Big Round Lake Fisheries Assessment, 2012-2013
Polk County, WI
MWBIC Code: (2627400)

Aaron J. Cole
Senior Fisheries Biologist
Wisconsin Department of Natural Resources
Northern Region - Barron
April, 2014

Executive Summary

Big Round Lake was surveyed in 2012-2013 to determine the abundance, harvest (both recreational and tribal), and population demographics (i.e., size and age structure, growth, and recruitment) of walleye as part of the treaty assessment protocol for lakes within the Ceded Territory. In addition, size structure, growth, and recruitment were assessed for other sport fish. Creel surveys were conducted during the open water fishing and ice fishing seasons to determine angler effort, preference, and harvest for all fish species throughout the entire year. Lastly, historical data from fall electrofishing surveys were used to assess the stocking efficacy of walleye from 1987-2011. The adult walleye population was estimated to be 1,090 or 1.1fish/acre (95% C.I. = 807-1,374), which is the lowest walleye population estimate documented for Big Round Lake. Walleye harvest from recreational anglers has also decreased and was estimated to be only 54 fish (0.1/acre), which is the lowest harvest on record. Tribal spearers harvested an additional 19 walleyes, making the total annual walleye exploitation 6.7%. There has been extensive walleye stocking in Big Round Lake using fry, small fingerlings, and large fingerlings, but the stockings have resulted in low recruitment. Future walleye stocking efforts should consist of large fingerling (6-8 in) walleye at a minimum rate of 10 fish/acre on an alternate year basis. The catch of bluegill during spring electrofishing was 48 fish/mile. Growth rates of bluegill improved from the 1997 survey as age-3 to age-7 bluegill were approximately 0.5 in greater (across all ages) in the 2012 survey compared to 1997. Size structure indices for bluegill also increased since 1997. A majority of angling effort during the open water (60.6%) and ice fishing creel seasons (54.5%) was directed at bluegill. It was estimated that 57,680 bluegills were harvested. The mean length of harvested bluegill was 8.3 in during the open water season and 8.4 in during the ice fishing season. Largemouth bass catch rates during electrofishing were high (62.5 fish/mile; 176.2 fish/hour), but have decreased from the 1997 survey. Largemouth bass in the 10 to 14-in length range were abundant. High largemouth bass densities, via predation, may help maintain the quality bluegill population in Big Round Lake. Hence, removing the current 14 in minimum length limit (MLL) for largemouth bass regulation could compromise the size structure of the panfish, without necessarily improving walleye stocking success.

Introduction

Big Round Lake is a 1,014-acre lowland drainage lake in east central Polk County, Wisconsin. The lake is considered eutrophic and is relatively shallow with a maximum depth of 17 ft. and a mean depth of 10 ft. The Straight River enters the lake on northwest side and flows out on the south side. Anglers have access to the lake through a state-owned public boat landing on the northwest side of the lake. There is also approximately 35 acres of state-owned land adjacent to the inlet of the Straight River. Much of the remaining shoreline is privately-owned and developed except for a half-mile long portion of the eastern shoreline, which is federally owned land on the St. Croix Indian reservation. There is a fairly-diverse aquatic plant community in Big Round Lake, and macrophytes are common in many littoral areas, vegetation can cover up to 49% of the entire lake, and 69% of the lake that is less than 13.5 ft. deep (Polk County Land and Water Resources Department 2013). Heavy algal blooms are also common, especially during summer. Curly leaf pondweed *Potamogeton crispus* (an invasive species) is present in Big Round Lake, and varies in abundance each year, but does not seem to reach nuisance levels (McComas and Stuckert 2013).

The sport fish community in Big Round Lake consists of bluegill (*Lepomis macrochirus*), pumpkinseed (*L. gibbosus*), black crappie (*Pomoxis nigromaculatus*), largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), walleye (*Sander vitreus*), northern pike (*Esox Lucius*), bullheads (*Ameiurus spp*.), and rockbass (*Ambloplites rupestris*). Muskellunge (*E. masquinongy*) are also present, but in low numbers and originate from downstream sources.

Big Round Lake has long had a reputation of being an excellent fishing lake, especially for panfish and walleyes (Cornelius 1999). It is likely one of the most heavily fished waters in the area. Fishing pressure and harvest rates have been so great the panfish fishery has been described as one that is "pulse-fished" where there will be several good years of panfishing and high angler harvest followed by several years of less desirable panfishing and low angler use (Cornelius 1999).

Big Round Lake has historically been one of the better walleye lakes in Polk County. Walleye are not native to Big Round Lake (Becker 1983), but were first stocked into the lake in 1933, and have been stocked nearly every year since then, except for the

period from 1938 to 1964. Walleye stocking in recent years has consisted of small fingerling and large fingerling stockings, with fry occasionally stocked by the St. Croix Tribe (Table 1). The Big Round Lake walleye fishery has been reliant on stocking, especially in recent years to maintain a recreationally important sport fishery for anglers and a culturally important spear fishery to the St. Croix Tribe. In addition to the recreational fishery and tribal spear fishery, Big Round Lake serves as the primary brood source lake for the St. Croix Tribal walleye hatchery operations. Historically, there has been some level of natural reproduction, but not at a level to maintain the fishery. Interestingly, the walleye fishery was supported by natural reproduction during the period from 1938 to 1964 (i.e., when no walleye stocking occurred). In an attempt to increase natural reproduction for walleyes, the St. Croix Tribe installed a walleye spawning reef on the northeast end of the lake in 2001. The overall contribution of this structure is unknown, but based upon the equivocal outcomes with similar walleye spawning reefs installed elsewhere in Wisconsin; the reef likely provides limited additional walleye recruitment.

The base regulation for walleye in Big Round Lake is an 18-in minimum length limit (MLL) with a 3-fish daily bag limit, but the bag limit is subject to change based on tribal spearing declarations and harvest. From 2002 to 2012 there was a special regulation on largemouth bass. The regulation was a 14-in MLL, where one fish could be under14 in, and a five fish daily bag limit. However, this regulation sunsetted in spring 2012 and the largemouth bass regulation reverted back to the statewide regulation, a 14-in MLL and 5 fish daily bag limit. All other species regulations follow the Wisconsin statewide fishing regulations.

Previous Wisconsin DNR comprehensive fish surveys, which consisted of walleye population estimates and creel surveys, were conducted in 1989, 1991, and 1997. In addition, there was a Great Lakes Indian Fish and Wildlife Commission (GLIFWC) walleye population estimate from 2007 that used slightly different field protocol, as the marking and recapture periods were conducted by boat electrofishing. During the most recent survey in 1997, the fishery was characterized by an abundant largemouth bass population with declining growth rates; a moderate walleye population (P.E. = 3.7 adult fish/acre) supported by both stocking and natural reproduction that had an annual

exploitation rate of 6.8%; an increasing northern pike population; and a panfish population with a below average size structure for Big Round Lake (Cornelius 1999). Management recommendations called for reevaluation of the 14-in MLL on largemouth bass since growth rates of bass declined after the statewide 14-in MLL was implemented in1989.

The primary objectives of this survey were to assess the abundance, harvest (both recreational and tribal), and population demographics (i.e., size and age structure, growth, and recruitment) of walleye in Big Round Lake as part of the treaty assessment protocol for lakes within the Ceded Territory. Secondary objectives were to estimate the size structure, growth, and recruitment of sport fish, and make comparisons with previous surveys. In addition, creel surveys were conducted during the open water fishing and ice fishing seasons to determine angler effort, preference, and harvest for all fish species throughout the entire year. Lastly, historical walleye recruitment data from fall electrofishing surveys were used to assess the stocking efficacy of walleye stocked at varying sizes and rates from 1987-2011.

Methods

Field Sampling:

The sport fishery in Big Round Lake was sampled in 2012 with early spring fyke netting, early spring and late spring electrofishing, fall electrofishing, and open water and ice fishing creel surveys following the Wisconsin Department of Natural Resources treaty assessment protocol (Table 2; Cichosz 2013).

The population abundance of adult walleye was estimated using mark and recapture methodology during the early spring netting and early spring electrofishing surveys. Walleye were considered adult fish if they were ≥15 in or otherwise sexable (i.e., extrusion of eggs or milt; Cichosz 2013). Abundance of adult walleye was estimated using Chapman's modification of the Petersen single-census method (Ricker 1975):

$$N = \frac{(M+1)(C+1)}{(R+1)} - 1$$

where N = population estimate; M = the number of fish marked in the first (marking) sample; C = the total number of fish (marked and unmarked) captured in the second (recapture) sample; and R is the number of marked fish captured in the second sample.

Walleyes were captured with fyke nets set at ice out when water temperatures were 40-50°F. Fyke nets were set March 26, 2012 and checked every 24-h for 10 days. Fyke nets had 4 x 6 ft. frames, 0.5 to 0.75-in bar measure mesh, and lead lengths of 75 or 100 ft. All walleye collected in fyke nets were measured to the nearest 0.5-in TL and sexed; adult walleye were marked by clipping the left pelvic fin. Aging structures were collected from five walleye of each sex per 0.5-in length group. Scales were taken from walleye <12 in and dorsal spines were taken from fish ≥12.0 in. For the recapture period, walleye were collected during one night of boat AC electrofishing along the entire shoreline of the lake with two dip netters. All walleye were measured, sexed, and checked for marks.

Largemouth bass and panfish were assessed by AC boat electrofishing at night along the shoreline in late spring with two dip-netters on May 16, 2012. There were three 1.5-mile gamefish transects in which only gamefish were collected, and two 0.5-mile index transects in which all species were collected. Weights and scale samples were collected from five fish per 0.5-in length group for age and growth analysis.

The year class strength of age-0 walleye was assessed with nighttime-boat AC electrofishing conducted in the fall with two dip-netters. The entire shoreline was sampled and all walleyes were dip netted. The catch rate of age-0 walleye shocking was determined with catch per mile and compared to previous fall evaluations.

Population Demographics:

Scale samples were pressed on acetate slides and aged on a microfiche reader by a single interpreter. Dorsal spines were mounted in plastic, cut with a Dremel saw and age determined on a microfiche reader by a single interpreter. Mean length at age were compared to previous surveys and the regional (18 county WDNR Northern Region) averages obtained from the WDNR Fisheries and Habitat database.

Age-length keys were constructed for walleye, largemouth bass, and bluegill. Age structure for each was determined with 0.5-in bins. Proportional size distribution (PSD) indices were used to describe and compare population size structure of bluegill, largemouth bass, and walleye to those of previous surveys (Guy et al. 2007). PSD values represent the percent of fish stock length or larger that are also larger also longer than a

specified length (Appendix Table 1). The Fisheries Assessment Classification Tool (FACT) was used to determine how PSD values for largemouth bass and walleye compared to those from similar waterbodies throughout Wisconsin. In addition, the catch per effort for 8, 12, and 15 in (CPUE8, CPE12, and CPE 15) largemouth bass were compared to similar waterbodies in Wisconsin. Relative Weight (*Wr*) was used to assess the condition level of largemouth bass using the standard weight equation developed by Henson (1991).

Recreation Creel and Tribal Harvest:

A year-round creel survey was completed on Big Round Lake to assess the pressure and harvest from recreational anglers. The creel survey began the first Saturday in May and went to the first Sunday in March of the following year (i.e., the Wisconsin gamefish season). However, no creel data were collected during November because of unsafe ice conditions. The creel survey was separated into the open water fishing and ice fishing periods. Creel survey methods followed a stratified random design as described by Rasmussen et al. (1998). The directed effort, catch, harvest, specific harvest rate, and mean length of harvested fish was evaluated for each species during the open water and ice fishing creel surveys. Seasonal harvest trends for each species were determined by calculating the relative harvest level each month. The angling exploitation rate for adult walleye was calculated by dividing the estimated number of marked adult walleye harvested by the total number of adult walleye marked (R/M; Ricker 1975). Tribal exploitation was calculated as the total number of adult walleyes harvested divided by the adult population estimate (C/N; Ricker 1975). Total adult walleye exploitation rates were calculated by summing angling and tribal exploitation.

Stocking Efficacy:

Trends in stocking efficacy were evaluated by plotting the catch rate of age-0 walleye in the fall electrofishing surveys against the number of walleye stocked the previous spring. Data were partitioned by the size of the fish stocked, with the sizes being fry, small fingerlings (~2 in), and large fingerlings (5-9 in). There was some overlap, as there were several instances in which more than one size of walleye was

stocked for the year. Only years when fish were stocked and there was a fall evaluation were used for this analysis. All fall evaluations were conducted after the stocking occurred.

Results

Early spring fyke netting and electrofishing

Walleye. There were up to 10 fyke nets fished for 10 nights, which totaled 90 net nights. The walleye catch per unit effort (CPUE) was 10.1 fish/net night. In total, there was 720 walleye collected fyke netting (Figure 1), 659 of which were adults that received marks. There were 606 males, 49 females, and 4 walleye of unknown sex that were 15-in TL or greater. In addition, there were also 36 immature walleyes, where the sex could not be identified, that were less than 15-in TL.

There were 58 walleyes collected during the early spring electrofishing (recapture period), for a catch rate of 10.2 fish/mile. Of those walleye collected electrofishing there were 37 recaptured males, 16 unmarked males, 0 recaptured females, 1unmarked female, and 4 unmarked walleye of unknown sex.

The adult walleye population was estimated to be 1,090 or 1.1fish/acre (95% C.I. = 807-1,374; Figure 2). This estimate was the lowest walleye population estimate on record. The male: female ratio was 9:1. Mean length of walleye (sexes pooled) from fyke netting was 16.7 in (SE=0.12). The mean length of male walleye was 16.6 in (SE=0.55) and mean length of female walleye was 24.1 in (SE=0.25).

Walleye size structure has improved in Big Round Lake. Walleye PSD from netting was 84 ± 3 and the PSD-P was 12 ± 2, both of which increased from the 1997 survey where the PSD was 80 ± 3 and the PSD-P was 6 ± 2. When compared to statewide trends, walleye PSD was in the 46th percentile and PSD-P was in the 24th percentile.

Walleye in Big Round Lake had potential to live long and had good growth rates. Walleye ages ranged from 1 to 13, while female ranged from 7 to 13 and male 3 to 13 (Tables 3, 4, & 5). There were several missing year classes (i.e., ages 5, 6, 10, & 12). It is evident that Big Round Lake has a stocking-dependent walleye fishery because the missing year classes corresponded to the few years that had no walleye stocking or a low level of stocking, as one year that had no stocking (2002), two years that had the lowest

stocking rates in recent history (2006 & 2007), and one year that had relative high stocking (2001; Table 1). Mean length at age for walleye in Big Round Lake was at or above the Northern Wisconsin regional average except for the oldest age classes captured in this survey (i.e., age 11 & 13; Table 3). Mean length at age for walleye in this survey closely resembled those of previous surveys; however, mean length at age for all ages was greater in 2012 compared to those from the 1997 survey. Similarly, mean length at age for male and female closely followed the long term trends from previous surveys, but mean length at age for all ages of each sex were greater in the 2012 survey compared to the 1997 surveys except for the oldest age class of female (age-13) collected in 2012 (Tables 4 & 5). Mean length at age for females was greater than that of male fish across all ages collected.

Northern Pike. Northern pike abundance in Big Round Lake was low. There were 17 northern pike collected during the spring fyke netting survey. The catch rate was 0.19 fish/net night. Northern pike ranged in length from 10.5 to 35.5 in, and had an average length of 21.7 in (SE=1.3).

Muskellunge. One muskellunge was collected fyke netting. It was a 38.3-in female. This fish likely emigrated from Bone Lake or the Apple River Flowage, as it had a pelvic fin clip, which was the mark used in the 2011 Bone Lake and 2011 Apple River Flowage muskellunge surveys. This fish traveled a minimum of 6 miles if it originated from Bone Lake, and 17 miles if it originated from the Apple River Flowage.

Late spring electrofishing

Largemouth Bass. Largemouth bass abundance was high with many sublegal length fish. There were 356 largemouth bass collected during the late spring electrofishing survey; the catch rate was 62.5 fish/mile or 176.2 fish/hour; both of which decreased from the 1997 survey, but are above the long term average (Figure 3). Catch rates of largemouth bass were high when compared to statewide trends, especially for the smaller size classes. The CPE8 and CPE12 were in the 96th and 97th percentiles, respectively. Catch rate for larger fish was much less, as the CPE15 was in the 18th percentile. Largemouth bass

ranged in length from 4.5 to 17.5 in, and the mean length was 12.0 in (SE=0.1; Figure 4). Largemouth bass in the 10 to 14-in length range were abundant, as 86% of the largemouth bass collected were within that range. Only 9% of the largemouth bass collected would be available for harvest with the current 14-in MLL.

Largemouth bass PSD was 57 ±5, and the PSD-P was 1 ±1, both of which have decreased from the 1997 survey when PSD was 71 ±2 and PSD-P was 4 ±1 (Figure 5). The PSD was in the 42nd percentile for similar waterbodies in Wisconsin. However, the general trend since 1989 has been an increase in largemouth bass PSD and decrease in PSD-P.

Largemouth bass growth rates have declined (Figure 6). Mean length at age for age-4 to age-8 bass was nearly 1 in less in this survey compared to the 1997 survey. Similarly, mean length at age for age-4 to age-7 largemouth bass in this survey was over 3 in less than those from the 1989 survey. Mean length at age for largemouth bass at age-5 to age-9 was also approximately 1.6 in less than the regional average.

Despite the high density largemouth bass population, the *Wr* was 116 (SE=1.8), which suggests the largemouth bass are still in good condition.

Bluegill. There were 48 bluegill collected during the late spring electrofishing survey. The catch was 48 fish/mile. Length of bluegill ranged from 2.9 to 8.8 in, and the mean length was 7.0 in (SE=1.0). Bluegill PSD was 89 ± 9 and PSD-P was 27 ± 13. Both indices increased from 1997 fyke netting survey when bluegill PSD was 9 ± 3 and PSD-P was 1 ± 1. Growth rates of bluegill improved from the 1997 survey (Table 7). Age-3 to age-7 Bluegill were approximately 0.5 in greater (across all ages) in the 2012 survey than those collected in the 1997 survey. Mean length at age for Big Round Lake bluegills were also greater than the regional average. Bluegill mean length at age was approximately 1 inch greater than the regional average for age-4 to age-8 fish.

Other panfish. There were 36 pumpkinseeds collected, which resulted in a catch rate of 36 fish/mile. The lengths ranged from 5.7 to 8.4 inches. The mean length was 7.7 in (SE=0.1). Pumpkinseed PSD was 97±5 PSD-P was 22±14. There were three yellow

perch collected, and their lengths ranged from 3.4 to 10.8 inches. Only one 2.9 in black crappie was collected.

Fall Electrofishing

Age-0 walleye. There were no age-0 or age-1 walleye collected during the fall electrofishing evaluation. Catch rates of age-0 walleye have remained low despite intensive stocking efforts (Figures 7, 8, & 9). There is not a strong relationship in the number of walleye fry and small fingerling stocked to the number of age-0 walleye collected in the fall. There were only four instances in which large fingerling walleyes were stocked in years with a fall electrofishing survey. There were only two years in which fall catch rates exceeded age-0 walleye/mile. One of those years appeared to correspond to the largest stocking of large fingerling walleye (13,159), and the other was from a 45,080 small fingerlings stocking event. Regardless, the low catch rates of age-0 walleye in stocked years indicate general survival of small fingerlings and fry has been low and that low stocking rate of large fingerlings has resulted in low catch rates.

Recreational Creel and Tribal Spearing

Open water angling effort amounted to 28,628 hours (28.2 hr/acre), which is slightly less than the 1991 and 1997 creel surveys (Table 8). Ice angling effort amounted to 19,137 hours (18.9 hr/acre), which was more than 1997, but not as high as 1989 or 1991. The projected angling effort on Big Round Lake during the 2012-2013 fishing season was 47,765 hours (47.1 hr/acre), which is the third highest effort documented for Big Round Lake.

Walleye. Walleye harvest from recreational anglers was estimated to be only 54 fish (0.1/acre), which is the lowest harvest on record (Table 9). There was an additional 19 walleyes harvested by off reservation tribal spearers. The recreational exploitation rate was 2.9%, and the tribal exploitation rate was 1.7%. Total annual walleye exploitation was 4.6%. However, this is likely a conservative estimate of exploitation because it does not account for on-reservation spearing harvest, which is not reported.

Fishing effort directed at walleyes accounted for only 2.9% of the total effort during the open water, and 7.9% during the ice fishing season (Tables 10 & 11). The majority (40%) of the walleye harvest occurred during the month of July, but June had the highest catch of walleyes by anglers (Appendix Tables 2 & 3).

Panfish. The majority of angling effort on Big Round Lake was directed at panfish (bluegill, pumpkinseed, black crappie, and yellow perch) over the entire year. During the open water season, 82.6% of the total effort was directed towards panfish (Table 10). Of the total effort, bluegill were the most sought after (60.6%), followed by black crappie (10.3%), pumpkinseed (8.8%), and yellow perch (2.9%). Similarly, during the ice fishing creel survey 63.8% of the total effort was directed toward panfish (Table 11). Again, bluegill was most targeted by ice fishermen (54.5%), followed by black crappie (8.5%), and yellow perch (0.8%). No effort was directed to pumpkinseeds in the ice fishing creel. There were 57,680 bluegill (56.9 fish/acre) estimated to be harvested over the entire year (Table 9). Most of the catch and harvest of bluegill occurred during the months of June and July (Appendix Tables 2 & 3). There were 42,986 bluegill estimated to be harvested during the open water season (Table 10). The mean length of harvested bluegill was 8.3 in during the open water season. It was estimated that 14,694 bluegill were harvested during the ice fishing season (Table 11). Mean length of harvested bluegill increased slightly in during the ice fishing creel and was 8.4 in.

Black crappie was the second highest species harvested by anglers. There were 6,275 black crappies (6.2/acre) estimated to be harvested (Table 9). Most black crappies were caught and harvested during the months of May, June, or February (Appendix Tables 2 & 3). The mean length of black crappie harvested was 9.7 in during the open water season and 10.5 in during the ice fishing season (Tables 10 &11).

There were 1,025 pumpkinseed harvested during the open water season, and only 122 harvested during the ice fishing season (Tables 10 & 11). Mean length of harvested pumpkinseed was 7.8 in during the open water season and 8.0 in during the ice fishing season.

Yellow perch comprised a much smaller component in the overall fishery in terms of both effort and harvest. There were 1,119 yellow perch (1.1/acre) harvested over the

entire year (Table 9). The mean length of harvested perch was 10.3 in during the open water fishing creel and 11.2 during the ice fishing creel (Tables 10 & 11).

Largemouth Bass: Largemouth bass catch was 20,152 fish and harvest was 1,110 fish (1.1 fish/acre), which is comparable to previous creel surveys (Table 9). Effort directed at largemouth bass was 12.6% of the total effort during both the open water, and ice fishing seasons (Tables 10 & 11). Mean length of harvested largemouth bass was 14.8 in during the open water season and 15.3 in during the ice fishing season. June had the greatest level of catch and harvest of largemouth bass (Appendix Tables 2 & 3).

Northern Pike: Northern pike represented a small portion of the sport fishery on Big Round Lake. There were 333 northern pike (0.3/acre) estimated to be harvested (Table 9). Only 1.3% of the open water effort was directed to northern pike, and 47 fish were estimated to be harvested (Table 10). Effort and harvest of northern pike was greater during the ice fishing season (Table 11). There were 286 northern pike harvested ice fishing, which represented 15.7% of the total effort. Mean length of northern pike harvested during open and ice fishing seasons was 23.3 and 23.7 in, respectively.

Summary and Discussion

Big Round Lake has a long history of being a popular fishing lake for panfish, bass, and walleye. It has been locally touted as the best panfish lake and Polk County. Big Round Lake remains a heavily fished lake, but it appears the sport fishery has changed since the 1997 survey. During that survey, Big Round Lake was characterized as having a moderate walleye density, an abundant largemouth bass population, and a below average bluegill fishery (Cornelius 1999). However, in the 2012-2013 survey the lake appeared to have a lower density walleye population, an abundant largemouth bass population, and an excellent bluegill population in terms of both size and numbers.

Adult walleye abundance in 2012 was lower than in any previous survey (1,090 fish; 1.1 fish/acre), but typical for Polk County lakes. Similarly, walleye harvest in 2012-2013 was the lowest recorded in history, which is assumed to be due to the reduction in the adult population. Historically, Big Round Lake was one of the better walleye lakes in

Polk County and was characterized as having some level of walleye natural reproduction. According to Hagen (1974) there was good walleye fishing during the 1950s and 1960s that was driven by natural reproduction. Likewise, Cornelius (1991 & 1993) documented walleyes in non-stocked years during the late 1970s and early 1980s using age structure data, indicating some level of natural reproduction occurred. However, age structure data is subject to interpretation error, especially with older fish. In recent decades, walleyes have been stocked nearly every year making it difficult to gauge the level of natural reproduction. There have only been four years since 1985 when no walleyes were stocked into Big Round Lake (i.e., 1995, 2002, 2008, &2012). Fall electrofishing surveys were conducted in only two of those years (2002 & 2012), and no naturally-recruited age-0 walleyes were collected during either of those surveys. Looking at the catch at age data for adult walleye in the present survey, there was only one fish that came from a non-stocked year. It was an age-4 walleye that would have been from the 2008 year class. Assuming the age of this fish was interpreted correctly, there may be a very low level of natural reproduction of walleye occurring on Big Round Lake, but not enough to sustain a population.

Big Round Lake has had an extensive history of walleye stocking. These stockings have consisted of fry, small fingerlings, and large fingerlings, all at varying stocking rates, and many occurring the same year. There appears to be low stocking efficacy for all sizes (i.e., fry, small fingerling, and large fingerling). Therefore, the recruitment of walleye in Big Round Lake remains to be very low despite decades of intensive stocking. Of the 19 fall electrofishing surveys that have occurred since 1986, the mean catch rate of age-0 walleye has been 0.76 fish/mile (SE=0.39). This is a very low catch rate, considering from 1990 to 2010 the average fall catch rate of age-0 walleye in a naturally-reproducing population from the Ceded Territory was 31.7 fish/mile (Cichosz 2013). Similarly, the average fall catch rate during that same period for stocked populations in the Ceded Territory was 5.7 fish/mile. Although the catch of age-0 walleye in fall evaluations has almost always been low in Big Round Lake, it is assumed the stocked fish from the late 1980s and early 1990s had a higher survival rate because there were not “missing” walleye year classes in previous surveys, like those documented

in this survey. As a result of low walleye recruitment, there has been a decrease in the adult population.

There is currently a low density northern pike population, which is not unusual for Big Round Lake, as all surveys with the exception of the 1997 survey noted lower density northern pike populations. Although northern pike are not abundant, they do appear to have good size structure.

Largemouth bass abundance in Big Round Lake was fairly high, and their growth rates were below the regional average. Although it is still a high density bass population, numbers appear to have stabilized since 1997 because the catch rates of largemouth bass have decreased and the mean lengths at age were only slightly less than those of the 1997 survey.

The high density largemouth bass population in Big Round Lake may be contributing to the quality panfish populations. Largemouth bass catch per effort is often positively correlated with bluegill size structure (Guy and Willis 1990). By thinning out small panfish through predation, growth rates of the remaining fish will increase. The PSD values for largemouth bass and bluegill observed in this survey line up well with the panfish management strategy (i.e., to maximize large panfish) described by Willis et al. (1993). They recommended largemouth bass PSD values to range from 20–40 and PSD-P values from 0–10, while bluegill PSD should be 50–80 and PSD-P should range from 10–30. The panfish fishery in Big Round Lake is currently excellent, especially for bluegill and pumpkinseed. Both of these species have good size structure with above average growth rates. The 2012-2013 creel data for bluegill are impressive in that there was a relatively high harvest rate for bluegill (56.9/acre) while the mean length of bluegill harvested in the open water creel was 8.3 in, and 8.4 in during the ice fishing creel. Few lakes in Northwest Wisconsin are capable of producing the quantity and quality of bluegill that Big Round Lake does.

Big Round Lake bluegill are popular with anglers. Anglers directed more hours at bluegill than all other fish combined during both the open water and ice fishing creel seasons. During the open water creel, 60.6% of the effort was directed toward bluegill, and 54.5% during the ice fishing creel. With the popularity of this fishery the bluegill population appears to undergo relatively high exploitation. Although anglers did not

claim to have targeted pumpkinseeds as much as bluegills, pumpkinseeds undoubtedly contributed to the Big Round Lake panfish fishery. The pumpkinseed fishery is closely associated with the bluegill fishery and their size structure will increase as largemouth bass abundance is high.

Abundance and subsequent angler catch of black crappie was low. It is not uncommon for crappie populations to fluctuate, as black crappies commonly have cyclical populations.

The abundant largemouth bass and panfish populations could be part of the explanation as to why walleye stocking success has declined through time. Researchers have observed fry and small fingerling walleye stocking to be ineffective at producing year classes of walleyes in centrarchid lakes. Santucci and Wahl (1993) found that stocking walleye greater than 7.8 in provided the highest return on investment for stocking walleyes in centrarchid lakes. Furthermore, Kampa and Hatzenbeler (2009) noted that large fingerling stockings produced detectable year-classes more consistently and should produce more stable walleye fisheries in stocked populations. Large fingerling stockings essentially began in Big Round Lake in 2009 and have occurred nearly every year since then. It is currently difficult to evaluate these stockings because the fish were not fully recruited to the gear in this survey. There were age-3 male walleyes collected that likely originated from the 2009 stocking, but no age-3 females were collected. In addition, two of the three stockings were well below the recommended rate of 10 large fingerlings/acre. Maintaining a stocking rate of at least 10 fish/acre in alternate years is recommended. Adult walleye densities should be managed at 1-2 fish/acre. A better assessment should be made on the relative contribution of the large fingerlings during the next comprehensive survey. If the large fingerling walleye stocking continues to have low efficacy in Big Round Lake, walleye stocking should be reconsidered altogether.

In addition, due to the high level of submerged macrophytes in Big Round Lake, a high density predator population is likely required to keep bluegill size structure high. Abundant macrophytes decrease the risk of predation of bluegill by largemouth bass (Savino and Stein 1982). When the risk of predation decreases, the size of the population will increase and their size structure should decrease. Big Round Lake has long been a

lake well-suited for largemouth bass. Hagen (1974) described the habitat conditions in Big Round Lake to be “ideal for largemouth bass”.

Management Recommendations

1. The current 18 in MLL and 3 fish daily bag limit for walleye (base regulation) should remain. However, if no natural reproduction is found in future surveys, it would be worth considering reverting to the statewide 15 in MLL because there is no need to protect the walleye for spawning purposes if they do not have natural reproduction.

2. Maintain walleye density between 1-2 fish/acre through stocking large fingerling walleyes. Continue to stock large fingerling (6-8 in) walleyes in alternate years at a rate of 10 fish/acre. The Big Round Lake association is encouraged to continue stocking large fingerling walleyes in alternate years. Walleye stocking efforts should focus solely on large fingerling stockings due to the poor return when stocking walleye fry and small fingerlings. A better assessment will be made on the relative contribution of the large fingerlings during the next comprehensive survey. If the large fingerling walleye stocking continues to have low efficacy in Big Round Lake, walleye stocking should be reconsidered altogether.

3. Monitor the largemouth bass population in the next survey. The growth rates and condition of largemouth bass will be assessed at that time. Otoliths should be the aging structure to avoid potentially underestimating the age of the slow- growing bass in Big Round Lake.

4. No specific management actions in regards to northern pike are recommended at this time.

5. The entire fish community will be assessed in the next comprehensive fisheries survey which is scheduled for 2018. Special attention should be directed at the

abundance, size structure, age structure, and growth of largemouth bass, panfish, and walleyes.

6. Through educational efforts, lakeshore property owners should be encouraged to minimize disturbance to the lakeshore and littoral zone, to protect both fish and wildlife habitat, and water quality.

7. The current invasive species monitoring, prevention, and control activities should continue.

Acknowledgements

Special thanks are extended to the Brian Spangler and Mark Stanley of the Barron field office with assistance in the field, as well as the staff with the Spooner treaty assessment unit, especially Gene Hatzenbeler, Misty Rood, Todd Brecka, and Jill Sunderland for data collection and data entry and creel survey data collection, entry, and completion of the creel survey report. Also thanks to GLIFWC and the St. Croix tribe for providing the fall electrofishing data.

Literature Cited

Becker, G. C. 1983. Fishes of Wisconsin. University of Wisconsin Press, Madison.

Cichosz, T. A. 2013. Wisconsin Department of Natural Resources 2011-2012 Ceded Territory Fishery Assessment Report. Administrative Report No. 73 Wisconsin Department of Natural Resources, Madison.

Cornelius, R. R. 1991. Fish Survey, Big Round Lake (2627400), Polk County – 1989. Wisconsin DNR memo. January 12, 1991.

Cornelius, R. R. 1993. Fish Survey, Big Round Lake (2627400), Polk County – 1991. Wisconsin DNR memo. January 28, 1993

Cornelius, R. R. 1999. Fish Survey, Big Round Lake (2627400), Polk County – 1997. Wisconsin DNR memo. January 19, 1999

Guy, C.S., and D.W. Willis. 1990. Structural relationships of largemouth bass and bluegill populations in South Dakota ponds. North American Journal of Fisheries Management 10:338-343

Guy, C. S., R. M., Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution: a further refinement of population size structure index terminology. Fisheries 32(7):348.

Hagen, S. A. 1974. Lake Survey - Big Round Lake - Polk County, 1972. Wisconsin DNR memo. March 4, 1974.

Henson, J. C. 1991.Quantitative description and development of a species-specific growth form for largemouth bass, with application to the relative weight index. Master's thesis. Texas A&M University, College Station.

Kampa, J. M., and G. R. Hatzenbeler. 2009. Survival and growth of walleye fingerlings stocked at two sizes in 24 Wisconsin lakes. North American Journal of Fisheries Management 29:996-1000.

McComas, S. and J. Stuckert. 2013. Aquatic Plant Surveys and Water Quality for Big Round Lake, Polk County, WI 2013. Blue Water Science report. December 2013.

Polk County Land and Water Resources Department. 2013. Big Round Lake Aquatic Macrophyte Survey August 2013. Balsam Lake, WI.

Rasmussen, P. W., M. D. Staggs, T. D. Beard, Jr., and S. P. Newman. 1998. Bias and confidence interval coverage of creel survey estimators evaluated by simulation. Transactions of the American Fisheries Society 127:469-480.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada Bulletin 191.

Santucci, V. J., Jr., and D. H. Wahl. 1993. Factors influencing survival and growth of stocked walleye (Stizostedion vitreum) in a centrarchid-dominated impoundment. Canadian Journal of Fisheries and Aquatic Sciences 50:1548–1558.

Savino, J. F., and R. A. Stein. 1982. Predator-Prey Interaction between Largemouth Bass and Bluegills as Influenced by Simulated, Submersed Vegetation Transactions of the American Fisheries Society 111:255-266.

Willis, D. W., B. R. Murphy, and C. S. Guy. 1993. Stock density indices: development, use, and limitations. Reviews in Fisheries Science 1:203–222.

Table 1. Walleye stocking history for Big Round Lake, Polk County, WI, 1985-2012.

Year	Size	Number Stocked
1985	Small Fingerling	50,974
1986	Small Fingerling	5,508
1987	Small Fingerling	64,250
1988	Fry	1,015,000
	Small Fingerling	54,688
1989	Fry	1,015,000
1989	Small Fingerling	50,750
1990	Small Fingerling	45,080
1991	Fry	389,614
	Small Fingerling	83,549
1992	Small Fingerling	79,341
1993	Large Fingerling	2,914
1994	Small Fingerling	67,332
1995	—	—
1996	Small Fingerling	40,778
1997	Small Fingerling	30,450
1998	Fry	123,360
	Small Fingerling	36,380
1999	Fry	500,000
	Small Fingerling	51,911
2000	Fry	340,000
2001	Fry	152,960
	Small Fingerling	153,101
	Large Fingerling	184
2002	—	—
2003	Fry	292,158
	Small Fingerling	103,223
2004	Fry	246,847
2005	Fry	125,385
	Small Fingerling	87,705
2006	Small Fingerling	9,961
2007	Fry	103,133
	Small Fingerling	2,334
2008	—	—
2009	Fry	332,896
	Small Fingerling	35,741
	Large Fingerling	3,055
2010	Fry	56,809
	Large Fingerling	3,000
2011	Small Fingerling	9,211
	Large Fingerling	13,159
2012	—	—

Table 2. Sampling effort for the 2012 Big Round Lake comprehensive fisheries survey.

Date	Gear	Survey type	Effort
Mar. 25 to Apr. 4, 2012	Fyke nets	Walleye netting	89.75 net nights
Apr. 4, 2012	Electrofishing	Walleye recapture	5.7 miles
May. 16, 2012	Electrofishing	Bass-Panfish electrofishing	5.7 miles
Sep. 25, 2012	Electrofishing	Age-0 walleye electrofishing	5.7 miles

Table 3. Mean length (in) at age for walleye (sexes pooled) in Big Round Lake, from the 1989, 1991, 1997, and 2012 comprehensive surveys, and the northern Wisconsin average. Standard errors are listed in parentheses.

Age	1989	1991	1997	2012	Northern WI average
1	—	—	6.7	7.6 (0.19)	6.4
2	9.7	10.7	7.7	11.7	9.5
3	13.9	11.6	13.8	14.6 (0.20)	11.7
4	17.8	15.6	15	15.0	13.8
5	20.2	17.6	17.3	—	15.8
6	20.1	20.7	16.4	—	17.5
7	23	22.2	20	20.0 (0.61)	19.1
8	22.3	20.3	—	22.4 (0.30)	20.5
9	22.1	21.4	19	21.7 (0.41)	21.6
10	23.3	24.1	17.7	—	22.7
11	22.5	23.7	20.3	23.2 (0.68)	23.7
12	25.8	26	20.8	—	24.4
13	23.7	21.9	22.5	25.1 (0.12)	25.2
14	27.3	23.1	—	—	25.8
15	—	26.6	23.4	—	25.6

Table 4. Mean length (in) at age for male walleye in Big Round Lake, from the 1989, 1991, 1997, and 2012 comprehensive surveys, and the northern Wisconsin average. Standard errors are listed in parentheses.

Age	1989	1991	1997	2012
1	—	—	—	—
2	—	—	—	—
3	13.9	11.8	13.7	14.9 (0.19)
4	17	15.9	15	—
5	18	16.9	16.1	—
6	19.2	18.1	16.4	—
7	21	18.8	18.2	18.7 (0.45)
8	20.4	19.4		—
9	20.5	20.3	17.8	19.0 (0.24)
10	20.8	21.1	18.1	—
11	20.8	21.8	19.9	20.6 (0.72)
12	22.2	21.1	20.8	—
13	22.5	21.3	21.3	25
14	—	22.8	—	—
15	—	—	21.4	—

Table 5. Mean length (in) at age for female walleye in Big Round Lake, from the 1989, 1991, 1997, and 2012 comprehensive surveys, and the northern Wisconsin average. Standard errors are listed in parentheses.
Female walleye

Age	1989	1991	1997	2012
1	—	—	—	—
2	—	—	—	—
3	—	—	15.9	—
4	—	—	—	—
5	21.2	19.4	18	—
6	20.7	21.7	—	—
7	23.8	23.6	20.5	22 (0.28)
8	25.3	23	—	22.4 (0.3)
9	24.5	24.9	21.4	24.5 (0.29)
10	26	25.8	17.5	—
11	25.9	26.7	21.3	25.3 (0.41)
12	26.4	29.7	—	—
13	27.2	24	27.2	25.1 (0.2)
14	27.3	25.6	—	—
15	—	26.6	29.5	—

Table 6. Mean length (in) at age for largemouth bass in Big Round Lake in the 1989, 1997, and 2012 surveys, and the northern Wisconsin average. Standard errors are listed in parentheses.

Age	1989	1997	2012	Northern WI average
1	—	—	4.5	3.8
2	7.6	7	8.7	6.6
3	11.6	9.1	9.2 (0.10)	9.0
4	13.4	11.5	10.2 (0.17)	10.8
5	15.1	12.4	11.4 (0.15)	12.7
6	16.8	13.4	13.1 (0.18)	14.3
7	18.3	14.8	13.8 (0.17)	15.7
8	—	15.5	14.7 (0.12)	17.0
9	—	15.9	16.4	17.9
10	—	15.2	17.8	18.5

Table 7. Mean length (in) at age for bluegill in Big Round Lake, from the 1997 and 2012 surveys, and the northern Wisconsin average. Standard errors are listed in parentheses.

Age	1997	2012	Northern WI average
1	—	1.5	2.4
2	3	3.1 (0.31)	3.7
3	4.4	4.8 (0.27)	4.7
4	5.8	6.3 (0.23)	5.6
5	6.6	7.5 (0.13)	6.5
6	7.7	8.3 (0.13)	7.1
7	8.5	8.7 (0.03)	7.7
8	8.7	8.7	8.2
9	9.3	—	8.8

Table 8. Recreational creel survey angling effort and effort per acre for Big Round Lake, Polk County, WI, 1989-2012.

	Open Water Fishing		Ice Fishing		Entire Season	
Year	Hours	Hours/acre	Hours	Hours/acre	Hours	Hours/acre
1989	25,883	25.5	30,247	29.8	56,130	55.4
1991	35,221	34.7	30,044	29.6	65,265	64.4
1997	31,483	31.0	10,803	10.7	42,286	41.7
2012	28,628	28.2	19,137	18.9	47,765	47.1

Table 9. Estimated harvest and harvest/acre (in parentheses) of sportfish by angling, Big Round Lake, Polk County, WI, 1989-2012.

Species	1989	1991	1997	2012
Walleye	1,718 (1.7)	297 (0.3)	425 (0.4)	54 (0.1)
Northern Pike	230 (0.2)	59 (0.1)	1,473 (1.5)	333 (0.3)
Muskellunge	0	0	6	0
Largemouth bass	1,120 (1.1)	1,100 (1.1)	2,206 (2.2)	1,110 (1.1)
Bluegill	26,348 (26.0)	185,389 (182.8)	16,116 (15.9)	57,680 (56.9)
Black Crappie	14,696 (14.5)	24,149 (23.8)	3,277 (3.2)	6,275 (6.2)
Yellow Perch	1,147 (1.1)	11,377 (11.2)	1,854 (1.8)	1,119 (1.1)

Table 10. Directed effort, catch, harvest, specific harvest rate, and mean length of harvested fish by species during the 2012 Big Round Lake open water creel survey.

Species	Directed Effort (Hours)	(%)	Catch	Harvest	Harvest/Hour	Mean Length (inches)
Bluegill	23,370	60.6	64,746	42,986	1.84	8.3
Largemouth Bass	4,864	12.6	19,130	749	0.15	14.8
Black Crappie	3,984	10.3	5,968	3,700	0.93	9.7
Pumpkinseed	3,381	8.8	1,531	1,025	0.30	7.8
Walleye	1,114	2.9	315	49	0.04	19.7
Yellow Perch	1,111	2.9	1,636	607	0.55	10.3
Northern Pike	512	1.3	628	47	0.09	23.3
Rock Bass	125	0.3	1,318	195	1.56	8.5
Muskellunge	80	0.2	0	0	—	—
Smallmouth Bass	9	0.0	2	0	—	—

Table 11. Directed effort, catch, harvest, specific harvest rate, and mean length of harvested fish by species during the 2012 Big Round Lake ice fishing creel survey.

Species	Directed Effort (Hours)	(%)	Catch	Harvest	Harvest/Hour	Mean Length (Inches)
Bluegill	13,378	54.5	21,765	14,694	1.10	8.4
Northern Pike	3,847	15.7	626	286	0.07	23.7
Largemouth Bass	3,102	12.6	1,022	361	0.12	15.3
Black Crappie	2,076	8.5	3,641	2,575	1.24	10.5
Walleye	1,933	7.9	30	5	0.00	19.4
Yellow Perch	199	0.8	4,036	512	2.57	11.2
Pumpkinseed	—	0.0	122	122	—	8.0
Rock Bass	—	0.0	33	13	—	8.9
Warmouth	—	0.0	8	0	—	—

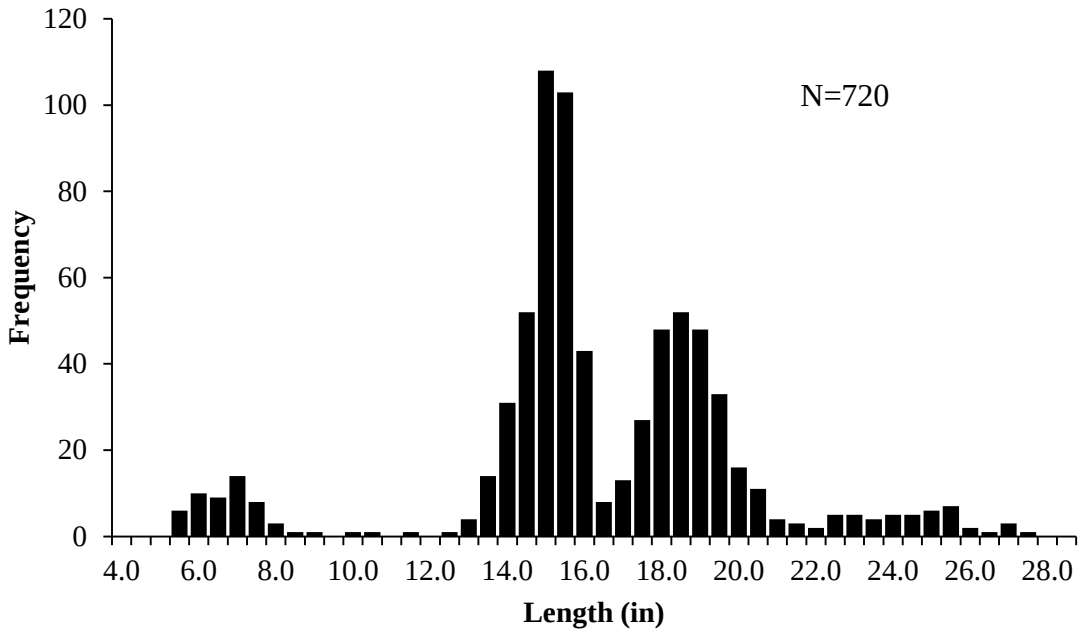

Figure 1. Length frequency histogram for walleye captured with fyke nets in Big Round Lake, Polk County, WI, 2012.

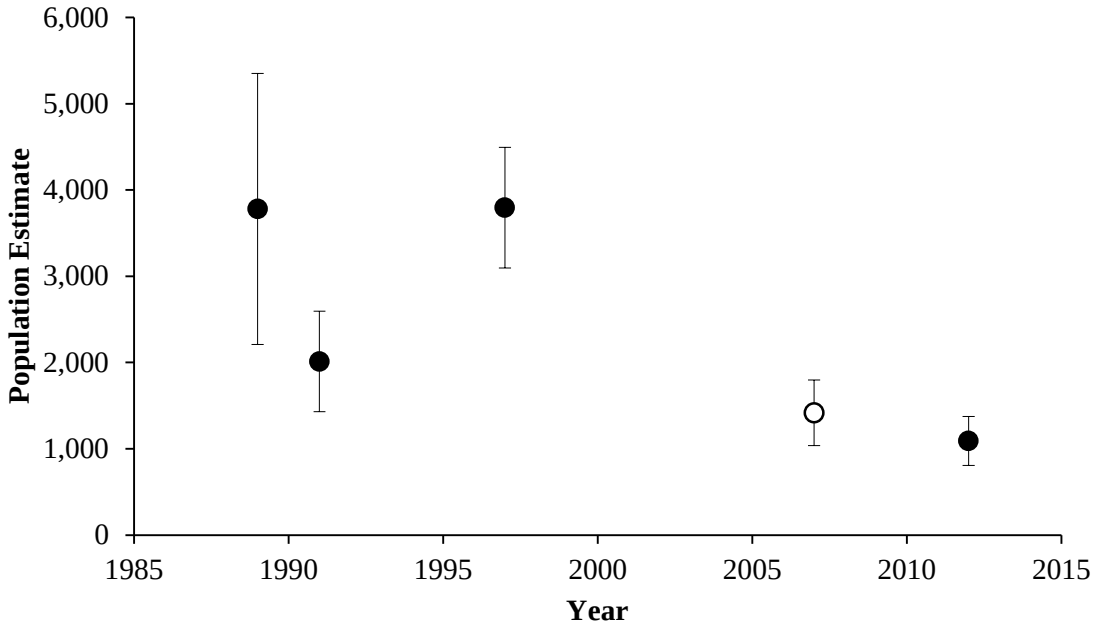

Figure 2. Population estimates for adult walleye (with 95% confidence intervals) in Big Round Lake, Polk County, WI 1989-2012. The 2007 survey was a GLIFWC survey which used different field protocol (i.e., electrofishing for both marking and recapture periods).

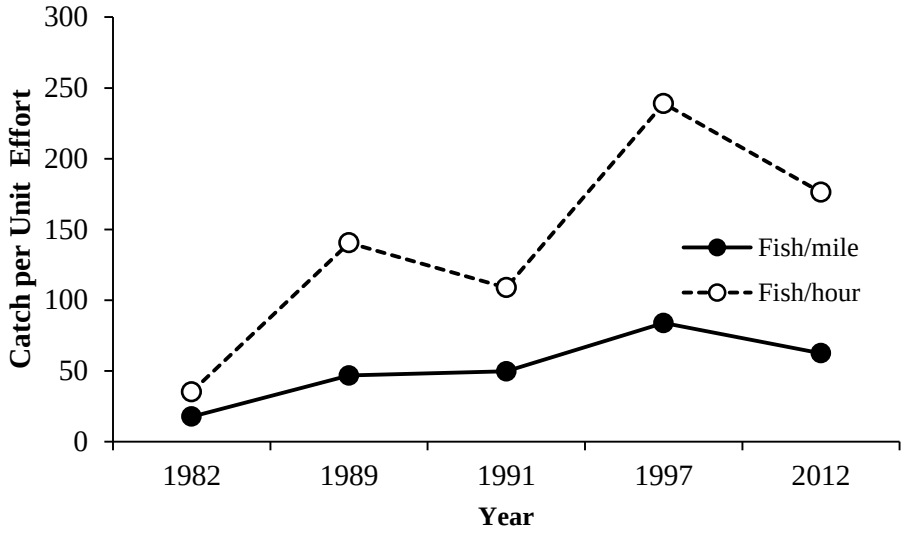

Figure 3. Catch per unit effort (CPUE) of largemouth bass (fish/hour and fish/mile) from electrofishing surveys on Big Round Lake, 1982-2012. All electrofishing surveys were conducted in spring, except for the 1991 survey which was conducted in fall.

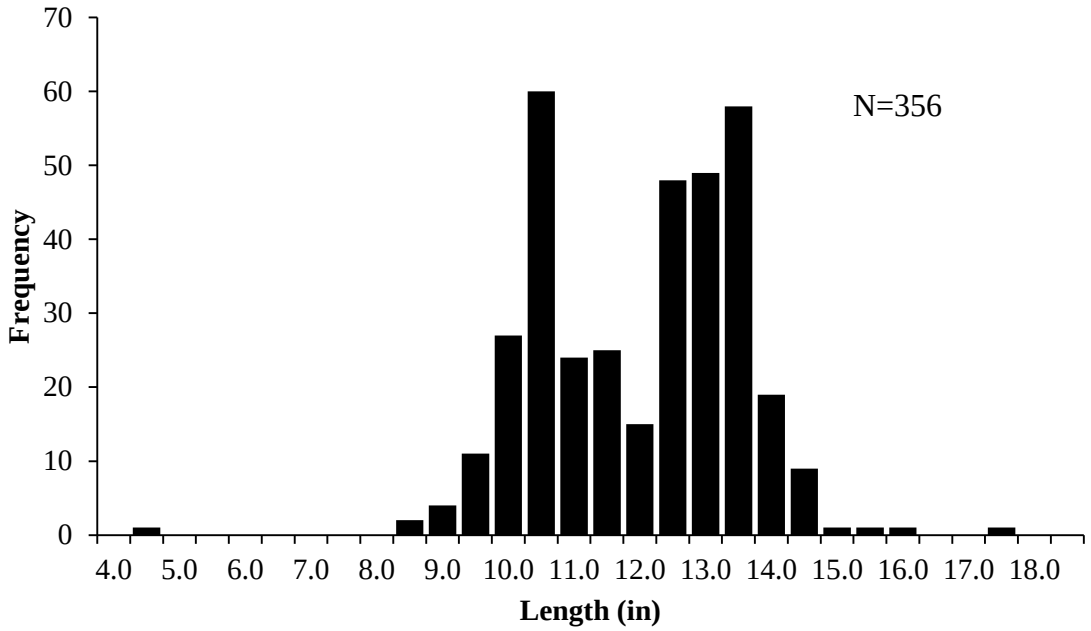

Figure 4. Length frequency histogram for largemouth bass captured in the late spring electrofishing in Big Round Lake, Polk County, WI, 2012.

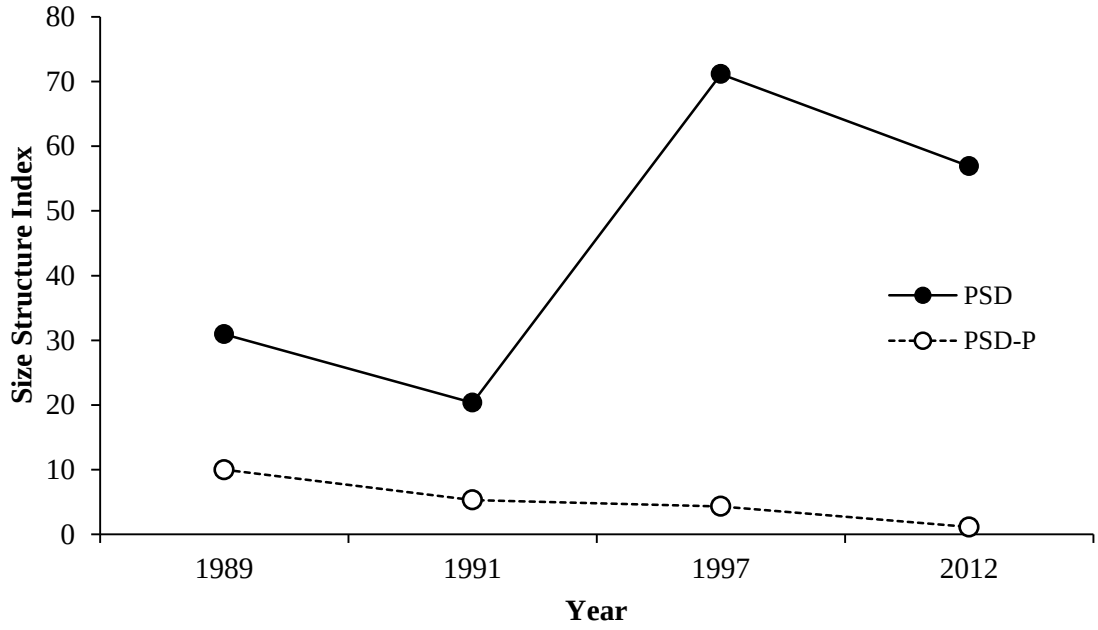

Figure 5. PSD and PSD-P values for largemouth bass collected electrofishing from Big Round Lake, Polk County, WI 1989-2012.

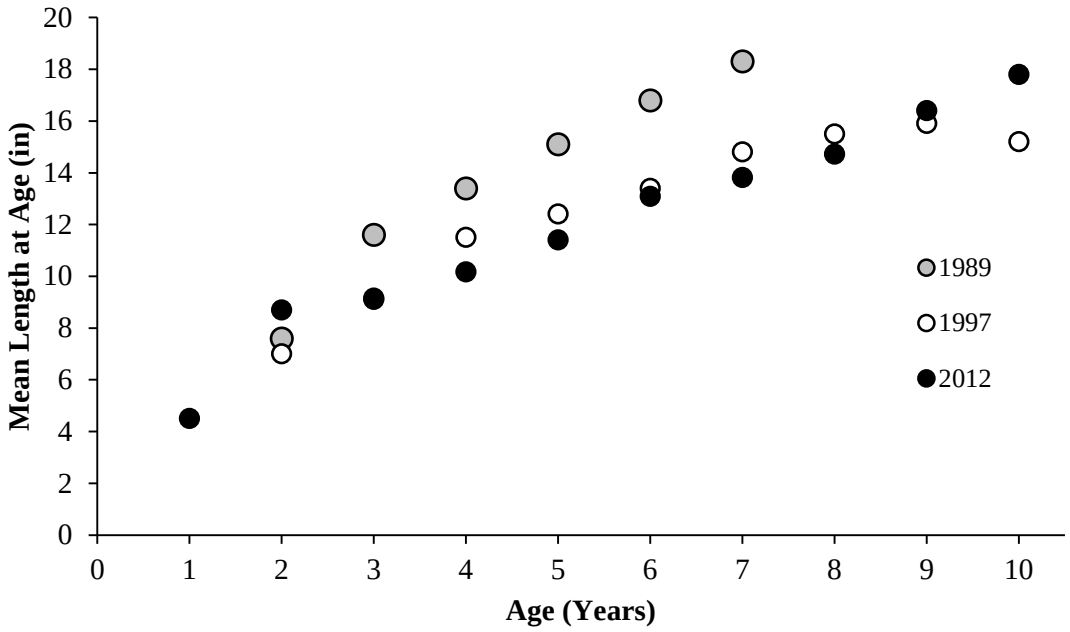

Figure 6. Mean length at age for largemouth bass collected from Big Round Lake, Polk County, WI, 1989-2012.

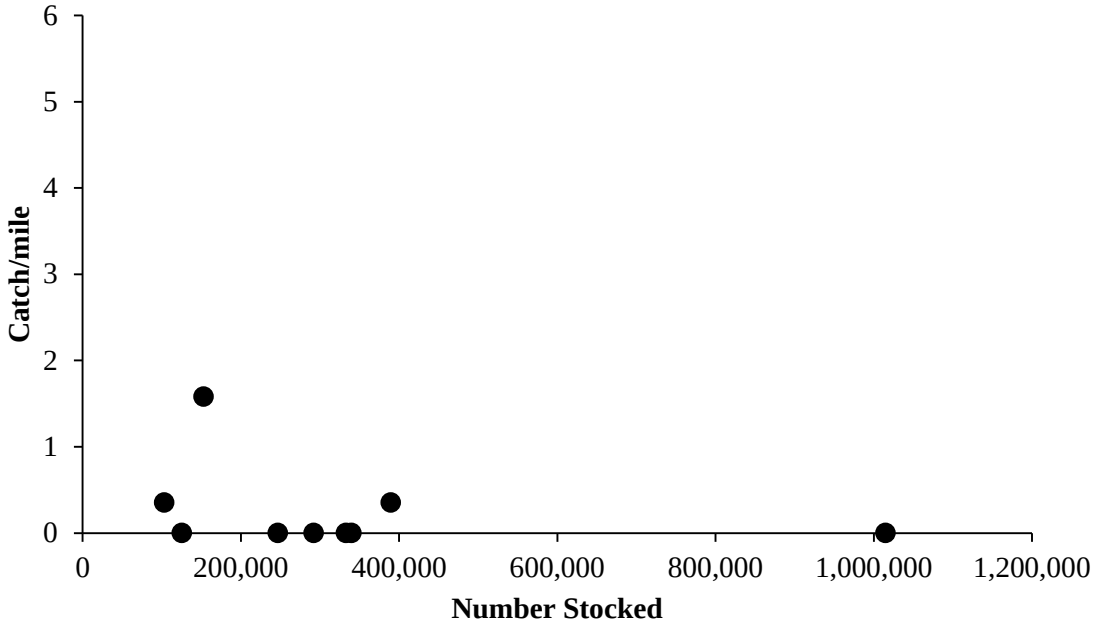

Figure 7. Catch per mile of age-0 walleye plotted against the number of walleye fry stocked.

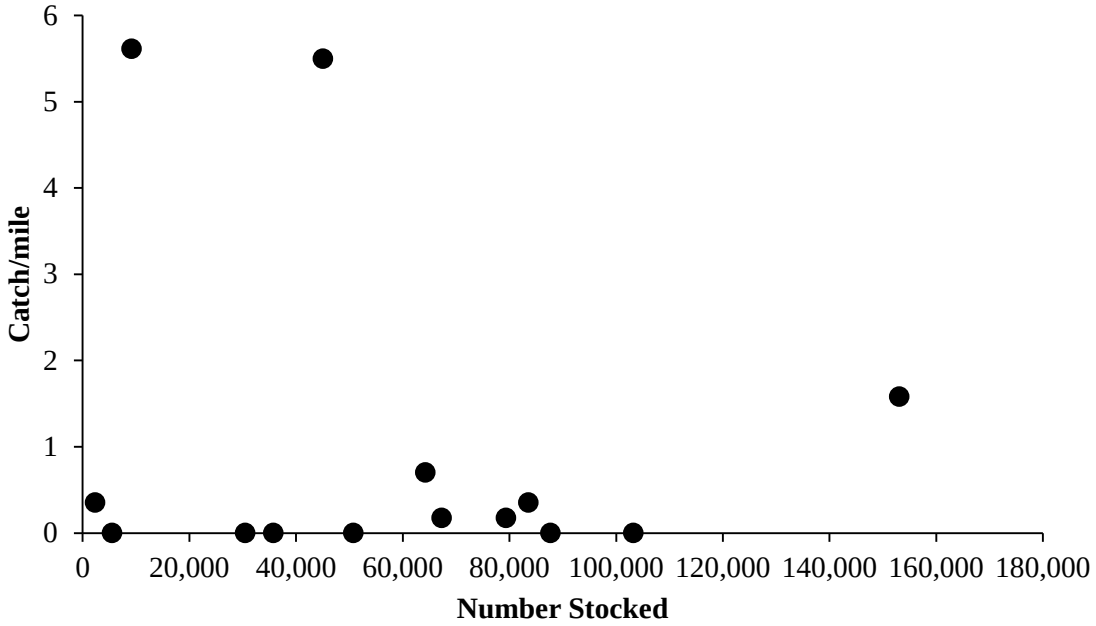

Figure 8.—Catch per mile of age-0 walleye plotted against the number of small fingerling walleyes stocked.

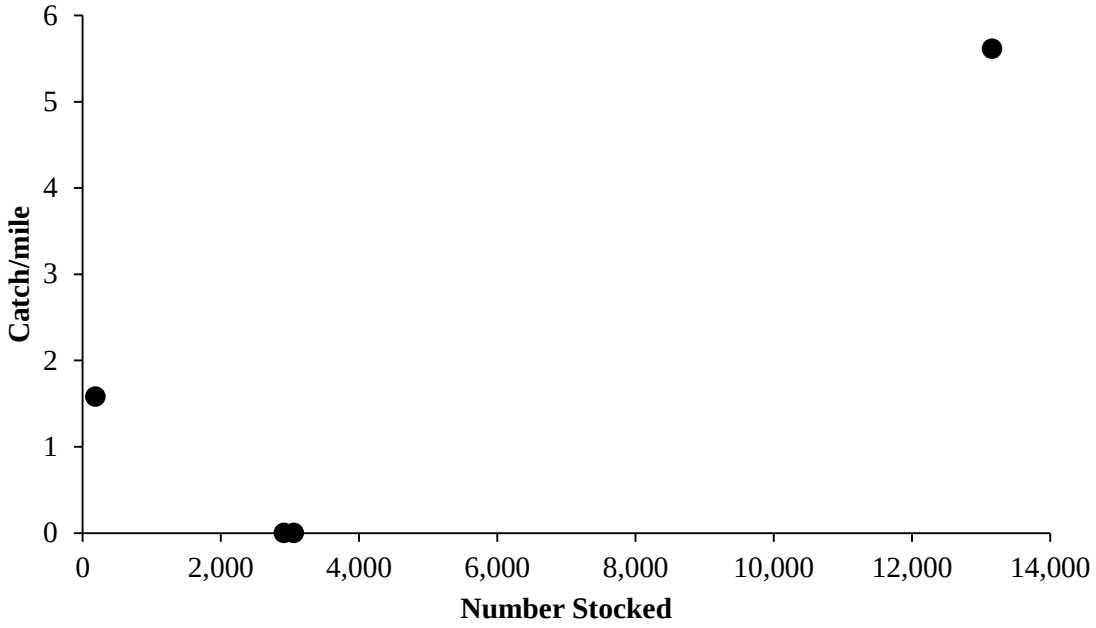

Figure 9. Catch per mile of age-0 walleye plotted against the number of large fingerling walleyes stocked.

Appendix Table 1. Values used in proportional (PSD) and preferred stock density (PSD-P) calculations.

Fish Species	Stock Size (in)	Quality Size (in)	Preferred Size (in)
Walleye	10	15	20
Largemouth bass	8	12	15
Bluegill	3	6	8

Appendix Table 2. Relative catch each month for the most common sportfish in Big Round Lake during the 2012 creel survey.

Species	May	June	July	Aug	Sep	Oct	Dec	Jan	Feb	Mar
Black Crappie	0.30	0.16	0.07	0.03	0.05	0.01	0.02	0.11	0.21	0.04
Bluegill	0.15	0.30	0.21	0.06	0.03	0.01	0.05	0.07	0.12	0.02
Largemouth Bass	0.25	0.36	0.20	0.08	0.05	0.00	0.00	0.02	0.02	0.01
Northern Pike	0.25	0.13	0.06	0.03	0.03	0.00	0.06	0.27	0.16	0.01
Pumpkinseed	0.24	0.43	0.16	0.06	0.04	0.00	0.00	0.04	0.02	0.01
Rock Bass	0.32	0.41	0.12	0.04	0.08	0.00	0.00	0.00	0.02	0.00
Walleye	0.18	0.40	0.14	0.14	0.06	0.00	0.01	0.08	0.00	0.00
Yellow Perch	0.02	0.05	0.06	0.05	0.11	0.00	0.03	0.28	0.29	0.10

Appendix Table 3. Relative harvest each month for the most common sportfish in Big Round Lake during the 2012 creel survey.

Species	May	June	July	Aug	Sep	Oct	Dec	Jan	Feb	Mar
Black Crappie	0.24	0.16	0.08	0.04	0.06	0.01	0.03	0.14	0.20	0.04
Bluegill	0.14	0.29	0.22	0.06	0.03	0.01	0.05	0.07	0.13	0.02
Largemouth Bass	0.15	0.26	0.12	0.08	0.05	0.01	0.01	0.14	0.14	0.04
Northern Pike	0.05	0.04	0.02	0.02	0.01	0.00	0.11	0.51	0.23	0.00
Pumpkinseed	0.18	0.44	0.18	0.05	0.05	0.00	0.00	0.06	0.03	0.01
Rock Bass	0.10	0.58	0.19	0.00	0.07	0.00	0.00	0.00	0.06	0.00
Walleye	0.13	0.25	0.36	0.12	0.04	0.00	0.00	0.10	0.00	0.00
Yellow Perch	0.04	0.16	0.13	0.10	0.11	0.00	0.04	0.06	0.36	0.00