5.05	2623	2.03	989	0.77	0.1555	0.0591	206	18.02	0.0789	0.0298	15988	12.37	33237	25.73
Franklin Lake	Forest	692900	NR	2	slot	892	1834	2.06	617	0.69	203	0.23	0.0697	0.0232	47	15.79	0.0399	0.0131	8763	9.82	15673	17.57
Trude Lake **	Iron	2295200	NR	2	none	781	3495	4.48	10335	13.23	3416	4.37	1.4707	0.4861	44	13.21	1.0744	0.3551	7027	9.00	11013	14.10
Turtle-Flambeau Flowage	Iron	2294900	NR	3	none	13545	54758	4.04	85230	6.29	33132	2.45	0.5659	0.2201	1058	13.57	0.4237	0.1647	150224	11.09	201493	14.88
Chain Lake	Oneida	1598000	NR	5	1>14	219	309	1.41	1648	7.53	247	1.13	0.5004	0.0723	63	13.73	0.2913	0.0437	3226	14.73	5735	26.19
Dam Lake	Oneida	1596900	NR	3	1>14	744	2556	3.44	4431	5.96	1320	1.77	0.5163	0.1529	200	11.99	0.2494	0.0743	8561	11.51	17768	23.88
Sand Lake	Oneida	1597000	NR	3	1>14	540	1166	2.16	1813	3.36	395	0.73	0.2858	0.0624	60	12.14	0.1554	0.0338	6326	11.71	11731	21.72
Sevenmile Lake	Oneida	1605800	NR	2	1>14	503	1342	2.67	1240	2.47	429	0.85	0.2235	0.0774	99	14.02	0.0983	0.0340	5476	10.89	12613	25.08
Stone Lake**	Oneida	1597600	NR	5	1>14	188	50	0.27	77	0.41	13	0.07	0.2705	0.0458	5	13.70	0.0512	0.0087	283	1.51	2284	12.15
Big Round Lake	Polk	2627400	C-ST	3	15	1015	3796	3.74	757	0.75	425	0.42	0.0375	0.0234	99	18.56	0.0179	0.0101	14938	14.72	42286	41.66
Lake Chetac	Sawyer	2113300	C-ST	2	15	1920	3336	1.74	4927	2.57	729	0.38	0.1317	0.0289	65	19.57	0.0314	0.0046	16506	8.60	157286	81.92
Sissabagama Lake	Sawyer	2393500	NR	3	none	719	4617	6.42	7100	9.87	2293	3.19	0.5152	0.1642	369	12.31	0.1931	0.0624	13396	18.63	36766	51.13
Birch Lake	Vilas	2311100	NR	3	1>14	528	478	0.91	2632	4.98	1106	2.09	0.6305	0.2648	281	11.95	0.2210	0.0929	4134	7.83	11912	22.56
Harris Lake	Vilas	2958500	NR	2	1>14	507	1913	3.77	970	1.91	562	1.11	0.1507	0.0860	133	15.07	0.0809	0.0469	6235	12.30	11988	23.65
Little St. Germain Lake	Vilas	1596300	ST	3	15	980	2212	2.26	1973	2.01	213	0.22	0.0881	0.0108	18	17.66	0.0191	0.0021	15406	15.72	104249	106.38
Papoose Lake	Vilas	2328700	NR	3	15	428	819	1.91	1114	2.60	79	0.18	0.3658	0.0249	21	17.46	0.1472	0.0104	3029	7.08	7573	17.69
Star Lake	Vilas	1593100	NR	3	1>14	1206	5474	4.54	5639	4.68	2884	2.39	0.3494	0.1786	395	13.92	0.2099	0.1074	15861	13.15	26861	22.27
Birch Lake **	Washburn	2113000	C-ST	3	15	368			3001	8.15	466	1.27	0.0796	0.0000	1	18.20	0.1643	0.0255	3924	10.66	29839	81.08

** Trude (Iron), Stone (Oneida) and Birch (Washburn) lakes were open water creels.
Slot regulation indicates walleye between 14 and 18 inches must be released; only one fish over 18 inches may be kept.
All lakes without a 15-inch size limit are included in the summary for exempt waters.

Appendix 6. 1997 muskellunge creel data. MWB Code is the master water body code assigned to a given lake by the Wisconsin Department of Natural Resources. Catch and harvest rates are measured in fish per hour. Lengths are measured in inches. Effort parameters are measured in hours.

Lake Name	County Name	MWB CODE	1997 Musky Code	Musky Length Limit	Lake Acres	Angler Catch	Angler Catch /Acre	Angler Harvest	Angler Harvest/ Acre	Specific Catch Rate	Specific Harvest Rate	Number of fish Measured	Mean Length	General Catch Rate	General Harvest Rate	Angler Directed Effort	Directed Effort /Acre	Angler Total Effort	Total Effort /Acre
Clam River Flowage*	Burnett	2654500																	
Lipsett Lake	Burnett	2678100	REM	34	393	7	0.02	0	0.00	0.0000	0.0000	0		0.0011	0.0000	78	0.20	15805	40.22
Upper St. Croix Lake *	Douglas	2747300	NONE	34	855	12	0.01	0	0.00	0.0000	0.0000	0		0.0021	0.0000	3	0.00	17509	20.48
Butternut Lake*	Forest	692400																	
Franklin Lake*	Forest	692900																	
Trude Lake**	Iron	2295200	C-ST	40	781	64	0.08	0	0.00	0.0304	0.00	0		0.0101	0.0000	2092	2.68	11013	14.10
Turtle-Flambeau Flowage	Iron	2294900	C-ST	40	13545	1293	0.10	22	0.00	0.0366	0.0008	2	42.00	0.0068	0.0001	25509	1.88	201493	14.88
Chain Lake	Oneida	1598000	C-	34	219	35	0.16	8	0.04	0.0107	0.0000	0		0.0066	0.0014	1304	5.95	5735	26.19
Dam Lake	Oneida	1596900	C-	34	744	252	0.34	0	0.00	0.0353	0.0000	0		0.0148	0.0000	6994	9.40	17768	23.88
Sand Lake	Oneida	1597000	C-	34	540	56	0.10	5	0.01	0.0167	0.0032	1	38.00	0.0060	0.0006	1705	3.16	11731	21.72
Sevenmile Lake	Oneida	1605800	NR	34	503	365	0.73	5	0.01	0.0582	0.0009	1	42.00	0.0327	0.0004	5283	10.50	12613	25.08
Stone Lake**	Oneida	1597600	NR	34	188	29	0.15	0	0.00	0.0310	0.0000	0		0.0178	0.0000	444	2.36	2284	12.15
Big Round Lake	Polk	2627400	REM	34	1015	13	0.01	6	0.01	0.0346	0.0000	1	41.00	0.0007	0.0003	182	0.18	42286	41.66
Lake Chetac *	Sawyer	2113300																	
Sissabagama Lake	Sawyer	2393500	C-	34	719	695	0.97	32	0.04	0.0381	0.0020	4	38.63	0.0193	0.0009	15831	22.02	36766	51.13
Birch Lake	Vilas	2311100	NR	34	528	343	0.65	4	0.00	0.0559	0.0008	1	38.00	0.0299	0.0003	5090	9.64	11912	0.01
Harris Lake	Vilas	2956500	NR	34	507	118	0.23	3	0.01	0.0355	0.0009	1	37.10	0.0108	0.0003	3232	6.37	11988	23.65
Little St. Germain Lake	Vilas	1596300	C-	34	980	658	0.67	39	0.04	0.0145	0.0017	1	36.30	0.0066	0.0004	23405	23.88	104249	106.38
Papoose Lake	Vilas	2328700	C-	40	428	152	0.36	0	0.00	0.0325	0.0000	0		0.0205	0.0000	3851	9.00	7573	17.69
Star Lake	Vilas	1593100	C-	34	1206	89	0.07	0	0.00	0.0097	0.0000	0		0.0035	0.0000	6586	5.46	26861	22.27
Birch Lake*	Washburn	2113000																	

* Clam River Flowage (Burnett), Upper St. Croix Lake (Douglas), Butternut Lake (Forest), Franklin Lake (Forest), Lake Chetac (Sawyer) and Washburn County's Birch Lake are not classified as musky waters.

** Trude (Iron), Stone (Oneida) and Birch (Washburn) lakes were open water creels.

Appendix 7. 1997 northern pike creel data. MWB Code is the master water body code assigned to a given lake by the Wisconsin Department of Natural Resources. Catch and harvest rates are measured in fish per hour. Lengths are measured in inches. Effort parameters are measured in hours.

Lake Name	County Name	MWB CODE	Lake Acres	Angler Catch	Angler Catch /Acre	Angler Harvest	Angler Harvest/ Acre	Specific Catch Rate	Specific Harvest Rate	Number of fish Measured	Mean Length	General Catch Rate	General Harvest Rate	Angler Directed Effort	Directed Effort /Acre	Angler Total Effort	Total Effort /Acre
Clam River Flowage	Burnett	2654500	359	1713	4.77	290	0.81	0.3405	0.0754	86	20.86	0.2308	0.0391	3615	10.07	7477	20.83
Lipsett Lake	Burnett	2678100	393	4213	10.72	616	1.57	0.5425	0.0917	252	19.94	0.2666	0.0390	5839	14.86	15805	40.22
Upper St. Croix Lake	Douglas	2747300	855	3380	3.95	403	0.47	0.3999	0.0759	190	20.54	0.1930	0.0230	4959	5.80	17509	20.48
Butternut Lake	Forest	692400	1292	1634	1.26	28	0.02	0.1612	0.0038	6	33.33	0.0503	0.0008	6113	0.00	33237	25.73
Franklin Lake	Forest	692900	892	2963	3.32	4	0.00	0.3470	0.0000	1	32.20	0.1914	0.0003	5437	6.10	15673	17.57
Trude Lake**	Iron	2295200	781	955	1.22	46	0.06	0.3586	0.00	0		0.2313	0.0112	449	0.57	11013	14.10
Turtle-Flambeau Flowage	Iron	2294900	13545	23264	1.72	2446	0.18	0.5477	0.0656	50	19.68	0.1165	0.0122	20347	1.50	201493	14.88
Chain Lake	Oneida	1598000	219	480	2.19	74	0.34	0.2280	0.0997	20	20.50	0.0868	0.0134	578	2.64	5735	26.19
Dam Lake	Oneida	1596900	744	687	0.92	77	0.10	0.1362	0.0221	13	22.14	0.0394	0.0044	841	1.13	17768	23.88
Sand Lake	Oneida	1597000	540	649	1.20	64	0.12	0.1942	0.0274	23	19.41	0.0563	0.0056	2207	4.09	11731	21.72
Sevenmile Lake	Oneida	1605800	503	214	0.43	92	0.18	0.0834	0.0342	22	20.85	0.0180	0.0078	1898	3.77	12613	25.08
Stone Lake**	Oneida	1597600	188	768	4.09	45	0.24	0.7968	0.0529	10	23.03	0.3363	0.0197	801	4.26	2284	12.15
Big Round Lake	Polk	2627400	1015	8501	8.38	1473	1.45	0.3414	0.0712	355	22.56	0.2014	0.0349	14144	13.93	42286	41.66
Lake Chetac	Sawyer	2113300	1920	25843	13.46	8978	4.68	0.4030	0.1599	687	20.85	0.1643	0.0571	38107	19.85	157286	81.92
Sissabagama Lake	Sawyer	2393500	719	1620	2.25	236	0.33	0.1058	0.0167	39	23.82	0.0447	0.0065	1699	2.36	36766	51.13
Birch Lake	Vilas	2311100	528	293	0.55	52	0.10	0.0652	0.0156	13	22.03	0.0258	0.0046	414	0.78	11912	22.56
Harris Lake	Vilas	2958500	507	544	1.07	128	0.25	0.2013	0.0919	33	19.52	0.0459	0.0108	705	1.39	11988	23.65
Little St. Germain Lake	Vilas	1596300	980	21152	21.58	2220	2.27	0.3773	0.0601	166	20.83	0.2031	0.0213	29696	30.30	104249	106.38
Papoose Lake	Vilas	2328700	428	85	0.20	9	0.02	0.1004	0.0115	3	23.67	0.0125	0.0014	651	1.52	7573	17.69
Star Lake	Vilas	1593100	1206	2337	1.94	540	0.45	0.1735	0.0664	71	20.82	0.0870	0.0201	4506	3.74	26861	22.27
Birch Lake**	Washburn	2113000	368	2039	5.54	239	0.65	0.1118	0.0494	3	19.93	0.0855	0.0100	4572	12.42	29839	81.08

** Trude (Iron Co.), Stone (Oneida Co.) and Birch (Washburn Co.) lakes were open water creels.

Appendix 9. 1997 largemouth bass creel data. MWB Code is the master water body code assigned to a given lake by the Wisconsin Department of Natural Resources. Catch and harvest rates are measured in fish per hour. Lengths are measured in inches. Effort parameters are measured in hours.

Lake Name	County Name	MWB CODE	Lake Acres	Angler Catch	Angler Catch /Acre	Angler Harvest	Angler Harvest/ Acre	Specific Catch Rate	Specific Harvest Rate	Number of fish Measured	Mean Length	General Catch Rate	General Harvest Rate	Angler Directed Effort	Directed Effort /Acre	Angler Total Effort	Total Effort /Acre
Clam River Flowage	Burnett	2654500	359	190	0.53	3	0.01	0.0248	0.0000	1	14.00	0.0420	0.0007	1044	2.91	7477	20.83
Lipsett Lake	Burnett	2678100	393	2887	7.35	387	0.98	0.3848	0.0667	110	14.29	0.1827	0.0245	4810	12.24	15805	40.22
Upper St. Croix Lake	Douglas	2747300	855	142	0.17	36	0.04	0.0416	0.0167	14	17.16	0.0086	0.0022	1213	1.42	17509	20.48
Butternut Lake*	Forest	692400	1292	12	0.01	0	0.00			0		0.0041	0.0000	0	0.00	33237	25.73
Franklin Lake	Forest	692900	892	13	0.01	0	0.00			0		0.0031	0.0000	0	0.00	15673	17.57
Trude Lake**	Iron	2295200	781	0	0.00	0	0.00	0	0.00	0		0	0.0000	71	0.09	11013	14.10
Turtle-Flambeau Flowage	Iron	2294900	13545	46	0.00	24	0.00	0.0903	0.0000	0		0.0014	0.0007	246	0.02	201493	14.88
Chain Lake	Oneida	1598000	219	4	0.02	0	0.00			0		0.0053	0.0000	0	0.00	5735	26.19
Dam Lake	Oneida	1596900	744	56	0.08	0	0.00	0.0449	0.0000	0		0.0051	0.0000	1252	1.68	17768	23.88
Sand Lake	Oneida	1597000	540	13	0.02	0	0.00	0.0246	0.0000	0		0.0053	0.0000	267	0.49	11731	21.72
Sevenmile Lake	Oneida	1605800	503	5	0.01	0	0.00	0.0098	0.0000	0		0.0005	0.0000	472	0.94	12613	25.08
Stone Lake**	Oneida	1597600	188	13	0.07	0	0.00	0.1936	0.0000	0		0.0182	0.0000	65	0.35	2284	12.15
Big Round Lake	Polk	2627400	1015	30367	29.92	2206	2.17	1.1753	0.0995	431	14.60	0.7195	0.0523	18207	17.94	42286	41.66
Lake Chetac	Sawyer	2113300	1920	12201	6.35	1212	0.63	0.4266	0.0449	51	15.59	0.0829	0.0082	20766	10.82	157286	81.92
Sissabagama Lake	Sawyer	2393500	719	407	0.57	20	0.03	0.2405	0.0097	3	14.00	0.0121	0.0006	971	1.35	36766	51.13
Birch Lake**	Vilas	2311100	528	15	0.03	0	0.00	0.0238	0.0000	0		0.0016	0.0000	191	0.36	11912	22.56
Harris Lake	Vilas	2958500	507	0	0.00	0	0.00			0		0.0000	0.0000	0	0.00	11988	23.65
Little St. Germain Lake	Vilas	1596300	980	2035	2.08	60	0.06	0.0584	0.0049	3	14.30	0.0211	0.0006	9939	10.14	104249	106.38
Papoose Lake	Vilas	2328700	428	5	0.01	0	0.00	0.0577	0.0000	0		0.0011	0.0000	95	0.22	7573	17.69
Star Lake	Vilas	1593100	1206	12	0.01	0	0.00	0.0000	0.0000	0		0.0008	0.0000	403	0.33	26861	22.27
Birch Lake**	Washburn	2113000	368	2171	5.90	65	0.18	0.5520	0.0000	1	15.90	0.1177	0.0035	3429	9.32	29839	81.08

* Butternut Lake (Forest) is not classified as a largemouth bass water.

** Trude (Iron), Stone (Oneida) and Birch (Washburn) lakes were open water creels.

Appendix 8. 1997 smallmouth bass creel data. MWB Code is the master water body code assigned to a given lake by the Wisconsin Department of Natural Resources. Catch and harvest rates are measured in fish per hour. Lengths are measured in inches. Effort parameters are measured in hours.

Lake Name	County Name	MWB CODE	Lake Acres	Angler Catch	Angler Catch /Acre	Angler Harvest	Angler Harvest/ Acre	Specific Catch Rate	Specific Harvest Rate	Number of fish Measured	Mean Length	General Catch Rate	General Harvest Rate	Angler Directed Effort	Directed Effort /Acre	Angler Total Effort	Total Effort /Acre
Clam River Flowage	Burnett	2654500	359	692	1.93	117	0.33	0.2471	0.0749	19	13.35	0.1388	0.0234	1342	3.74	7477	20.83
Lipsett Lake*	Burnett	2678100	393	29	0.07	5	0.01	0.1555	0.0482	1	13.50	0.0037	0.0006	99	0.25	15805	40.22
Upper St. Croix Lake	Douglas	2747300	855	1005	1.18	46	0.05	0.2505	0.0111	9	15.69	0.0680	0.0031	1343	1.57	17509	20.48
Butternut Lake	Forest	692400	1292	9543	7.39	832	0.64	0.6395	0.0620	168	14.82	0.3638	0.0317	11503	8.90	33237	25.73
Franklin Lake	Forest	692900	892	2622	2.94	271	0.30	0.3657	0.0424	58	14.93	0.1799	0.0186	6253	7.01	15673	17.57
Trude Lake**	Iron	2295200	781	453	0.58	77	0.10	0.5566	0.0000	3	13.00	0.0926	0.0158	474	0.61	11013	14.10
Turtle-Flambeau Flowage	Iron	2294900	13545	5163	0.38	611	0.05	0.1351	0.0166	20	16.13	0.0283	0.0034	21683	1.60	201493	14.88
Chain Lake*	Oneida	1598000	219	61	0.28	0	0.00	0.5000	0.0000	0		0.2430	0.0000	56	0.26	5735	26.19
Dam Lake	Oneida	1596900	744	75	0.10	11	0.01	0.0931	0.0163	1	20.50	0.0059	0.0009	682	0.92	17768	23.88
Sand Lake	Oneida	1597000	540	24	0.04	0	0.00	0.0517	0.0000	0		0.0097	0.0000	340	0.63	11731	21.72
Sevenmile Lake	Oneida	1605800	503	37	0.07	9	0.02	0.0500	0.0127	1	12.00	0.0041	0.0010	366	0.73	12613	25.08
Stone Lake**	Oneida	1597600	188	61	0.32	0	0.00	0.1737	0.0000	0		0.0333	0.0000	175	0.93	2284	12.15
Big Round Lake*	Polk	2627400															
Lake Chetac	Sawyer	2113300	1920	5125	2.67	441	0.23	0.2763	0.0376	12	15.87	0.0372	0.0032	8919	4.65	157286	81.92
Sissabagama Lake	Sawyer	2393500	719	5633	7.83	110	0.15	0.9293	0.0160	12	14.18	0.1581	0.0031	2334	3.25	36766	51.13
Birch Lake	Vilas	2311100	528	126	0.24	10	0.02	0.1545	0.0260	2	13.05	0.0119	0.0009	372	0.70	11912	22.56
Harris Lake	Vilas	2958500	507	251	0.50	40	0.08	0.3476	0.0631	5	13.26	0.0239	0.0038	519	1.02	11988	23.65
Little St. Germain Lake	Vilas	1596300	980	1225	1.25	23	0.02	0.0703	0.0011	1	11.70	0.0128	0.0002	10375	10.59	104249	106.38
Papoose Lake	Vilas	2328700	428	64	0.15	0	0.00	0.0298	0.0000	0		0.0101	0.0000	615	1.44	7573	17.69
Star Lake	Vilas	1593100	1206	205	0.17	12	0.01	0.0769	0.0000	2	13.25	0.0089	0.0005	1169	0.97	26861	22.27
Birch Lake**	Washburn	2113000	368	1625	4.42	0	0.00	0.0499	0.0000	0	-	0.0975	0.0000	930	2.53	29839	81.08

* Lipsett, Chain, and Big Round Lakes are not classified as smallmouth bass waters.

** Trude (Iron), Stone (Oneida) and Birch (Washburn) lakes were open water creels.