

Population characteristics, and sport and tribal use of largemouth bass, northern pike, and walleye in North Sand Lake, Burnett County, Wisconsin, 2006.

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Executive Summary

North Sand Lake was sampled in 2006 to determine population abundance, growth, and size distribution of walleye Sanders vitreus and largemouth bass Micropterus salmoides. Northern pike Esox lucius were also collected to determine size distribution and relative abundance. A creel survey was conducted for the entire fishing season (May 6, 2006 – March 4, 2007) to determine angler effort, harvest, and exploitation. A total of 201 walleyes were collected by fyke nets and electrofishing during the spawning period. Adult population abundance was estimated to be 307 fish or 0.32 fish/acre. This is the lowest abundance estimate done on North Sand Lake to date. While abundance has decreased for all size groups, walleyes measuring ≥ 20 in now make up a larger percentage of the population than during any previous survey. Growth rates continue to be good and remain better than state and regional averages. Natural reproduction of walleyes is very limited and recruitment is consistently low, despite decades of intensive stocking. A total of 750 largemouth bass were collected with electrofishing and fyke nets. Abundance was estimated to be 4,364 fish or 4.5 fish/acre. May electrofishing runs captured largemouth bass at a rate of 24 per mile, and PSD and RSD-15 values were 65 and 10, respectively, which is comparable to past surveys. Less than 1% of the sample measured ≥ 18 in. Largemouth bass growth rates have declined greatly and do not meet the minimum growth standard established by Wisconsin Department of Natural Resources (WDNR). A total of 238 northern pike were captured with fyke nets. Both abundance and size structure appear to have increased since past surveys. Catch per net night was higher than in past surveys, and PSD was 42, which is much higher than previously found. Open water angler effort on North Sand Lake was 12.6 hours per acre, which is light and comparable to the previous survey in 2000. Anglers target largemouth

bass, northern pike, and bluegill Lepomis macrochirus the most. Less of the directed fishing effort was targeted at walleyes than in previous creel surveys.

Introduction

North Sand Lake is a 962 acre seepage lake in east central Burnett County. There is a town owned boat landing on the west side of the lake. The water is clear and relatively infertile. The shoreline is nearly entirely privately owned and is well developed. The majority of the bottom substrate is sand, although there are some small areas of gravel and cobble. Aquatic vegetation is limited. The maximum and mean depths of North Sand Lake are 73 feet and 24 feet, respectively. The fishery consists mainly of largemouth bass, walleye, northern pike, bluegill, and black crappie Pomoxis nigromaculatus. Smallmouth bass M. dolomieu, pumpkinseed L. gibbosus, rock bass Ambloplites rupestris, yellow perch Perca flavescens, brown bullhead Ameiurus nebulosus, yellow bullhead A. natalis, and bowfin Amia calva are also present. Common forage species include white sucker Catostomus commersoni and bluntnose minnow Pimephales notatus.

Numerous fisheries surveys have been conducted on North Sand Lake. A June 1954 fyke net survey captured bluegill, pumpkinseed, northern pike, and largemouth bass. Recommendations were for northern pike and largemouth bass management with no stocking (Klingbiel, Wisconsin Conservation Department files, 1962). A September 1957 fyke net survey found similar results and recommended no walleye stocking due to past failures. Another fyke net survey in April 1961 captured just one walleye, resulting in a recommendation for walleye fingerling stocking to bolster the population. Walleyes were stocked that year for the first time since 1944. A September 1962 electrofishing survey was conducted to assess the previous years stocking. Catch rates were low. Two May 1969 electrofishing surveys captured several year classes of walleyes. In October

1969 an electrofishing run caught young-of-the-year (YOY) walleyes at a rate of 3 per mile. No walleye stocking had occurred that year. Donatell (1970) concluded that the “buildup of the walleye population over the past several years has not had an adverse effect on the largemouth bass population”. Recommendations included periodic walleye stocking, walleye spawning area enhancement, and installation of fish crib shelters.

North Sand Lake is part of the ceded territory of northern Wisconsin and has had annual tribal harvest of walleyes for all but one of the last 20 years, annually reducing the daily bag limit for anglers. There has been a 15 in minimum length limit on walleyes since 1990. Prior to 1990 a 13 in minimum length limit on walleyes was in place for more than 20 years. There has been a 14 in minimum length limit on largemouth and smallmouth bass since 1996. Previously, a 12 in minimum length limit on bass had been in place since 1989. From 1979 through 1988 there was a 10 in minimum length limit on bass due to a Burnett County-wide regulation. Prior to that there were no length limits on bass for more than 25 years. In 1992 the bass harvest opener was moved back from the first Saturday in May to mid June throughout northern Wisconsin. In 2000 the north/south boundary line was moved north, placing North Sand Lake in the southern bass management zone. North Sand Lake remains in the southern zone and, therefore, is open for bass harvest on the first Saturday in May annually.

As a response to the initiation of tribal spear harvest WDNR began a treaty assessment program in the ceded territory of northern Wisconsin to monitor the effects of increased exploitation on walleye populations. The walleye population of North Sand Lake was heavily exploited by Native American spearing in 1987 and 1988 (Johannes, 1989). A fyke net, electrofishing, and creel survey was conducted in 1988 to estimate walleye population abundance and angler exploitation of walleyes. The survey found a

low density adult walleye population (0.8 fish/ acre) and low angler exploitation (5.7%). However, it was estimated that 33% of the adult walleye population was removed during tribal spearing. Management recommendations included stocking walleye fingerlings annually until adult densities reached 3 fish per acre. 1988 marked the first of four treaty assessment surveys on North Sand Lake to determine walleye population abundance, angler effort, and angler exploitation of walleyes. Surveys in 1993 and 2000 expanded to include gamefish and some sampling of the entire fish community. Walleye population estimates and angler creel surveys found that adult walleye densities remained low, despite intensive annual stocking. Angler exploitation rates also remained low. The survey work in 2000 included a summer mini-fyke net survey to sample the entire fish community. Fourteen species of fish were captured with bluegills and bluntnose minnows dominating the catch. Of note, several banded killifish Fundulus diaphanous were captured.

North Sand Lake has been stocked extensively over the years, with the first record of stocking occurring in 1936. Before 1970 largemouth bass, “sunfish”, northern pike, and walleye were stocked occasionally. One unsuccessful stocking of rainbow trout Oncorhynchus mykiss occurred in 1958. Since 1970, with the exception of one largemouth bass stocking in 1989, walleyes have been stocked exclusively and intensively. A May 1990 electrofishing survey attempted to assess survival of accelerated growth walleye fingerlings stocked the previous year. Low survival was found. WDNR and a local tribal natural resources department have conducted several fall electrofishing surveys to assess walleye recruitment since the initiation of tribal harvest. Recruitment has been consistently low, even in heavily stocked years. Natural reproduction of walleye has been very limited. Currently, walleyes are stocked every

other year at a rate of 35 fingerlings per acre. A local tribal hatchery occasionally supplements WDNR stocking efforts.

Objectives of the 2006 treaty assessment survey included determining population abundance, size structure, growth, recruitment, and other population parameters of walleye and other gamefish. A creel survey was run for the entire fishing season to determine angler effort, harvest, success, and exploitation of gamefish, especially walleyes.

Methods

North Sand Lake was sampled in 2006 following Wisconsin Department of Natural Resources treaty assessment protocol (Hennessey 2002). Adult walleyes were targeted and collected during the spring spawning period with fyke nets and AC electroshocking. Adult walleyes were defined as all fish for which sex could be determined and all fish 15 in or longer (Hennessey 2002). Seven (4x6 ft frame) fyke nets were set on 10 April when water temperatures reached 42 F (Figure 1). Three more nets were set on 11 April. Four nets were removed on 16 April, and the remaining 6 nets were removed on 17 April for a total of 63 net lifts.

All walleyes, northern pike, and largemouth bass were measured to the nearest 0.1 in (total length). Walleyes and northern pike were sexed by the presence of gametes. All adult walleye and northern pike were given a left ventral fin clip. In addition, unsexable walleye ≥ 15 in, unsexable northern pike ≥ 12 in, and all largemouth bass ≥ 12 in were given a left ventral fin clip. All other walleye, northern pike, and largemouth bass were given a top caudal clip.

Adult walleye population abundance and largemouth bass abundance were estimated using the Chapman modification of the Petersen method (Ricker 1975) with adjustments for spearing harvest. Walleyes and largemouth bass were grouped by length to estimate abundance. These

numbers were then combined for an estimate of total adult population abundance. For walleyes, the fyke net catch was used as the marked sample, while the first electrofishing run was used as the recapture sample. Changes in length frequency distribution of the walleye sample between years were tested using a Kolmogorov-Smirnov test. For largemouth bass, the fyke net catch was combined with the first three electrofishing samples for the marked sample. The recapture sample for largemouth bass was the fourth and final electrofishing run. Angler exploitation of walleye was calculated by dividing the number of marked walleyes harvested by the number of adult walleye marked during sampling.

For age analysis, scale samples were removed from walleyes and largemouth bass less than 12 in, while dorsal spines were removed from larger walleyes and largemouth bass. Age interpretations on northern pike were not conducted due to the unreliability and difficulty of determining annuli. Casselman (1990) found this to be due to irregular growth and resorption or erosion on the midlateral region. Mean length-at-age comparisons for walleye and largemouth bass were made to regional (18 county Northern Region) and statewide data using the WDNR Fish and Habitat statewide database. Local comparisons for largemouth bass were made using Washburn and Burnett County data from 2000 to 2006. An index of proportional stock density (PSD) and relative stock density (RSD) was used to describe and compare population size structure of northern pike and largemouth bass to regional means and past surveys (Anderson and Neumann 1996). PSD values for northern pike and largemouth bass represent the percent of fish larger than stock length (14.0 and 8.0 in, respectively) that are larger than 21.0 and 12.0 in, respectively. RSD-15 values represent the percent of largemouth bass larger than stock length that are larger than 15 in.

Results and Discussion

Walleye. A total of 201 walleyes were captured using fyke nets (N=189) and electrofishing (N=12) and ranged in length from 11.4 to 27.0 in (Figure 2). Male walleyes accounted for 60% of the catch and averaged 18.6 in (SD=1.9), while females averaged 21.8 in (SD=2.2). The average length of all captured walleyes was 19.5 in (SD=3.0). Total average length and average length by sex are very comparable to those found during the 3 previous surveys in 1988, 1993, and 2000. The male: female ratio in the catch was 1.7:1, which is lower than past surveys (3.0:1 in 2000; 2.8:1 in 1993; 4.0:1 in 1988). Low male: female ratios are typically indicative of low density populations. As in past surveys (mean=93%), nearly all (96%) of the 2006 sample measured at least 15 in, and the bulk of the sample (73%) measured between 17 and 21.9 in. Despite these similarities, size structure differed significantly from 2000 to 2006 ($D=0.19$, $P<0.0003$). Approximately half (48%) of the 2006 sample measured 20 in or greater, which is much greater than in the past. Size structure in surveys from 1983 to 2000 were similar (1988 to 1993, $D = 0.08$, $P = 0.28$; 1993 to 2000, $D = 0.07$, $P = 0.37$).

The total number of adult walleyes in North Sand Lake in 2006 was estimated to be 307 fish (95% C.I. 188-426) or 0.32 walleyes/acre. Although all previous walleye abundance estimates on North Sand Lake have shown a low density population, 2006 is the lowest walleye abundance estimate to date (Figure 3). The 2006 abundance estimate is less than half of any of the 3 previous estimates. Further, the estimated abundance in each length group is also lower than in any previous estimate. Consistent with a trend toward larger but fewer walleyes, approximately two-thirds of the estimated population measured ≥ 20 in.

Growth of walleyes in North Sand Lake has consistently been above regional and statewide averages (Figure 4) and remains so in 2006. Walleyes now grow at a faster rate than they did during any previous survey, which is likely due to reduced competition for food from a lower

density population. The most abundant year classes present in the ageing sample were from 1996, 2000, and 2002, all years in which stocking by WDNR occurred.

One night of electrofishing was conducted in September 2006 to assess walleye recruitment. Thirty one (3.7 per mile) YOY walleyes were captured, which is slightly higher than any of the previous five sampling years' totals (Figure 5). A combination of state and tribal hatcheries stocked more than 100 fingerling walleyes per acre in North Sand Lake in 2006. WDNR currently stocks fingerling walleyes at a rate of 35/acre. Since 1987, 13 fall walleye recruitment surveys have been conducted, averaging 4.4 YOY walleyes per mile. However, none of the 7 surveys since 1992 caught more than that average. This is evidenced by the relatively low number of small and medium sized walleyes in the 2006 survey. Walleye stocking by either WDNR or a local tribal hatchery has occurred in all but 4 of the last 20 years, and a fall recruitment survey was conducted in only one of those non-stocked years, capturing 3.0 YOY walleyes per mile. Although there is a lack of fall recruitment surveys in non-stocked years, a relatively low number of adults now present from non-stocked years and consistently poor fall recruitment indicate that natural reproduction is minimal.

Northern pike. A total of 238 northern pike averaging 20.3 in were captured with fyke nets, ranging in length from 11.2 to 33.0 in (Figure 6). Female northern pike accounted for 57% of the sample and averaged 21.0 in, while males averaged 19.1 in. Northern pike measuring between 18 and 22.9 in accounted for 61% of the sample. Twenty fish (8.4%) measured ≥ 26 in. In 1988 only 4% of the sample measured ≥ 26 in, and no fish ≥ 26 in were captured in the 1993 survey. Northern pike PSD in 2006 was 42, which is higher than the mean (30) reported by Margenau et al. (1998) for 19 northern Wisconsin lakes. In contrast, PSD values were 17 and 29 in 1988 and 1993, respectively. In addition to improved size structure, northern pike abundance appears to be increasing. Fyke net catch per effort was 3.8 fish per net night in 2006 compared

to 3.1 per net night in 1988 and 1.7 per net night in 1993. Northern pike were not sampled in the 2000 survey.

Largemouth bass. A total of 750 largemouth bass were captured using fyke nets (N=80; 1.3 per net night) and electrofishing (N=670), including the final electrofishing run, which captured 271 unmarked and 32 marked largemouth bass. Lengths ranged from 5.2 to 20.1 in and averaged 12.6 in. The bulk of the sample (70%) measured between 11.0 and 14.9 in. Twenty five percent of the sample was ≥ 14.0 in, which is better than in any of the 3 previous surveys, dating back to 1988 (Figure 7). However, less than 1% of the sample was ≥ 18 in. Largemouth bass PSD and RSD-15 were 65 and 10, respectively, which are very comparable to the averages (66 and 9) from the last 3 surveys. As in each of the other sample years, more largemouth bass measured in the 12 and 13 in classes than in any other length groups. Electrofishing catch-per-effort (CPE) averaged 23.4 largemouth bass per mile during the 4 shocking runs in April and May 2006. Two runs in April and May 2000 captured largemouth bass at a rate of 12.3 fish/mile. May electrofishing CPE in 1993 and 1988 was 7.6/mile and 5.2/mile, respectively.

Largemouth bass abundance in North Sand Lake during 2006 was estimated at 4,364 fish (95% C.I. 2,961-5,768) or 4.5 fish/acre for all largemouth bass ≥ 8 in. Seventy eight percent of the estimated population measured between 8.0 and 13.9 in. Estimates of North Sand Lake largemouth bass abundance were not made in past surveys.

Growth of largemouth bass in North Sand Lake has declined with each survey since 1988 and is now below both local and statewide means (Figure 8). It now takes more than 7 full growing seasons for the average largemouth bass in North Sand Lake to reach the 14 in legal minimum. In 1988 and 1993 age 7 largemouth bass averaged greater than

17 and 16 in, respectively. North Sand Lake does not meet the minimum growth standard established by WDNR for largemouth bass (≥ 12 in at 5 years). An exemption to the minimum length limit has been recently proposed for North Sand Lake due to the failure to meet the minimum growth standard.

Previous work has found largemouth bass to interact strongly with walleyes in northern Wisconsin lakes. Relative abundance of largemouth bass has been negatively related to walleye abundance (Inskip and Magnuson 1983). Fayram et al. (2005) found that survival of stocked walleyes was negatively related to indices of largemouth bass abundance, and indices of largemouth bass abundance increased as indices of walleye stocking intensity increased. Fayram et al. (2005) also found that walleye growth is positively related to largemouth bass abundance, and that largemouth bass prey on juvenile walleyes. In North Sand Lake largemouth bass abundance has increased, while walleye abundance has declined. Intensive walleye stocking may have helped fuel the increase in largemouth bass.

Five smallmouth bass were also captured in the fyke net and electrofishing samples. Lengths ranged from 15.6 - 17.7 in and averaged 17.0 in. Although sample size was small, age interpretations showed comparable growth rates to those of largemouth bass.

Angling and Harvest. Open water angling effort on North Sand Lake in 2006 was light (12.6 hours per acre) and comparable to effort in the 2000 creel (Tables 1 and 2). Anglers targeted largemouth bass (33% of the directed angling effort), northern pike (19%), and bluegill (17%) the most. The specific catch rate for largemouth bass (1.24 fish/hr) exceeded 1 fish per hour for the first time in 4 creel surveys (1988 – 2006), and the projected harvest was 433. Despite greater directed effort and a better catch rate, northern pike harvest was half of the number harvested in the 2000 creel. Mean length of

the northern pike harvest (22.6 in) increased by 1.4 in since 2000, indicating that anglers are selecting for larger northern pike. In comparison, Margenau et al. (2003) found the mean length of harvested northern pike in 55 northern Wisconsin lakes from 1990-1999 to be 21.6 in. The projected harvest of black crappie decreased from 1,404 fish in the 2000 creel to 200 fish in 2006.

Fishing effort directed at walleyes accounted for less than 10% of the open water effort in 2006. Projected harvest of walleye was only 48 fish, and the mean length of harvested walleye was 19.8 in. Open water harvest ranged from 40 to 84 walleyes in the 3 previous creel surveys, and the average length of harvested walleye ranged from 17.3 to 20.3 in (Table 2). Open water angler exploitation of walleye on North Sand Lake in 2006 was 6.7%. Previous creel surveys found walleye exploitation rates by anglers ranging from 4.0-11.0%. In comparison, the average walleye exploitation rate by anglers on all treaty assessment surveys (N=270) in the ceded territory of northern Wisconsin from 1990-2001 was 8.2% (Jamison Wendel, WDNR, personal comm.).

Native American tribal spearers harvested 59 walleyes in 2006 from North Sand Lake. After taking 138 and 256 walleyes in 1987 and 1988, respectively, Native Americans did not harvest walleyes from North Sand Lake in 1989. Since then, tribal harvest has averaged 49 walleyes and been relatively stable (SD=9.9; WDNR unpublished data, Spooner; Figure 9).

Summary and Management Recommendations

1. Walleye abundance in North Sand Lake in 2006 remained low. The adult population estimate was lower than in any previous survey. Recruitment continues to be low despite decades of intensive stocking, while walleye growth remains better than state and regional averages. Angler effort for walleyes has decreased as abundance has decreased.

In order to rehabilitate the walleye population of North Sand Lake, annual stocking of extended growth walleye fingerlings at a rate of 5 fish per acre should be conducted for 5 years. Private stocking of additional extended growth walleye fingerlings would expedite recovery efforts, but no other size classes of walleyes should be stocked over the 5 year period. In addition, an 18 in minimum length limit on walleyes should be implemented. This would protect most females until they spawn for the first time. Due to good growth rates, the average female walleye reaches the current legally harvestable size (15 in) before becoming mature. Coupling this with the removal of the minimum length limit on largemouth bass to reduce bass density, should provide an opportunity for increased walleye recruitment.

A walleye population assessment should be planned for five years after extended growth stocking begins. A goal of 1 adult walleye per acre should be reached within 5 years. Another population assessment should be conducted five years after the first to determine the full contribution of the extended growth stockings. A population of 2 adult walleyes per acre should be attained by this survey.

Ideally, the walleye population of North Sand Lake will become self-sustaining. However, this may be unreasonable. The efforts listed above will, hopefully, at minimum, allow the walleye population to be sustained through a combination of natural reproduction and small fingerling stocking.

If walleye rehabilitation efforts fail to approximate these goals, consideration should be given to discontinuing management for walleyes on North Sand Lake.

2. Largemouth bass were abundant in North Sand Lake. Sampling catch-per-effort was much higher than in previous surveys. The growth rate of largemouth bass declined since 1988 and was below state and local averages in 2006. Despite this, the average length of sampled largemouth bass in 2006 was the same as it was in the 1988 survey. Largemouth bass received more directed effort than any other species in North Sand Lake in 2006, and anglers were targeting and harvesting bass at a greater rate than in the past.

Eliminating the 14 in minimum length limit on largemouth bass will likely reduce density and improve growth. While assessing the walleye population in the future, May electrofishing CPE for largemouth bass should be reduced to less than 20 fish per mile, with the eventual goal of ≤ 15 largemouth bass per mile. Growth rates of largemouth bass should exceed the minimum growth standard (≥ 12 in after 5 years).

3. The northern pike population of North Sand Lake has improved in both abundance and size structure. Anglers are directing more effort at northern pike

and have become more selective for larger fish. No specific management actions in regards to northern pike are recommended at this time.

4. Angling effort on North Sand Lake is light and comparable to past surveys. Largemouth bass, northern pike, and bluegill are targeted the most. Angler catch rates for largemouth bass and northern pike were higher than previously found. Less effort was directed at walleyes than in past surveys, presumably due to the decline in walleye abundance.

Acknowledgements

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Table 1. Open water angler and catch data from North Sand Lake, Burnett County, 2006.

Species	Directed Effort			Mean Length (in)
	(Hours)	Catch	Harvest	
Total Hours Fished	12,133			
Largemouth Bass	6,004	9,555	433	15.0
Northern Pike	3,395	3,120	173	22.6
Walleye	1,780	73	48	19.8
Smallmouth Bass	128	23	0	-----
Bluegill	3,025	17,389	5,041	7.2
Pumpkinseed	2,168	2,219	536	7.5
Black Crappie	816	395	200	11.0
Rock Bass	334	1456	291	7.8
Yellow Perch	293	110	0	-----

Table 2. Historical open water angler catch data from North Sand Lake, Burnett County, 1988-2006.

	1988	1993	2000	2006
Total Hours Fished	8,340	2,364	12,320	12,133
Walleye				
Harvest	71	40	84	48
Catch	116	96	116	73
Directed effort (hours)	N/A	760	3,160	1,780
Mean Length (in)	17.3	18.4	20.3	19.8
Northern Pike				
Harvest	148	78	346	173
Catch	769	179	2,342	3,120
Directed effort (hours)	N/A	583	2,983	3,395
Mean Length (in)	20.2	21.9	21.2	22.6
Largemouth Bass				
Harvest	332	123	331	433
Catch	1,582	452	6,470	9,555
Directed effort (hours)	N/A	852	4,711	6,004
Mean Length (in)	13.3	13.2	15.3	15.0

MARKING	
NET#	DATE(S)
1	04/11-16/06
2	04/11-17/06
3	04/11-17/06
4	04/11-14/06
4A	04/15-17/06
5	04/11-16/06
6	04/11-15/06
6A	04/16/06
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8	04/12-14/06
8A	04/15-17/06
9	04/12-16/06
10	04/12-17/06

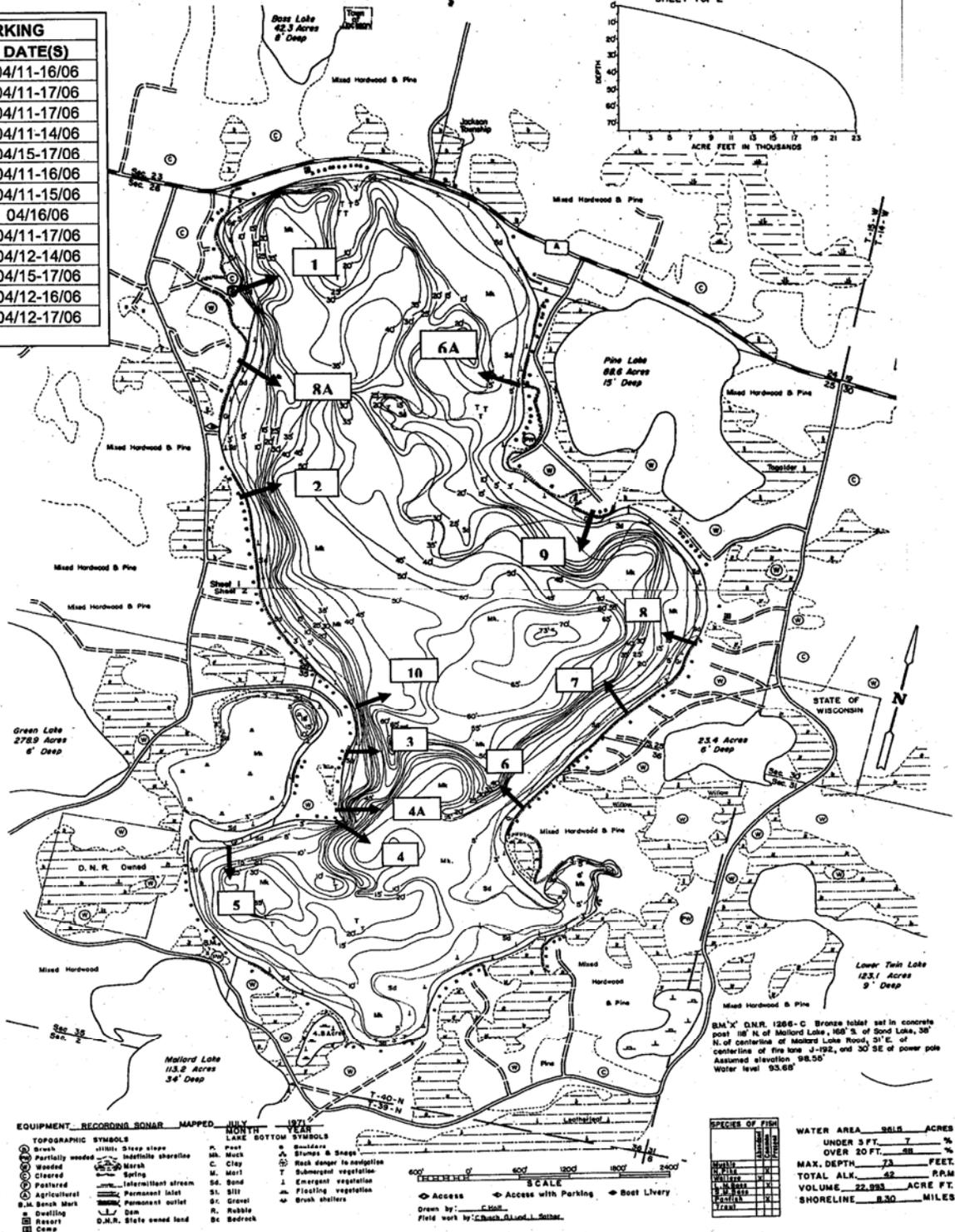


Figure 1. Fyke net locations, North Sand Lake, Burnett County, 2006.

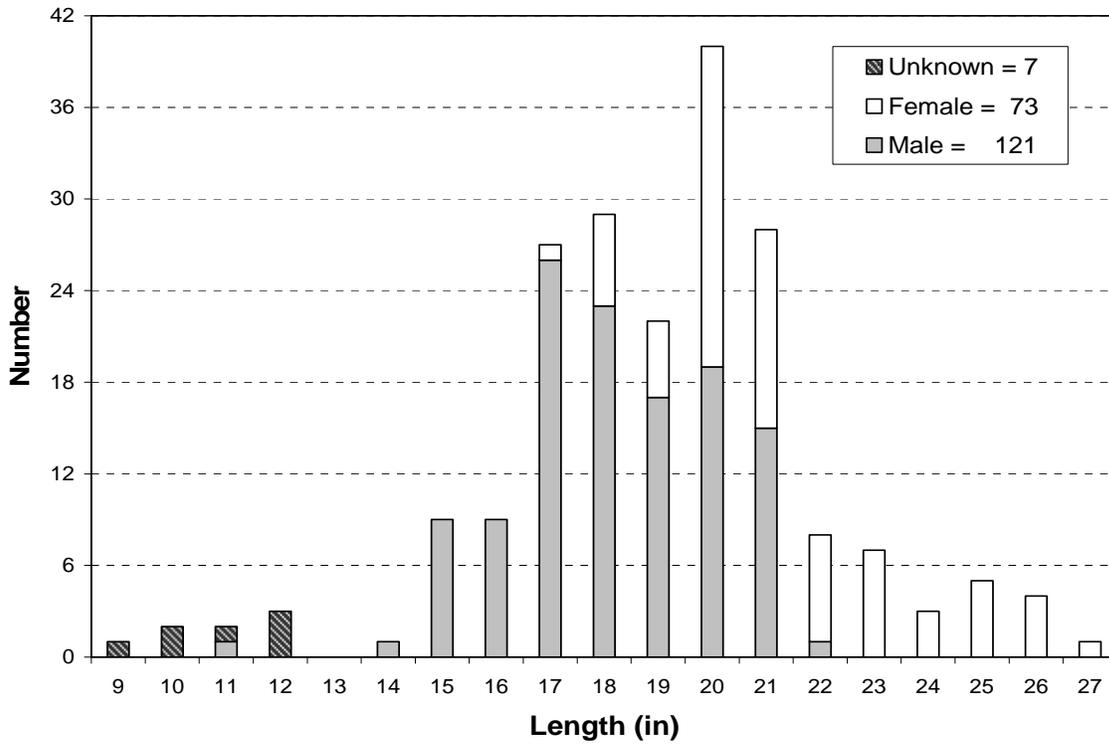


Figure 2. Length frequency by sex of walleyes captured in North Sand Lake, Burnett County, 2006.

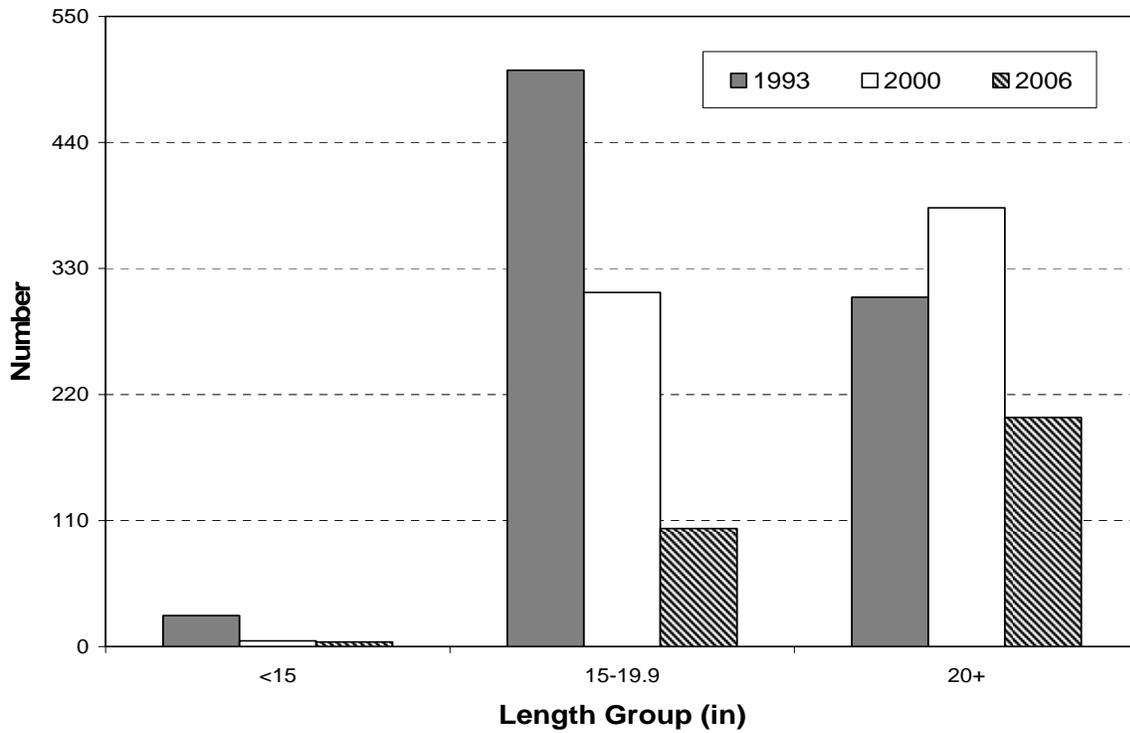


Figure 3. Adult walleye population abundance estimates by length group in North Sand Lake, Burnett County, 1993, 2000, and 2006.

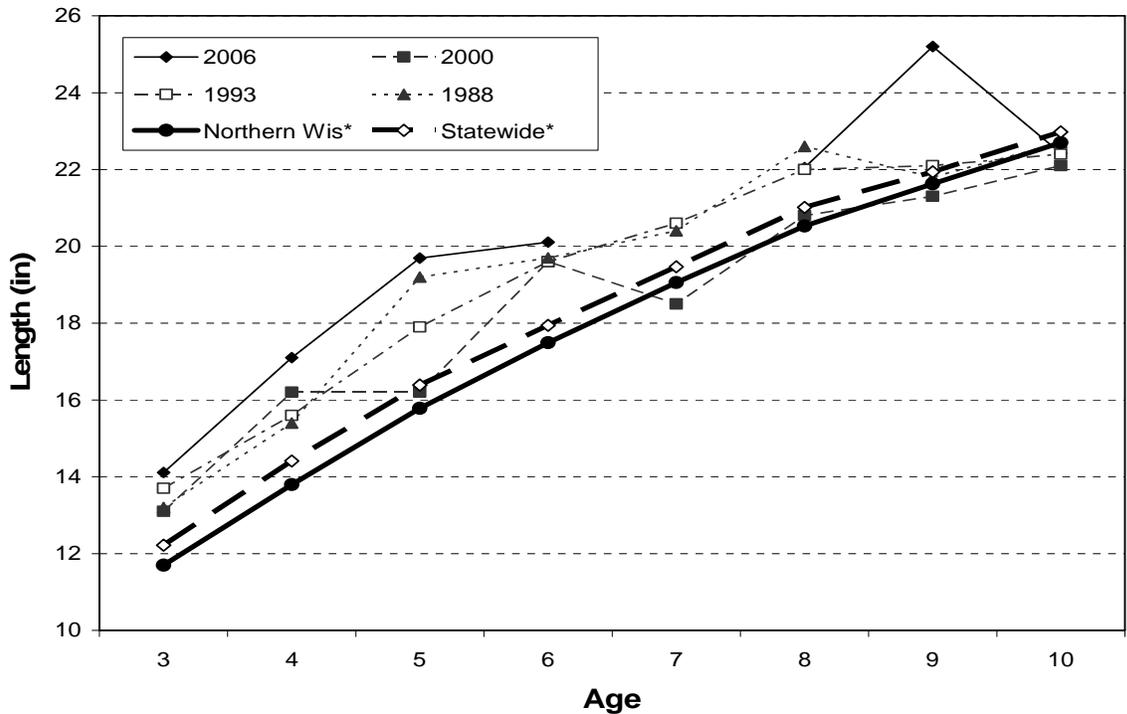


Figure 4. Mean lengths at age of walleye from North Sand Lake, Burnett County, 1988, 1993, 2000, and 2006, with comparisons to regional and statewide means.

*from WDNR Fish and Habitat Database

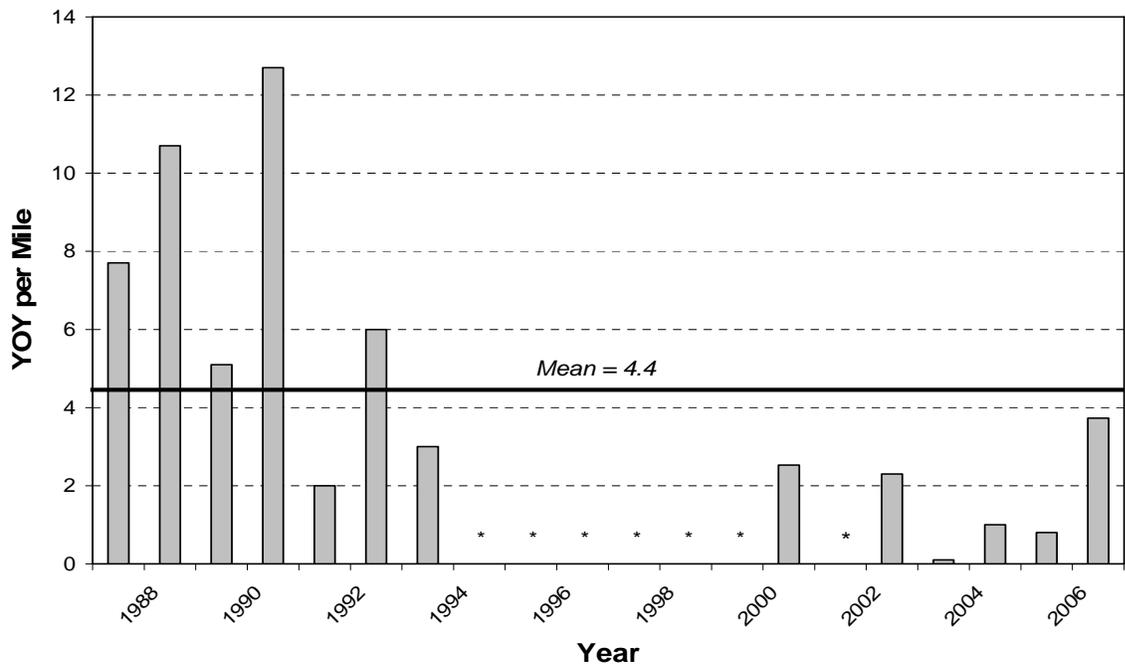


Figure 5. Walleye young-of-the-year catch per effort in North Sand Lake, Burnett County, 1987-2006.

*not sampled in these years

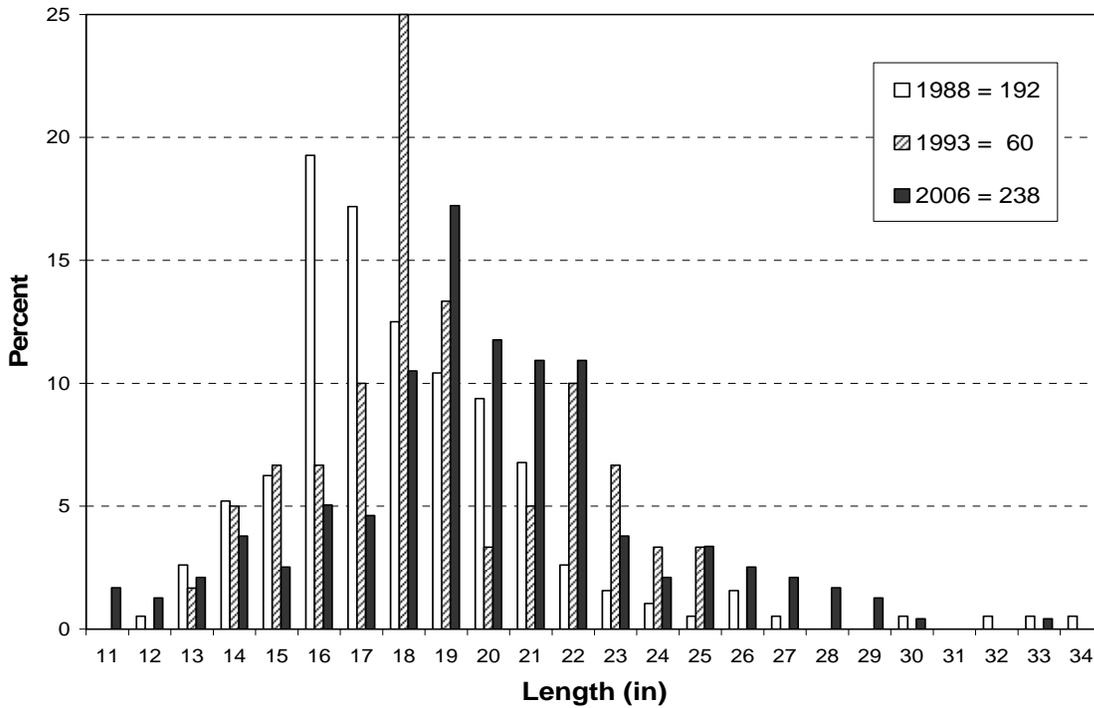


Figure 6. Length frequency as a percentage of total catch of northern pike captured in North Sand Lake, Burnett County, 1988, 1993, and 2006.

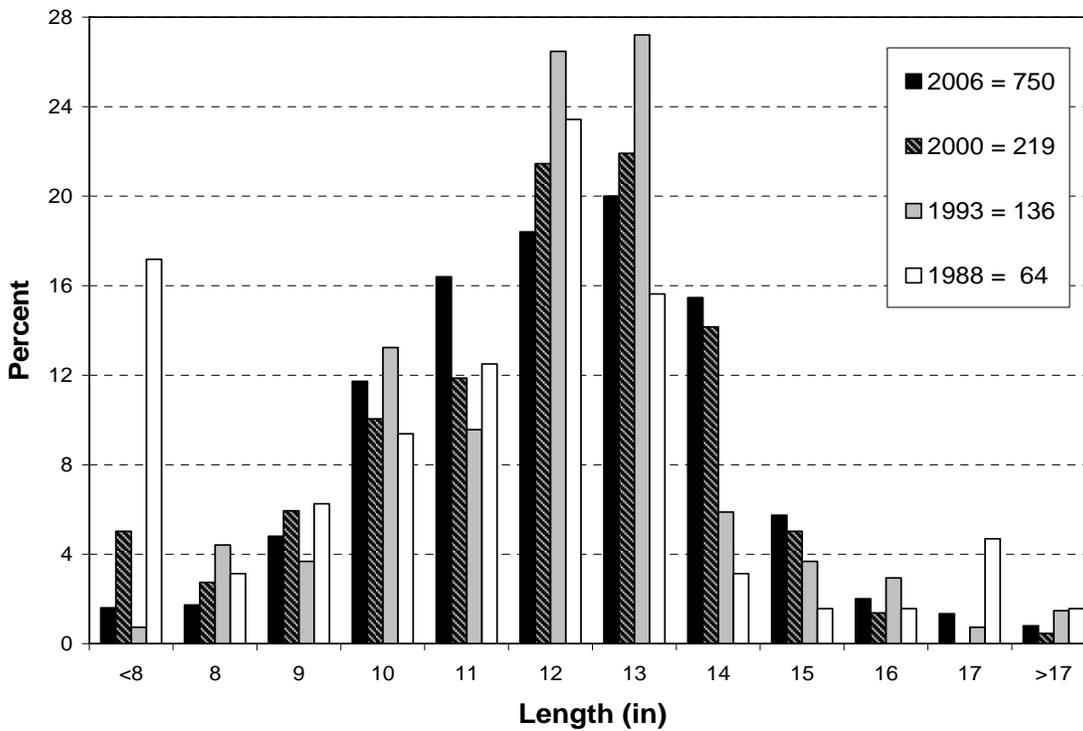


Figure 7. Length frequency as a percentage of total catch of largemouth bass captured in North Sand Lake, Burnett County, 1988, 1993, 2000, and 2006.

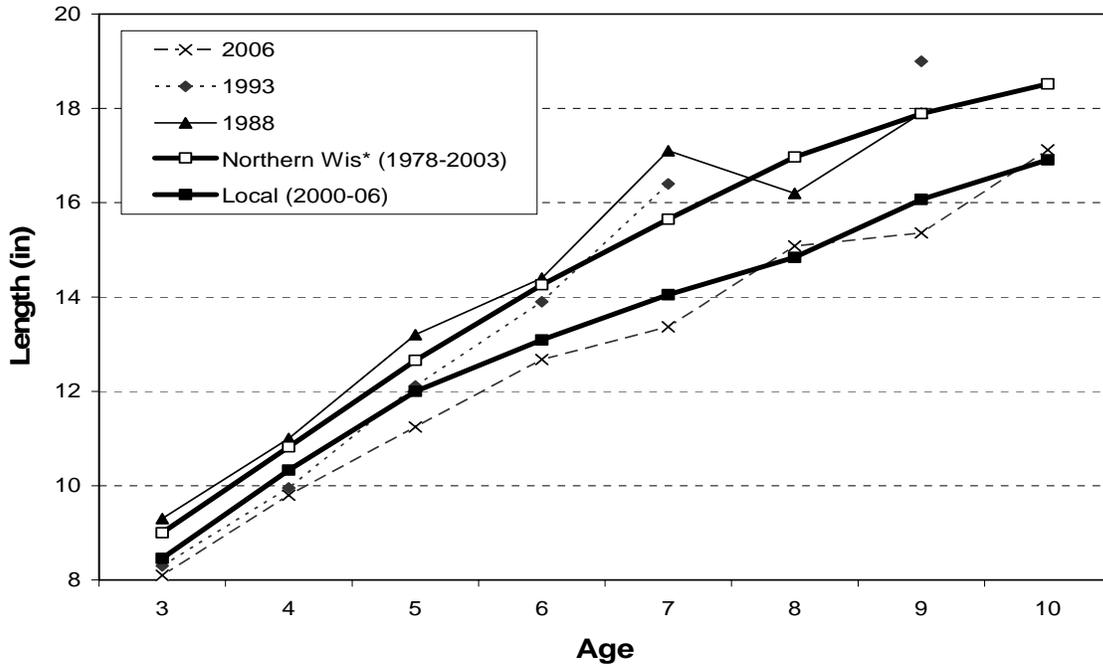


Figure 8. Mean lengths at age of largemouth bass from North Sand Lake, Burnett County, with comparisons to local (Washburn and Burnett counties) and statewide means.
*from WDNR Fish and Habitat Database

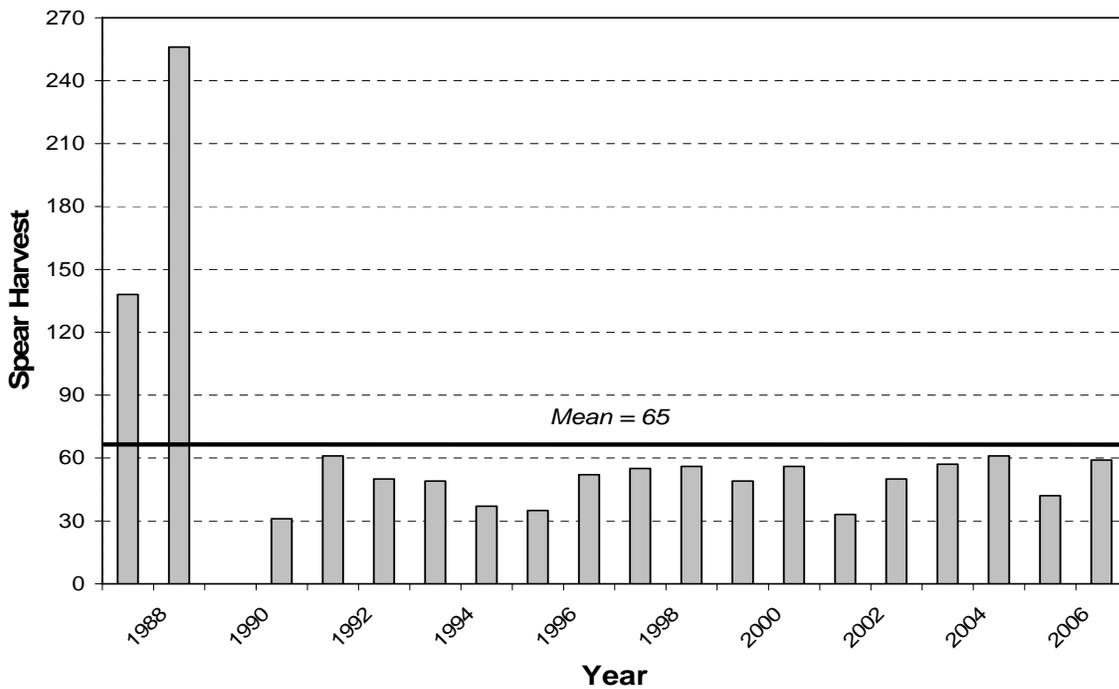


Figure 9. Harvest of walleyes by tribal spearing, North Sand Lake, Burnett County, 1987-2006.