Whitefish (Bardon) Lake - Fishery Survey Report
Douglas County, Wisconsin, 2004-2005
WBIC Code: 2694000

Paul J Riordan and Cordell H. Manz
Fisheries Technician
Wisconsin Department of Natural Resources
Northern Region – Brule
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Executive Summary

The fisheries of Whitefish (Bardon) Lake (Douglas County) were surveyed during 2004-2005. Results indicated adult walleye abundance (≥ 15.0 in and all sexable fish) was 1.1 fish/acre, lower than previous surveys on Whitefish Lake and the average adult fish/acre for Bayfield and Douglas County lakes, but similar to other oligotrophic lakes in Bayfield County. Recruitment of walleye was sustained entirely by natural reproduction since stocking was discontinued after 1993. Northern pike were present in low abundance. Largemouth and smallmouth bass densities were 0.16 and 0.18 fish/acre respectively and were considered low. Trout and cisco were not sampled in this survey. Management recommendations include: 1) Continue fall shocking to access year class strength of walleye along with a comprehensive evaluation of adult walleye after a period of 6 years, 2) Discontinue population estimates of largemouth and smallmouth bass due to sampling difficulties and monitor changes in relative abundance from the first and second electroshocking runs, 3) Maintain existing regulation on northern pike, 4) Further evaluate the adult panfish community with a panfish netting survey and the panfish community as a whole with a creel survey, along with considering a 10 panfish/day regulation change if overharvest is occurring, 5) Continue every third year stocking of brown trout and include questions regarding anglers attitude towards a continued trout stocking program in the creel survey, 6) Initiate a sampling protocol at the same frequency interval as walleye to provide important information on the presence and potential relative abundance of cisco, and 7) Work with local residents, associations and groups to incorporate this information into the lake management plan that addresses fisheries management goals, habitat protection and rehabilitation as well as education of users and riparian residents.

Introduction

Whitefish Lake, also known as Bardon Lake, is an 832-acre seepage lake with very clear, soft water and excellent water clarity. It has been designated as an "Outstanding Resource Water" under Natural Resources Administrative Code 102 and is the deepest inland lake in Douglas County, with a maximum depth of 102 feet and a mean depth of 30 feet. The mean summer secchi disk depth (TSI) value on Whitefish Lake between 1995 and 2005 was 30.1 (SD = 2.71, n = 83). Average summer chlorophyll-a and total phosphorus TSI values were 36.2 (SD = 3.27, n = 20) and 42.7 (SD = 1.21, n = 22) respectively, over the same time period. [Trophic state index (TSI) values were calculated for water clarity (secchi disk measurements), chlorophyll-a, and total phosphorus values on Whitefish Lake from 1995 to 2005. TSI is an index for evaluating the trophic state or nutrient condition of lakes and represents a continuum ranging from very clear, nutrient poor water (low TSI's) to extremely productive, nutrient rich water (high TSI's).] Overall, data from Whitefish Lake indicates that it is oligotrophic, with low primary productivity, when considering secchi disc and chlorophyll-a values and it is slightly mesotrophic when considering total phosphorus TSI values.

As a result of limited nutrient availability characteristic of oligotrophic lakes, density of aquatic vegetation is low to moderate in Whitefish Lake. Aquatic plant diversity in Whitefish Lake is also relatively average for northern Wisconsin Lakes (Toshner 2004). A "Sensitive Area Designation Survey" of Whitefish Lake in 2003 identified a total of twenty different aquatic plant species (Table 1) occurring within sensitive areas, and no exotic species (Toshner 2004).

Whitefish Lake has no tributaries or natural surface water inlets or outlets, with water levels being maintained as a result of the water table. Topographically, the lake consists of two deep basins connected by a narrows section. Littoral substrates are over ninety-five percent sand (Weiher 1967), but some soft detrital sediments overlay sand in areas of greater depths outward of two to five feet. The shoreline of Whitefish Lake is highly developed, with over 85 cottages and permanent homes. The upland shoreline area is dominated by oak (*Quercus sp.*), aspen *(Populus sp.)*, jack pine (*Pinus banksiana*)

and red pine *(P. resinosa)*. Adequate public access is limited to a boat landing with parking located at the southwest end of the lake off of Whitefish Lake Road.

Whitefish Lake has a history of fish stocking dating back to 1934 (Table 2). Prior to 1949, only walleye (*Sander vitreus*) and largemouth bass (*Micropterous salmoides*) were stocked. From 1949 to 1952, smallmouth bass (*M. dolomieui*) and northern pike (*Esox lucius*) were stocked in addition to walleye and largemouth bass. In 1958, Kamloops strain rainbow trout *(Oncorhynchus mykiss)* were introduced, and continuing through 1977 the lake was managed for salmonids in addition to warm water fish. During that time period it was stocked mostly with rainbow trout and brown trout *(Salmo trutta),* but also with brook trout *(Salvelinus fontinalis)* from 1962 - 1965, lake trout *(S. namaycush)* in 1964, and coho salmon *(O. kisutch)* in 1970-71. The main factors contributing to the initiation of this two-story management plan were Whitefish Lake's cold water temperatures, the large numbers of cisco *(Coregonus artedii)* present, and the abundant volume of deep water (Schram 1979). Although minor numbers of trout have been sampled during fishery surveys in 1959, 1961, 1967, and 1977, no evidence of natural reproduction has been found to occur to date for any salmonids stocked in Whitefish Lake.

After a variety of fishery surveys were performed in 1977, recommendations were to stock walleye in order to diversify the fishery and provide additional predation on bluegill (Schram 1979). Since 1978, Whitefish Lake has continued to be managed as a two-story fishery for both warm and coldwater fish species, with management primarily directed towards walleye, largemouth and smallmouth bass, northern pike, brown trout and rainbow trout, and panfish species; including, bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), and yellow perch (*Perca flavescens*). Trout stocking was to be done every third year under this management plan (Kampa 1988). Almost 397,000 walleye fingerlings were stocked from 1978 – 1993; however, walleye stocking was discontinued after 1993 because natural reproduction was sufficiently maintaining the fishery (it was also thought they were drastically reducing abundance of panfish populations). Although it was recommended by Kampa (1988) that yearling rainbow trout be stocked every third year because there was evidence of some year-to-year carry-over, stocking of rainbows was discontinued after 1991 in hopes that brown trout would

survive better because of less stringent habitat requirements (Sand 1991). Brown trout have continued to be stocked approximately every third year thereafter.

Other fish species documented as present from past surveys of Whitefish Lake include: pumpkinseed (*L. gibbosus*) and green sunfish (*L. cyanellus*); warmouth (*L. gulosus*) and rock bass *(Ambloplites rupestris)*; yellow (*Ictalurus natalis*) and black bullhead (*I. melas*); white sucker (*Catostomus commersoni*) and shorthead redhorse *(Moxostoma macrolepidotum)*; banded killifish (*Fundulus diaphanus*); johnny (*Etheostoma nigrum*) and Iowa darter *(E. exile)*; creek chub *(Semotilus atromaculatus)*; bluntnose (*Pimephales notatus)* and fathead minnow *(P. promelas)*; and golden (*Notemigonus crysoleucas*), common (*Notropis cornutus*), spottail (*N. hudsonius*), mimic *(N. volucellus)*, and blacknose shiner *(N. heterolepis)*. Through personnel communication with lake residents it has also been suspected that channel catfish *(I. punctatus)* have been present in the past.

Fishing regulations for walleye have changed over time in Whitefish Lake. Until 1989 these changes had been in concurrence with statewide bag and length limit changes. This included a minimum length of 13 in from 1966 through 1974 and a change back to no minimum length for walleye from 1974 through 1989. In 1990, the length limit for walleye was again changed to the present statewide minimum length of 15 in. Recent management has included walleye bag limits that have had to be adjusted annually (to two or three fish daily bag limit) since tribal harvest began on Whitefish Lake in 1987.

Starting in 2003, trout regulations on Whitefish Lake have been category 2, with a bag limit of five in total and a 7 in minimum length. Prior to 2003, regulations were category 1, with a bag limit of ten trout in all, and minimum length of 7 in. Northern pike, bass, and panfish regulations on Whitefish Lake have followed that of statewide bag and length limits in place at the time.

The most recent fishery surveys of Whitefish Lake prior to 2005 were in 2004, when four miles of shoreline was sampled by electrofishing gear in September and mini-fyke netting (eight net lifts) was conducted in August as part of the WDNR's statewide lake baseline monitoring program to investigate the health of lake ecosystems by sampling their fish communities. Recent management has also included fall electrofishing surveys nearly every year since 1991 to assess year-class strength of

young-of-the-year (YOY) and yearling walleye. The last comprehensive fisheries surveys conducted by Wisconsin DNR personnel took place in 1988 and 1991, with adult walleye population estimates performed those years using methods as outlined by Staggs (Intradepartmental Memo, April 12, 1989) for Treaty Assessment work. Creel surveys to assess fishing pressure and harvest were also performed in those years. In addition, the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) performed a walleye population estimate in 2001. Data collected from baseline surveys performed in 2004 showed more comprehensive fisheries data was again needed from Whitefish Lake to provide more reliable information on existing fish populations which would allow for better future management decisions (Manz 2004).

The objective of the 2005 survey of Whitefish Lake was to determine the present status of walleye, largemouth and smallmouth bass, and northern pike populations; specifically, to determine population densities, growth, and size structure of walleye and bass in order to update safe harvest levels and evaluate current harvest regulation strategies. In addition, we hoped to determine some population parameters for northern pike and panfish in Whitefish Lake.

Methods

Whitefish Lake was sampled during 2005 following the Wisconsin Department of Natural Resources treaty assessment protocol (Hennessy 2002). Comprehensive sampling included: spring fyke netting (4 x 6 ft frames, 0.5 in bar mesh) and electroshocking (A.C. boomshocker) to estimate walleye and bass abundance, and fall electroshocking to estimate year class strength of YOY walleye. Fall electroshocking surveys followed protocols given by Stewart (2001) for Wisconsin's statewide baseline monitoring program. Mini-fyke netting in 2004 was conducted following the Wisconsin Department of Natural Resources baseline lakes field sampling protocol (Simonson 2004).

Walleye were captured for marking in the spring immediately after ice out on Whitefish Lake using fyke nets. Each fish was measured to the nearest one-tenth inch total length (TL), sexed, fin clipped, and observed for other marks. For aging purposes, the second or third dorsal spine was removed from ten walleye per inch group and sex.

Adult (mature) walleyes were defined as any fish for which sex could be determined, or any walleye fifteen inches or greater. Walleyes of unknown sex less than fifteen inches in length were classified as juveniles (immature) and were marked with a secondary fin clip, rather than the primary fin clip given to adults. Marking effort for walleyes was based on a goal of marking 10% of the anticipated spawning population estimate.

To estimate walleye abundance, walleyes were recaptured during two electrofishing runs. The first run (to estimate adult abundance) occurred one day after fyke netting was complete, and a second recapture run (required to estimate total walleye abundance) took place on May 16, 2005, twenty-six days after the first. Because of the short interval between marking and recapture events, the entire shoreline was sampled to ensure equal vulnerability for capturing both marked and unmarked walleyes. All walleyes collected during recapture runs were measured and examined for marks. Unmarked walleyes were given the appropriate mark so that a total population estimate could be calculated upon completion of the second electrofishing run. Population estimates (for walleye ≥7.0 in) were calculated with the Chapman version of the Petersen formula (Ricker 1975). Abundance and variance were estimated by individual length groups of walleye (7.0 -11.9, 12.0 -14.9, 15.0 -19.9, and ≥20.0 in.) and then summed to estimate total adult walleye abundance and variance. Variance (of a proportion) for the abundance estimates for these length groups was calculated using the formula:

$$\text{var}(p \cdot pe) = p^2 \cdot \text{var}(pe) + pe^2 \cdot \text{var}(p) - \text{var}(p) \cdot \text{var}(pe),$$ where

var = variance,

p = the proportion of fish sampled in a specific length group,

pe = the population estimate for fish > 7.0 in.

Age and growth of walleye was determined from dorsal spine cross sections viewed microscopically at 100 X (Margenau 1982). Growth rates of male and female walleye were compared separately to Douglas County averages obtained from the Spooner, WI Treaty Assessment Unit.

Largemouth and smallmouth bass were collected, measured, and marked during fyke netting and subsequent electrofishing runs for walleye. Scales were also taken for age interpretation. Bass ≥12.0 in were given the same primary (adult) fin-clip given to walleye for that lake. Bass 8.0 -11.9 in were given the secondary (juvenile) fin-clip for

the lake. Bass were also marked on a third electrofishing run on May 24th and recaptured on a final electrofishing run conducted on June 1, 2005, following the second recapture run for walleye. Bass populations were estimated after both the third and fourth runs using the Chapman version of the Petersen estimate (Ricker 1975). Estimates were made for each species in three length classes: 8.0- 13.9, 14.0- 17.9, and ≥18.0 in. The recapture run yielding the lowest coefficient of variation was the population estimate reported. Age and growth for bass and other fish species (northern pike and panfish) were determined by viewing acetate scale impressions under a 30 X microfilm projector. Growth rates were compared to northern region averages obtained from the WDNR statewide fisheries database. Length distributions were summarized using proportional (PSD) and relative stock (RSD) densities (Anderson and Gutreuter 1983). The PSD and RSD value for a species is the number of fish of a specified length and longer divided by the number of fish of stock length or longer, the result multiplied by 100 (Table 3).

Results

Total survey effort in 2005 included fifty-eight fyke net lifts targeting spawning gamefish (April 13 - 19), four spring electrofishing surveys of the entire shoreline (April 20, May 16 and 24, and June 1) totaling 10.9 hrs, and one fall electrofishing survey (October 27) totaling 2.7 hrs. Total survey effort in 2004 included 8 net lifts targeting juvenile panfish and non-game fish (August 16-17) and one fall electrofishing survey (September 14) totaling 1.59 hrs. Over 2,400 fish representing thirteen different species were captured, using various gear types for all sampling events. However, if sampling from 2004 is included a total of 4,581 fish have been sampled in 2004-2005 combined, representing sixteen different fish species (Table 4). Non-game fish species accounted for a majority of the diversity with nine different species sampled in 2004-2005, whereas gamefish and panfish species were most abundant overall, making up approximately 92% of the total number of fish sampled.

Adult gamefish sampled in order of abundance in 2005 were walleye, smallmouth bass, largemouth bass, and northern pike. Yellow perch were the most frequently collected panfish, followed by bluegills and rock bass. However, if mini-fyke netting data from 2004 is included, bluegills appear to be more abundant than yellow perch

because of the high numbers of YOY and juvenile bluegills sampled while mini-fyke netting. White sucker, bluntnose minnow, spottail shiner, and mimic shiners were the most common non-game fish species found in 2004-2005, and along with bluegill and yellow perch (and possibly cisco) may comprise the bulk of the forage base in Whitefish Lake. Fish species found in past investigations, but not found in 2004-2005, include: black crappie, pumpkinseed, green sunfish, warmouth, black bullhead, shorthead redhorse, banded killifish, fathead minnow, and golden and blacknose shiners. No cisco or trout were sampled in 2004-2005.

Walleye**.** Walleye were the most abundant gamefish sampled in 2005 with a combined total of 1,224 collected for all gear types and sampling events. A total of 378 adult walleye, and 407 walleye in all ≥ 7.0 in were marked while fyke netting after ice-out. Adult walleye abundance (≥ 15.0 in and all sexable fish) was 880 (95% C.I. = 637<N<1107; CV = 0.14) or 1.1 fish/acre. Total walleye abundance ≥ 7.0 in was 3,245 (95% C.I. = 1,056<N<5,434; CV = 0.34), or 3.9 fish/acre.

An adult walleye population estimate of 1.1 fish/acre in 2005 is lower than population estimates performed by the WDNR in 1988 and 1991 when the spawning walleye population was estimated at 1.9 adult fish/acre (95% C.I. = 1,170<N<2,060) and 2.3 adult fish/acre (95% C.I. = 1,260<N<2,490), respectively. The estimate in 2005 was however, similar to the population estimate done by GLIFWC in 2001, which was 974 ± 232, or 1.2 adult fish/acre (Figure 1).

Size structure of walleye sampled in 2005 was good based on PSD and RSD values. Mean length for all walleye >10.0 in collected while spring fyke netting was 15.7 in (SD = 2.44, N = 404). Males averaged 16.0 in (SD = 2.05, N = 337, length range = 11.2 – 20.6 in) and females averaged 19.4 in (SD = 2.78, N = 34, length range = 15.0 – 27.9 in) in 2005. Proportional stock density (PSD) and relative stock density (RSD-20) for all fish was 55 and 4, respectively.

Overall size structure in 2005 appears roughly similar to walleye sampled in 1988, but somewhat better than in 1991 (Figure 2). Specifically, by size class there has been an increase in the proportion of walleyes in the 15.0 – 19.9 in length range since 1991 that is comparable with 1988 percentages. In 1988, PSD was 61 and RSD-20 was

4. Values in 1991 were lower than 1988 and 2005, with a PSD of 42 and an RSD-20 of 3.

Age of adult walleye ranged from III to XIV. Male and female walleye first reached maturity at III and IV, respectively. Age IV walleye represented 40% of the aged adult population. Age distribution data from 1988, 1991, and 2005 shows consistent natural reproduced year classes (Figure 3). In the 2005 survey growth rates for male and female were dimorphic with males reaching 15 inches between ages IV and VI and females between the ages IV and V. Growth rates in 1988, 1991, and 2005 were similar to Douglas County averages through age VIII when they fall below the county average (Figure 4).

Relative abundance of Young of Year (YOY) walleye in Whitefish Lake in 2005 was 26.5 fish/mile (67.8 fish/hour). The average YOY/mile was 30.4 (SD = 22.1, N = 15) for surveys completed from 1986-2006. However, fingerling relative abundance has been highly variable from 1986 to 2006 with a range of 4.3 fish/ mile to 92.2 fish/mile (14.3 fish/hour to 227.1 fish/hour; Figure 5).

Northern Pike. Relative abundance (the number of fish caught with each fyke net lift) of northern pike was 0.3, 0.2 and 0.4 fish/net in 1988, 1991 and 2005 survey years. There was not an adequate number of northern pike marked to estimate abundance; however, the density of northern pike appeared low. Mean length for northern pike (fyke net samples) decreased then increased from 23.7 (SD = 5.13, N = 28) to 13.8 (SD = 7.05, N = 11) to 19.1 (SD = 9.21, N = 45) inches from 1988 to 1991 to 2005. PSD for spring fyke net samples was 100, 40 and 78 for 1988, 1991 and 2005. RSD-28 for spring fyke net samples was 22, 0 and 26 for the same time period. The largest northern pike caught during the 2005 fyke net survey was 40.5 in.

Largemouth and Smallmouth Bass. In 2005, largemouth bass represented 45% and smallmouth bass 55% of the total number of bass surveyed (N = 149). Largemouth bass abundance (≥ 14 in) in Whitefish Lake was 136 (CV = 33; 0.16 fish/acre) for 2005. Relative abundance for largemouth bass for the third and forth electroshocking surveys was 10.4 fish/hour for 2005. Size structure for the 2005 survey was excellent with a mean length of 15.2 in (SD = 1.62; N = 66) and PSD and RSD-15 values of 97 and 55, respectively (Figure 6).

Smallmouth bass abundance (≥ 12 in) in Whitefish Lake was 150 (CV = 28; 0.18 fish/acre) for 2005. Relative abundance for smallmouth bass for the third and fourth electroshocking surveys was 13.8 fish/hour for 2005. Size structure was excellent, mean length of smallmouth bass for the 2005 survey was 14.2 in (SD = 2.22; N = 82) and had a PSD and RSD-14 values of 90 and 54, respectively (Figure 7).

Panfish. Yellow Perch were the most abundant panfish species (N = 550) sampled in Whitefish Lake during the fyke netting survey of 2005. PSD and RSD-10 values of 0 and 0 indicate a poor size structure for yellow perch. Bluegills were the second most abundant panfish species sampled (N = 130). PSD and RSD-8 values of 20 and 3 indicate poor size structure for bluegills. Rock Bass were the third most abundant panfish species sampled (N = 10).

Discussion

Whitefish Lake has supported, and continues to support a diverse fish community and popular sport fishery. With the exception of brown trout, good to excellent natural reproduction supports all fish species.

Results from the 2005 survey suggest that since walleye stocking ended in 1993 natural reproduction has sustained the fishery. Fall electrofishing surveys to assess year class strength of YOY walleyes have demonstrated that good natural reproduction is occurring in Whitefish Lake including the 2002 year class that is responsible for 40% of the walleye from the 2005 survey. Although adult walleye abundance was lower in 2005 than previous estimates in 1988 and 1991, size structure of adult walleye has improved. Adult walleye abundance in Whitefish Lake is similar to other oligotrophic lakes in Bayfield county including Diamond Lake (1.15 fish/acre in 2006), Lake Owen (1.13 fish/acre in 2007), Upper Eau Claire Lake (2.0 fish/acre in 2004), but is below the 3.7 adult fish/acre average for Bayfield and Douglas county walleye lakes.

Northern Pike relative abundance has remained low.. Natural reproduction is providing consistent recruitment of northern pike into the lakes ecosystem. Although there has not been an adequate sample size to have a population estimate of northern pike in Whitefish Lake, they do represent a portion of the lakes diversity and offer anglers a potential for a trophy fish.

Largemouth and smallmouth bass densities were low compared to western ceded territory county averages which are 4.6 fish/acre (SD = 5.06, N = 10) and 1.2 fish/acre (SD = 1.30, N = 9) respectively. However, size structure for both largemouth and smallmouth bass was excellent. The 2005 largemouth and smallmouth population estimates were the first completed on Whitefish Lake and were complicated by the inefficiency of the sampling gear on the large sand flats and sharp drop offs that are characteristic of Whitefish Lake. Historic surveys provide no accurate comparisons due to the lack of largemouth and smallmouth that were sampled. The inability to effectively sample bass in Whitefish Lake makes future population estimates of limited value.

The panfish community was not targeted in the survey completed in 2005. However, in the 2004 survey juvenile panfish were targeted with mini-fyke nets. When combining the data from 2004 mini-fyke netting and 2005 fyke netting bluegills were the most abundant panfish followed by yellow perch and rock bass. Size structure and relative abundance of panfish in Whitefish Lake appears to be relatively low. The introduction of walleye into Whitefish Lake to reduce the over-abundant bluegill population through predation appears to have been successful based on large numbers of YOY bluegills present in the mini-fyke net survey and adults not being sampled in large numbers during walleye netting. However, without specifically targeting adult bluegills it is difficult to discern their true abundance, therefore, future creel surveys or panfish netting surveys would provide more accurate information on adult bluegill abundance and impacts of walleye predation.

Ciscoes were found in Whitefish Lake during the 1967, 1971, 1977, 1982 and 1983 surveys. These pelagic prey fish were captured in the open water with gillnets in 2006 and 2007 and their densities were found to be within the range expected for an oligotrophic lake (Hrabik 2007).

Summary and Management Recommendations

1. Walleye abundance in Whitefish Lake was below statewide goals and regional averages. Continued fall shocking to access year class strength should continue along with a comprehensive evaluation of the adult walleye after a period of 6 years.

2. Largemouth and smallmouth bass were difficult to sample in Whitefish Lake. Future population estimates should not be performed. Due to low capture and recapture rates these estimates produce high variance and robust estimates. Relative abundance from the first and second electroshocking runs should provide enough information to detect changes in abundance. In addition, creel surveys would also provide further information on the bass fishery.

3. Northern Pike abundance in Whitefish Lake was low. No regulation changes are recommended at this time.

4. Panfish size and numbers in Whitefish Lake are low. Panfish netting should be considered to obtain accurate adult abundance information. If a future creel survey suggests overharvest of panfish by anglers, a regulation change of 10 panfish/day should be considered.

5. Continue every third year stockings of brown trout to continue the two-story fishery. Anglers should be asked the following questions during a future creel survey to evaluate the attitude towards a continued trout stocking program: 1) Have you ever caught a trout? 2) If so, when? 3) Would you like to see trout stocking continued?

6. Initiate a sampling protocol at the same frequency interval as walleye to provide important information on the presence and potential relative abundance of cisco.

7. Work with local residents, the Whitefish Lake Conservation Organization Inc. and the WDNR lake grants program to create and adopt a lake management plan that would: 1) develop management objectives for fisheries including goals for densities and size structures for the various fish species found in the lake, 2) develop strategies for protecting and enhancing sensitive aquatic and shoreline habitats, 3) formally establish exotic species survey and control programs targeting satellite infestations, 4) provide educational and participation forum for environmentally sensitive shoreline living, 5)

identify uses and user groups to facilitate all recreational uses on the lake, 6) continue water quality monitoring through the citizen lake monitoring network.

No amount of regulation or voluntary catch and release practices will change the need for healthy aquatic environments. Although water quality remains high, habitat loss, declining shoreline aesthetics, and exotic introductions are warning signs of cultural disturbances that are degrading ecosystem health. To preserve and enhance the ecosystem, vigilance for exotic species must continue and shoreline restoration projects in areas that are currently lacking buffers should be explored. Preventing the spread of exotics and enhancing habitat through restoration projects, as well as preserving the existing habitat will be far more beneficial than losing what is currently present and relying on stocking and artificial habitat improvements to maintain the fishery and ecosystem as a whole.

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Table 1. Aquatic plants identified in Whitefish Lake, Douglas County, Wisconsin during a 2003 Sensitive Area Designation Survey (Toshner 2004).

Aquatic Vegetation Category	Scientific Name	Common Name (s)
Emergents	*Scirpus americanis*	Three-square, chairmakers rush
	Eleocharis acicularis	Needle spikerush, hairgrass
	Eleocharis palustris	Creeping spikerush
Submersed plants	*Vallisneria americana*	Wild celery, eelgrass, tapegrass
	Najas flexilis	Slender naiad, bushy pondweed
	Elodea canadensis	Common waterweed, elodea
Pondweeds	*Potamogeton gramineus*	Variable or grass-leaf pondweed
	Potamogeton robbinsii	Fern or robbins pondweed
	Potamogeton praelongus	White-stem pondweed
	Potamogeton amplifolius	Large-leaf pondweed, bass weed
	Potamogeton spirallis	Spiral-fruited pondweed
Turf formers/rosettes	*Isoetes* spp.	Quillworts
	Lobelia dortmanna	Water lobelia
	Eriocaulon aquaticum	Pipewort
	Juncus pelocarpus	Brown-fruited rush
	Sagittaria latifolia	Common or broad-leaf arrowhead, duck potato, wapato
	Sagittaria graminea	Grass-leafed or slender arrowhead
	Ranunculus flammula	Creeping spearwort
	Myriophyllum tennellum	Dwarf water milfoil
Algae	*Nitella* spp.	Nitellas, stoneworts
	Chara spp.	Musgrasses, stoneworts, charas

Table 2. Stocking history of Whitefish Lake, Douglas County, Wisconsin.

Year	Species	Number Stocked	Size
1934	Walleye	150,588	-
1938	Largemouth Bass	16,086	Fry
1939	Largemouth Bass	1,000	Fingerling
1940	Walleye	600,000	Fry
	Largemouth Bass	4,000	Fry
1941	Walleye	500,000	Fry
1942	Walleye	800,000	Fry
1943	Walleye	800,000	Fry
1944	Largemouth Bass	1,000	Fingerling
1945	Largemouth Bass	1,320	Fingerling
1947	Largemouth Bass	4,170	Fingerling
1948	Largemouth Bass	8,360	Fingerling
1949	Largemouth Bass	650	Fingerling
	Northern Pike	170,000	Fry
	Smallmouth Bass	300	Fingerling
1950	Northern Pike	180,000	Fry
1952	Northern Pike	159,000	Fry
1958	Kamloop Trout	20,820	Fingerling
1961	Rainbow Trout	10,000	Legal
	Brown Trout	1,500	Fingerling
	Brown Trout	1,200	Legal
1962	Rainbow Trout	5,00	8-10 in Legal
	Brook Trout	210	Adult
1963	Rainbow Trout	10,000	6-8 in Yearling
	Brook Trout	210	Adult
1964	Rainbow Trout	3,464	7-10 in Yearling
	Lake Trout	25,000	5-6 in Fingerling
	Brook Trout	250	Yearling
1965	Rainbow Trout	2,500	7-9 in Legal
	Brown Trout	5,000	Fingerling
	Brook Trout	500	Legal
1966	Rainbow Trout	2,500	Yearling
	Brown Trout	4,000	Yearling
1967	Rainbow Trout	2,500	Yearling
1968	Rainbow Trout	5,000	9 in Yearling
1969	Brown Trout	2,500	7 in Yearling
1970	Coho Salmon	10,960	5-7 in Yearling
	Brown Trout	3,000	7 in Yearling
1971	Coho Salmon	4,000	7 in Yearling
	Brown Trout	3,000	7 in Yearling
	Brown Trout	6,000	5-7 in Yearling
1972	Brown Trout	3,000	7 in Yearling

Table 2. Whitefish Lake stocking history, continued.

Year	Species	Number Stocked	Size
1973	Rainbow Trout	3,000	9 in Yearling
1974	Rainbow Trout	3,000	9 in Yearling
1975	Rainbow Trout	3,000	9 in Yearling
1976	Rainbow Trout	1,200	7 in Yearling
	Rainbow Trout	1,800	9 in Yearling
1977	Rainbow Trout	3,000	9 in Yearling
1978	Walleye	80,111	2 in Fingerling
	Rainbow Trout	529	Adult
	Brown Trout	104	Adult
1979	Walleye	80,068	Fingerling
1980	Walleye	59,825	Fingerling
1981	Walleye	80,135	Fingerling
1983	Brown Trout	3,000	7 in Yearling
1984	Walleye	79,892	Fingerling
1987	Rainbow Trout	3,000	9 in Yearling
1988	Rainbow Trout	2,500	9 in Yearling
	Walleye	41,064	3 in Fingerling
1990	Walleye	14,365	3 in Fingerling
1991	Rainbow Trout	2,500	8.9 in Yearling
1993	Walleye	41,606	3.1 in Fingerling
1994	Brown Trout	2,500	7.1 in Yearling
1995	Brown Trout	2,500	7.1 in Yearling
1997	Brown Trout	2,500	6.3-7.4 in Yearling
2003	Brown Trout	2,545	7.3 in Yearling
	Brown Trout	14,998	2.8 in Fingerling
2005	Brown Trout	4,175	4.6 in Fingerling

Table 3. Proportional and relative stock density values.

Species	Stock Size (In.)	Quality Size (In.)	Preferred Size (In.)
Bluegill	3	6	8
Largemouth Bass	8	12	15
Northern Pike	14	21	28
Smallmouth Bass	7	11	14
Walleye	10	15	20
Yellow Perch	5	8	10

Table 4. Species composition of the fish community in Whitefish Lake, Douglas County, Wisconsin.

Common Name	Scientific Name	Fyke Netting 2005	Spring Shocking 2005	Fall Shocking 2005 (Walleye)	Mini-fyke Netting 2004	Fall Shocking 2004 (Baseline)	Total Sampled
Gamefish							
Walleye	*Sander vitreus*	407	623	194	0	95	1,319
Largemouth Bass	*Micropterus salmoides*	2	76		574	6	658
Smallmouth Bass	*Micropterus dolomieui*	0	93		91	5	189
Northern Pike	*Esox lucius*	38	10		0	3	51
Panfish							
Yellow Perch	*Perca flavescens*	550			64	50	664
Bluegill	*Lepomis macrochirus*	130			1,137	47	1,314
Rock Bass	*Ambloplites rupestris*	10			5	3	18
Non-game fish							
White Sucker	*Catostomus commersoni*	223			1	0	224
Yellow Bullhead	*Ictalurus natalis*	1			0	0	1
Common Shiner	*Notropis cornutus*	2			0	0	2
Spottail Shiner	*Notropis hudsonius*	41			0	0	41
Mimic Shiner	*Notropis volucellus*	2			5	27	34
Bluntnose Minnow	*Pimephales notatus*	0			49	0	49
Creek Chub	*Semotilus atromaculatus*	2			0	0	2
Iowa Darter	*Etheostoma exile*	0			8	0	14
Johnny Darter	*Etheostoma nigrum*	0			0	1	1
Total sampled	16 Species	1,408	802	194	1,934	237	4,581

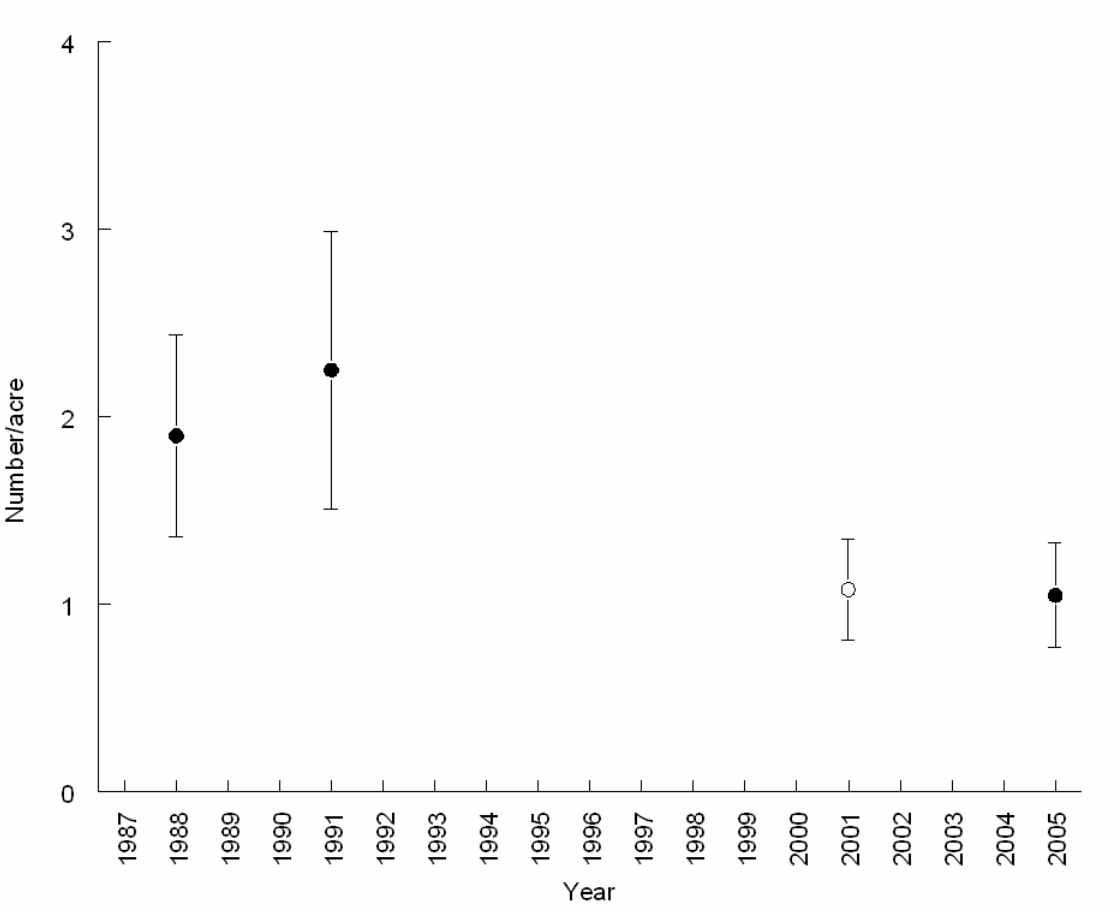

Figure 1. Number of walleye ≥ 15 in and sexable fish (number/acre ± 95% confidence intervals) by year in Whitefish Lake, Douglas County, WI. Survey in 2001 utilized electroshocking for both marking and recapture.

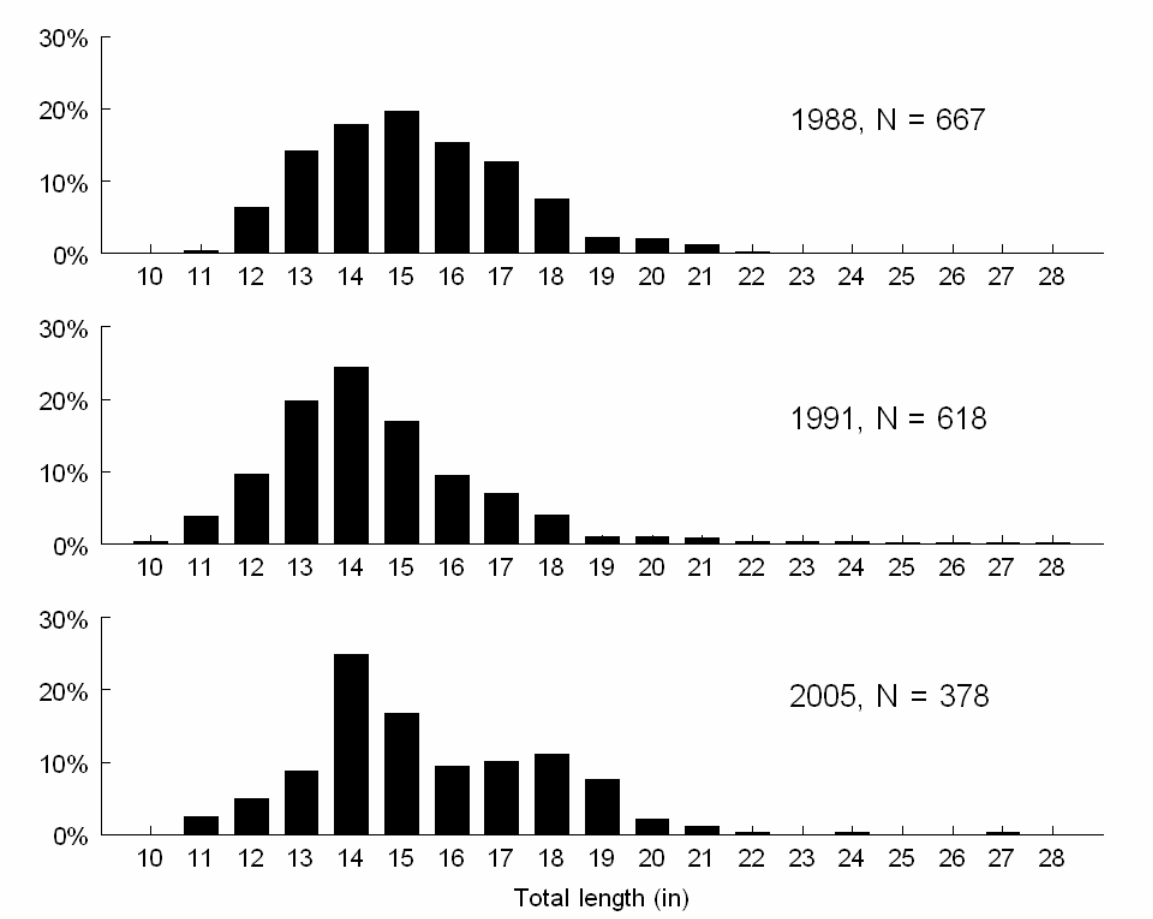

Figure 2. Percentage length frequency of fyke net catches for walleye by length interval in Whitefish Lake, Douglas County, WI.

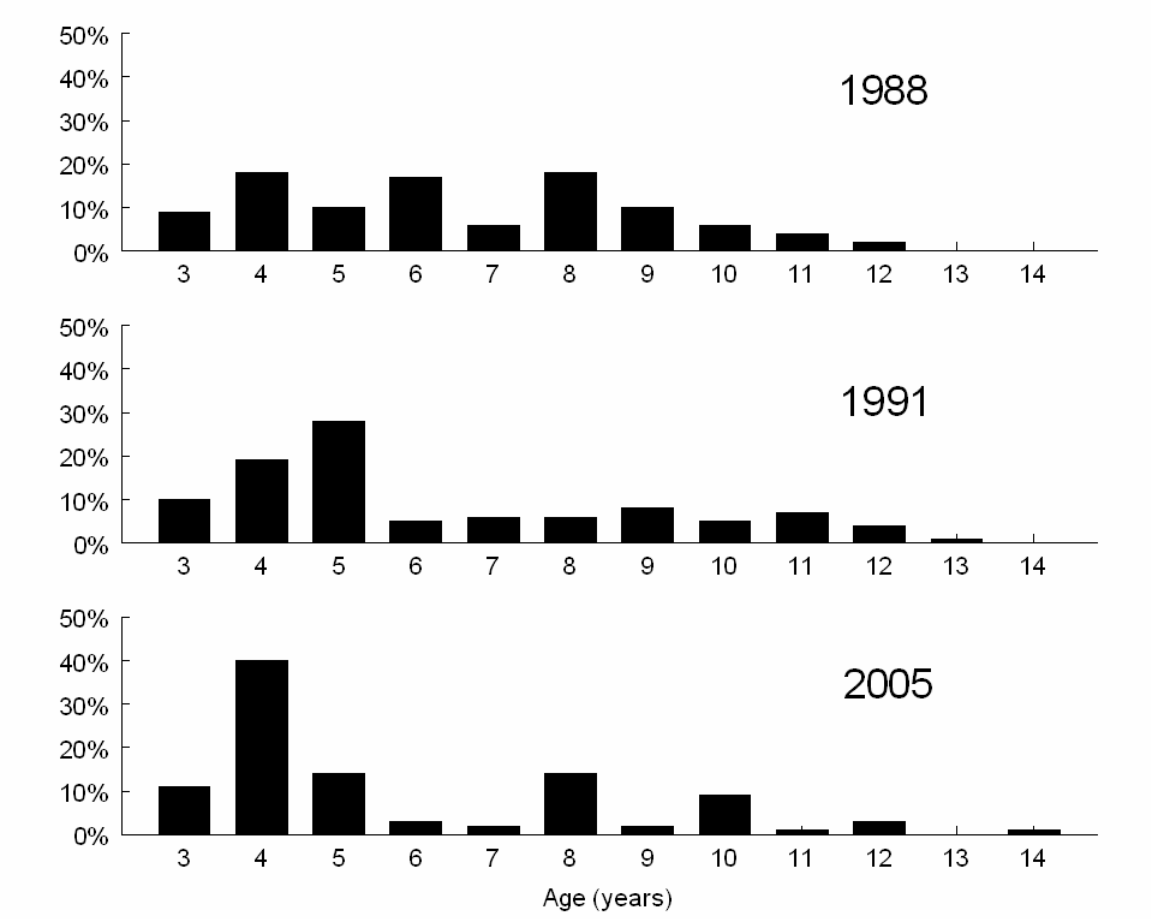

Figure 3. Percent distribution by age of walleye in Whitefish Lake, Bayfield County, Wisconsin.

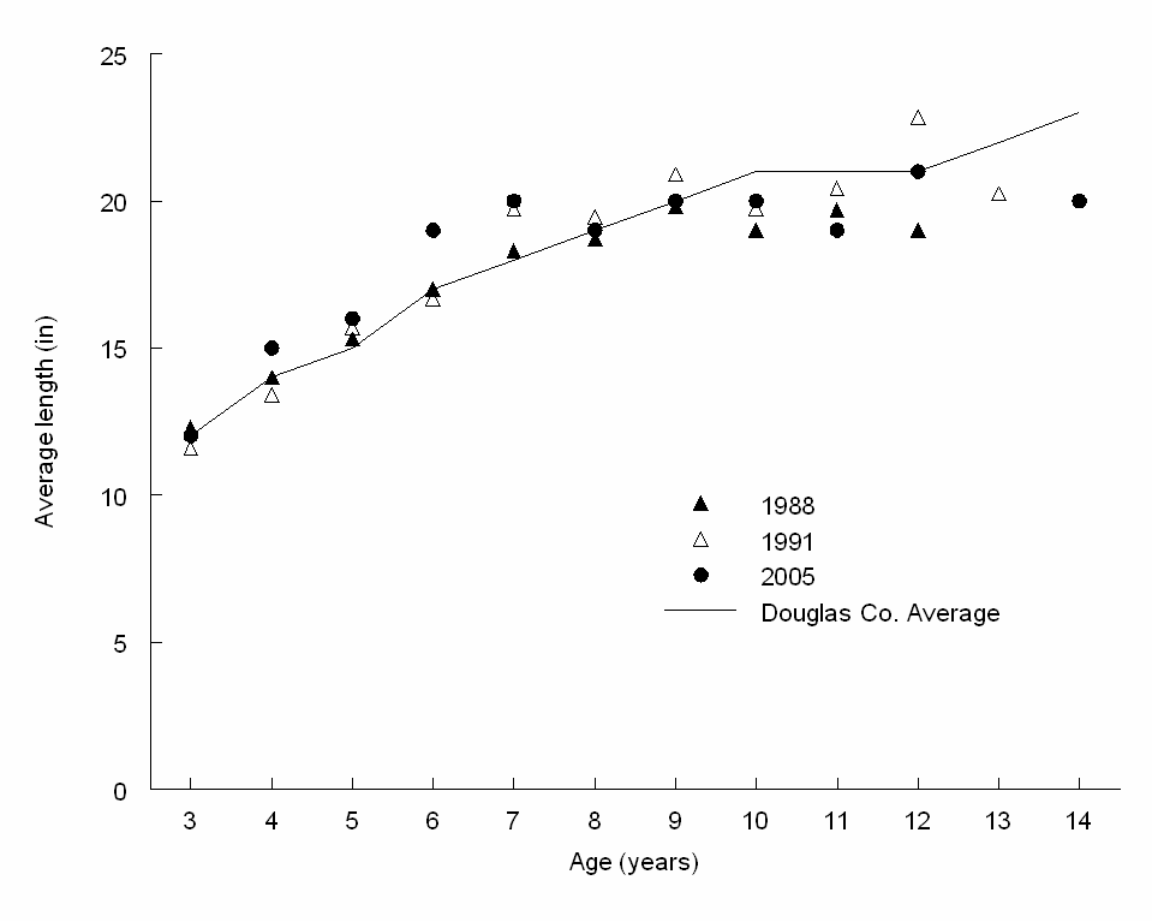

Figure 4. Age at length of walleye in Whitefish Lake, Douglas County, Wisconsin.

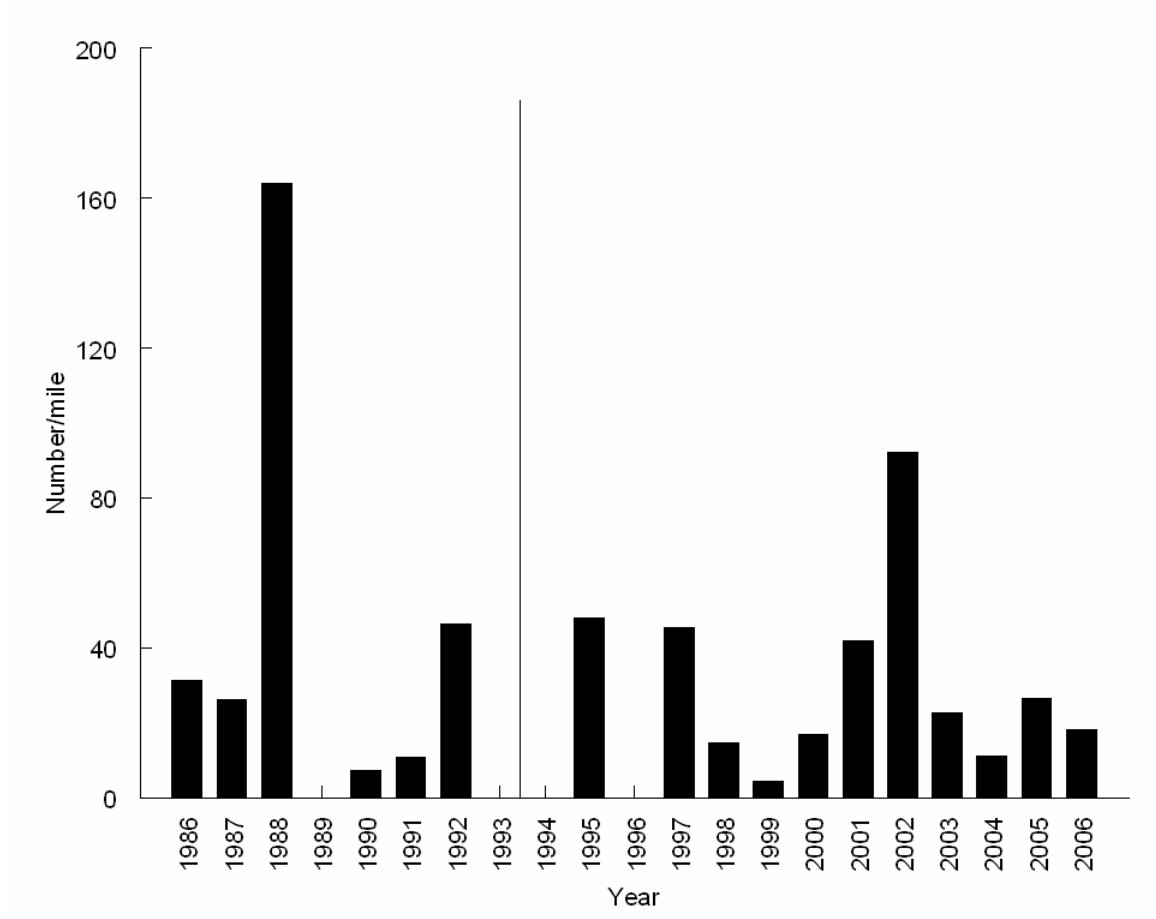

Figure 5. Young of the year walleye relative abundance determined by fall electroshocking in Whitefish Lake, Douglas County, Wisconsin. Surveys were not completed in 1989, 1993, 1994 and 1996. Vertical line represents termination of walleye stocking.

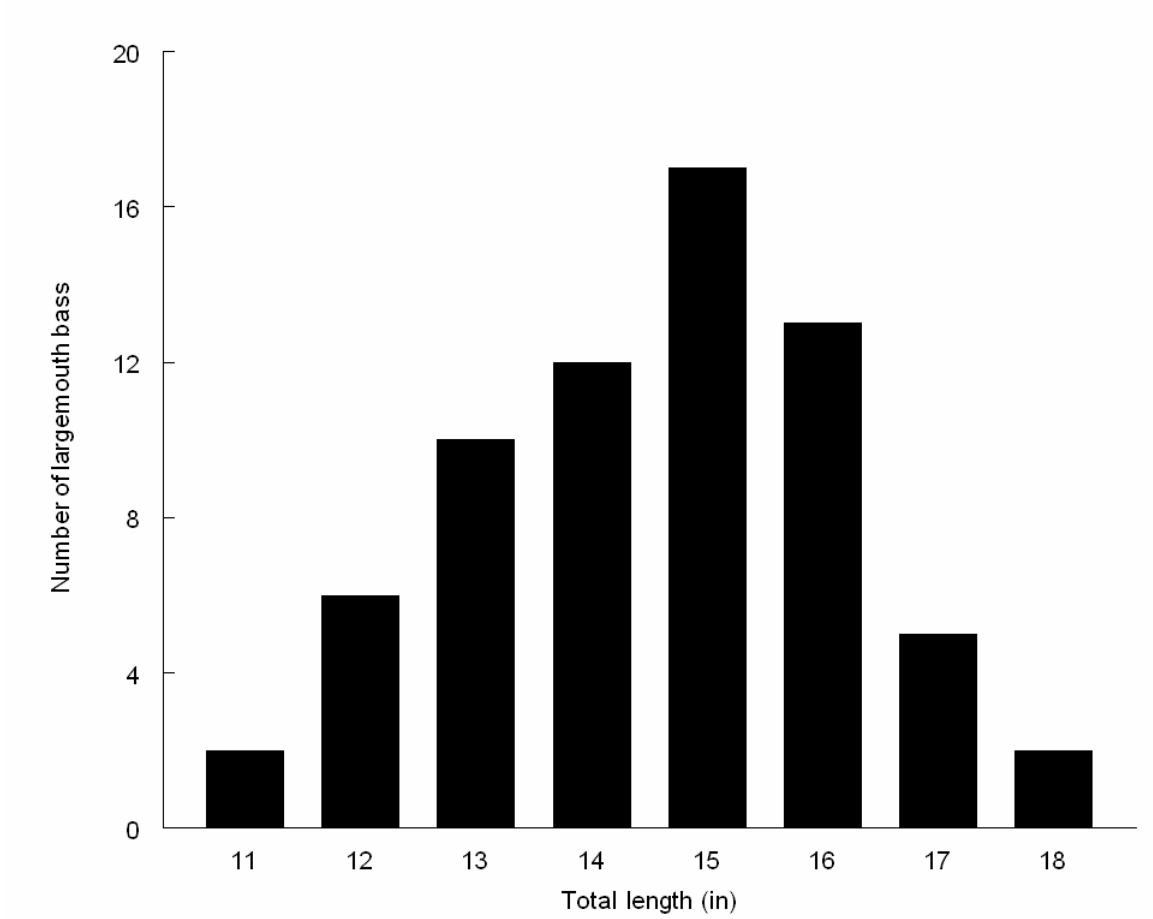

Figure 6. Largemouth bass length frequency, 2005, Whitefish Lake, Douglas County, Wisconsin (N = 66).

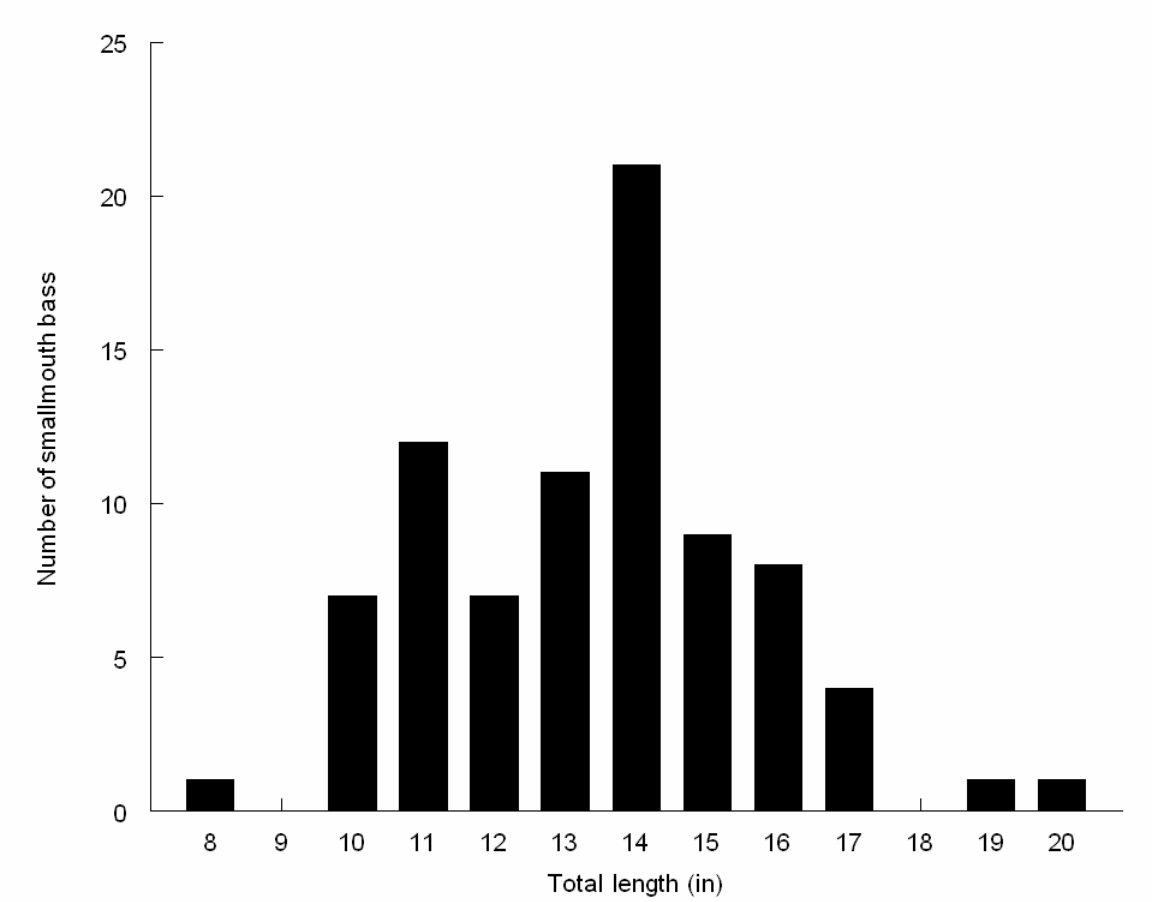

Figure 7. Smallmouth bass length frequency, 2005, Whitefish Lake, Douglas County, Wisconsin (N = 82).