WISCONSIN DEPARTMENT OF NATURAL RESOURCES

# Fishery Survey Report for Granite Lake, Barron County, Wisconsin 2019-2020

WATERBODY IDENTIFICATION CODE: 2100800


**Kyle J. Broadway**
DNR Fisheries Biologist-Senior
&
**Craig L. Landes**
DNR Fisheries Technician-Advanced


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# Executive Summary

Granite Lake was surveyed during 2019-2020 to determine the abundance, harvest and population demographics (size and age structure, growth and recruitment) of walleye as part of the Treaty assessment protocol for lakes within the Ceded Territory. In addition, abundance and population demographics were assessed for other sport fish. Lastly, open water and ice fishing creel surveys were completed to assess the pressure and harvest from recreational anglers. The adult walleye population during 2019 was estimated to be 1,236 fish (95% CI = 1,004 – 1,469 fish) or 8.0 fish/acre (95% CI = 6.5 – 9.5 fish/acre) which has increased since 1994 and 2005 and was the second highest adult walleye density estimated in the Ceded Territory during 2019. The current walleye fishery resembles that of historic populations and a typical naturally reproducing walleye fishery characterized by moderate-high abundance, low size structure, male-biased sex ratio and slow growth rates. Walleye angling was very popular and the main driver of the recreational fishery in Granite Lake. Adult walleye harvested from the recreational fishery was moderately high compared to other popular fisheries in the area, with an angling exploitation rate of 16.8%, and no tribal exploitation occurred during 2019. The walleye management objective is to sustain adult densities above three fish/acre and observe age-0 catch rates above 20 fish/mile. The current walleye harvest regulation (Ceded Territory base regulation) will be maintained as this regulation is conservative in managing harvest, promotes greater population size structure and reproductive potential by protecting larger fish but also allows some harvest opportunity. Efforts to protect and maintain natural shorelines and nearshore walleye spawning habitat is encouraged. A low-density largemouth bass population was present with an excellent size structure and above-average growth and body condition. Largemouth bass population demographics remained similar to 2005. The largemouth bass population remains healthy, supports a recreational fishery, and no management actions are recommended at this time. Healthy panfish populations were present with quality size structure that offers anglers quality harvest opportunities. Panfish composed approximately a third of the recreational fishery but directed efforts targeting black crappie and bluegill specifically were both below-average compared to other fisheries in Barron and Polk counties. Low-density panfish populations corresponded with low fishing effort, but fish caught and harvested were of quality size and representative of quality population size structures. Future fishery surveys should continue to monitor panfish population abundance and demographics due to their importance to the overall fish community. The current panfish regulation (25 fish daily bag limit in aggregate) should continue to promote both quality recreational fisheries and sustainable population dynamics. No specific management actions for black crappie and bluegill are recommended at this time.

# Introduction

Granite Lake is a 154-acre drainage lake located in Barron County, Wisconsin. The lake has a maximum depth of 34 feet and a mean depth of 18 feet. Granite Lake is best characterized by relatively steep sloping shorelines with a small littoral area (6.6% of area under 3 feet) with wetlands in the northern and southern portions of the lake. Nearshore land use is primarily natural and undeveloped (69.4%). The watershed is composed primarily of forests and wetlands (75.9%). There are 16.2 dwellings per shoreline mile, which doubled since 1975 (7.4 dwellings per shoreline mile). Bottom substrates are composed primarily of sand, gravel and rubble. Granite Lake receives light recreational boating use and angling pressure and has quality and diverse fisheries. Granite Lake is a naturally stained system and is classified as a complex-cool-dark lake (Rypel et al. 2019). The July-August mean Trophic State Index (TSI) values for chlorophyll-a and total phosphorus were 48 and 47, respectively. Mean TSI has generally remained stable over the past decade. Moderate algal blooms can occur on Granite Lake, but water clarity is generally good throughout the year and submerged aquatic macrophytes are present but not overly abundant in the littoral areas. There is one small inlet that enters the lake from the north and an outlet on the south end of the lake that flows to Duck Lake. Currently recognized invasive species include curly-leaf pondweed and purple loosestrife. There is one public boat landing located along the western shoreline off 25 3/4 Ave (45.578, -92.009).

The sport fish community in Granite 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.*), white sucker (*Catostomus comersoni*) and common carp (*Cyprinus carpio*). Walleye are the dominant predator species and the focal point of the recreational fishery.

Fisheries management activities on Granite Lake began as early as 1933, and previous surveys reflect dramatic changes in the fishery over time. From 1938 – 1954, the fish community consisted primarily of northern pike, largemouth bass and abundant panfish populations. Granite Lake was consistently stocked with northern pike during this time frame. A shift in fish community structure was inadvertently initiated during 1951 when a channel was established from Duck Lake to Beaver Dam Lake. This channel allowed fish passage from Beaver Dam Lake to Duck and Granite lakes. Shortly after the channel was completed, walleye and common carp (two species not present before the hydrological connection to Beaver Dam Lake) established populations and quickly increased in abundance. A quality walleye fishery developed shortly after the connection to Beaver Dam Lake, and walleye soon dominated the fish community. The adult walleye population was abundant, slow growing and naturally reproducing by the late 1950s and continued through the 1970s. The 1975 fisheries survey noted a moderate northern pike population and a low largemouth

bass population. During the early 1980s, the walleye population abundance declined and the largemouth bass population increased. Walleye stocking was initiated in 1984 to mitigate population declines and occurred at least every other year until the early 2000s. A 1989 survey showed signs of recovery with increasing numbers of adult and juvenile walleyes. The largemouth bass population at this time was noted to be low, like in the 1970s, and the northern pike population was modest and showed no clear temporal changes. Walleye abundance remained low during the early 1990s, with an adult density of 1.4 adults/acre. In the early 2000s, walleye showed strong signs of recovery with an increased population size, modest size structure and slow growth rates. Walleye abundance increased from 1994-2004, and the adult density in 2005 was 3.9 fish/acre. Although, the effectiveness of stocking was questioned as no clear correlation between stocking years and year class strength was observed. Walleye stocking was eventually discontinued during 2008 as evidence of natural reproduction was strong.

All fish species follow statewide or Ceded Territory regulations.

The Wisconsin Department of Natural Resources (DNR) surveyed Granite Lake to assess the status of the fishery during 2019-2020. A mark-recapture survey was performed to estimate the adult density of walleye. We assessed catch rates of largemouth bass, bluegill and other panfish species to estimate relative abundance. We assessed population characteristics, size structure and growth for all species when possible. Creel surveys were conducted to assess angler effort, catch and harvest. Recent management efforts have focused on sustaining walleye natural reproduction, public outreach and maintaining littoral zone habitat and water quality.

# Methods

## FIELD SAMPLING

Granite Lake was sampled during 2019 with early spring fyke netting (SN1), early spring (SE1) and late spring (SE2) night electrofishing, fall night electrofishing and open water and ice fishing creel surveys following the DNR's comprehensive Treaty assessment protocol (Appendix Table 2; Cichosz 2021).

The population abundance of adult walleye was estimated using mark-recapture methodology during the SN1 and SE1 surveys. The population size of adult walleye was estimated with Chapman's modification of the Peterson model (Ricker 1975):

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

*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. Fyke nets were set April 22, 2019 and checked every 24 hours for two days. Fyke nets had 4 x 6-foot frames, 0.5 to 0.75-inch bar measure mesh, and lead lengths of 75 feet or less. All walleye were measured (total length), weighed, sexed and given a specific mark indicating capture. Adult walleye ≥ 15 inches or sexable (extrusion of eggs or milt; Cichosz 2021) were marked with a fin clip, and juvenile walleye < 15 inches were marked with a different fin clip. Aging structures were collected from five walleye of each sex per 0.5-inch length group. Scales were taken from walleye < 12 inches, and dorsal spines were taken from fish > 12.0 inches. For the recapture period, walleye collected during the SE1 survey were measured, sexed and checked for marks.

The SE2 survey was conducted on May 29, 2019 to assess largemouth bass and panfish populations. The SE2 survey consisted of 0.5-mile index stations where all gamefish and panfish were captured and 1.5-mile gamefish stations where all gamefish were collected. There were two index stations and two gamefish stations completed on Granite Lake. All fish were measured, but weights and aging structures were collected from five fish per 0.5-inch length group for age and growth analysis. Catch per unit effort (CPUE; index of relative abundance) was estimated as catch per mile.

A fall night electrofishing survey was conducted on September 25, 2019 to assess the year class strength of naturally recruited age-0 and age-1 walleye. Results from the 2021 and 2022 fall electrofishing surveys were also included. The entire shoreline was sampled, and walleyes < 12 inches were collected. The CPUE age-0 and age-1 walleye was compared to previous fall evaluations.

## POPULATION DEMOGRAPHICS

Population estimates and CPUEs were compared to previous surveys and lake class standards when possible.

Walleye and largemouth bass were aged with dorsal spines, and bluegill were aged with scales. Dorsal spines were cut with a Dremel saw and aged with a dissecting microscope by a single interpreter. Scale samples were pressed on acetate slides and aged on a microfiche reader by a single interpreter. When data were available, mean length at age was compared to previous surveys, county (Barron and Polk counties) averages, northern region averages (18 counties in the DNR northern region) and the median length at age for similar complex-cool-dark lakes (Rypel 2019).

The von Bertalanffy (1938) growth model was determined using mean length at age data to assess growth using the following equation:

$$Lt = L_{inf}\ (1 - e^{-k(t-t_0)})$$

*Where $L_t$ is length at time t, $L_{inf}$ is the maximum theoretical length (length infinity), e is the exponent for natural logarithms, k is the growth coefficient, t is age in years, and $t_0$ is the age when $L_t$ is zero.*

Growth equations for largemouth bass and walleye were completed by pooling sexes, despite sex-specific growth differences.

Size structure was assessed using proportional size distribution (PSD) and relative frequency and compared to previous surveys (Neumann et al. 2013). Kolmogorov-Smirnov (KS) tests were used to statistically compare size structures between survey years. The PSD 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. Relative weight ($W_r$) was used to describe fish condition (Wege and Anderson 1978). $W_r$ is the ratio of a fish's weight at capture to the weight of a "standard" fish of the same length determined by a standard weight equation. The mean $W_r$ was determined.

The instantaneous mortality (Z) and annual mortality ($A = 1-e^{-Z}$) rates of largemouth bass were determined using a catch curve regression fitted to those ages fully recruited to the gear (Miranda and Bettoli 2007).

### RECREATIONAL CREEL AND TRIBAL HARVEST

Open water and ice fishing creel surveys were completed on Granite Lake to assess the pressure and harvest from recreational anglers. The creel survey began the first Saturday in May and went through the first Saturday in March the following year. However, no creel data were collected during November because of unsafe ice conditions. 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. Directed angling effort for each species was compared to other lakes creel surveys in Barron and Polk counties using 19 creel surveys from 2003 – 2021 and only included the most recent creel survey for each lake. 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.

# Results

### EARLY SPRING FYKE NETTING AND ELECTROFISHING

#### WALLEYE

There were six fyke nets fished for two nights, which totaled 12 net nights. The adult walleye population during 2019 was estimated to be 1,236 fish (95% CI = 1,004 – 1,469 fish) or 8.0 fish/acre (95% CI = 6.5 – 9.5 fish/acre; CV = 0.10). Adult walleye density has

increased since 1994 and 2005 (Figure 1). Walleye CPUE was 37.4 fish/net night, which increased nearly three-fold since 2005 (14.0 fish/net night) and was above the 95$^{th}$ percentile (29.2 fish/net night) for similar complex-cool-dark Wisconsin lakes. There were 590 walleyes collected during the SN1 and SE1 surveys (Figure 2).

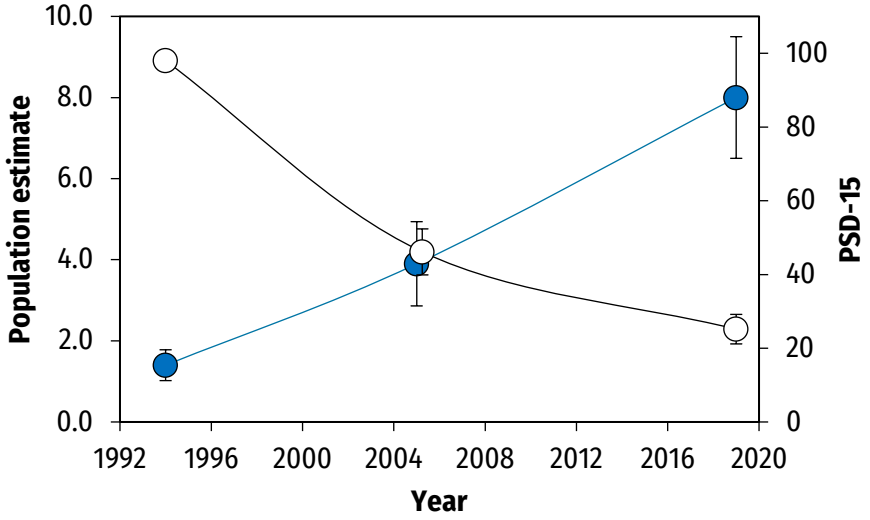


*Figure 1. Walleye population estimates (number of fish per acre ± 95% CI; blue circles) and PSD-15 (± 95% CI; hollow circles) during the 1994, 2005 and 2019 Granite Lake fishery surveys.*

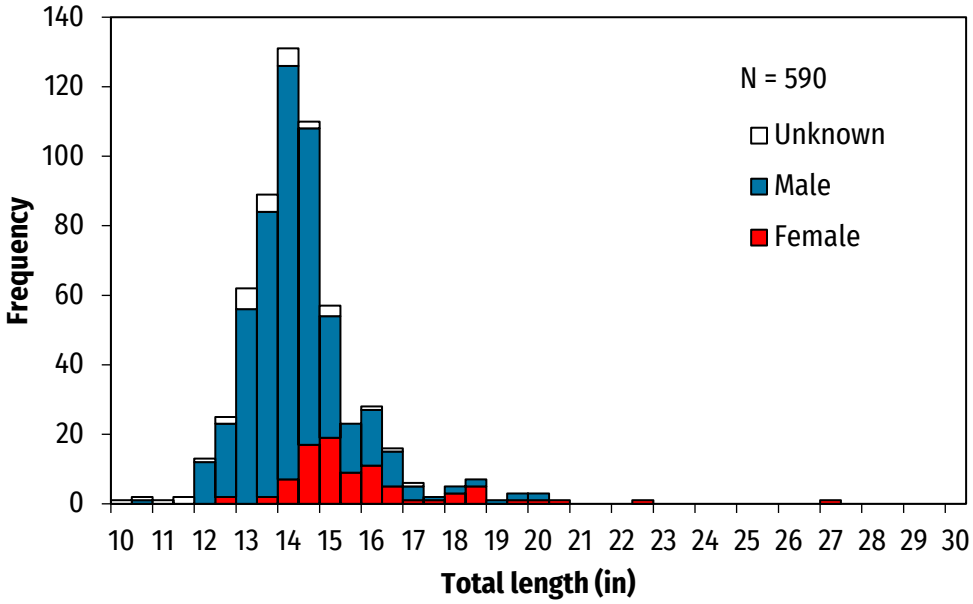


*Figure 2. Length frequency histogram of walleye collected during the SN1 and SE1 surveys in Granite Lake, Barron County, WI, 2019.*

There were 224 walleyes collected during the SE1 survey (recapture period) with a CPUE of 65.9 fish/mile.

Walleyes ranged in length from 10.2 – 27.2 inches, and the mean lengths of females and males were 15.9 inches and 14.3 inches, respectively (SN1 and SE1 surveys; Figure 2). Walleye PSD-15 was 25 and PSD-20 was < 1. The PSD indices were low and indicated below-average size structure (PSD-15 = 30 - 60; Anderson and Weithman 1978). Size structure indices declined since 1994 (PSD-15 = 98) and 2005 (PSD-15 was 46 and PSD-20 was 5). Population relative length frequencies were not considered statistically different between 2005 and 2019 (KS test: D = 0.11, P = 0.32; Figure 3), although fewer walleye > 15 inches were collected during 2019 (25%) compared to 2005 (46%). The sex ratio was male-biased with a male-to-female ratio of approximately 5:1.

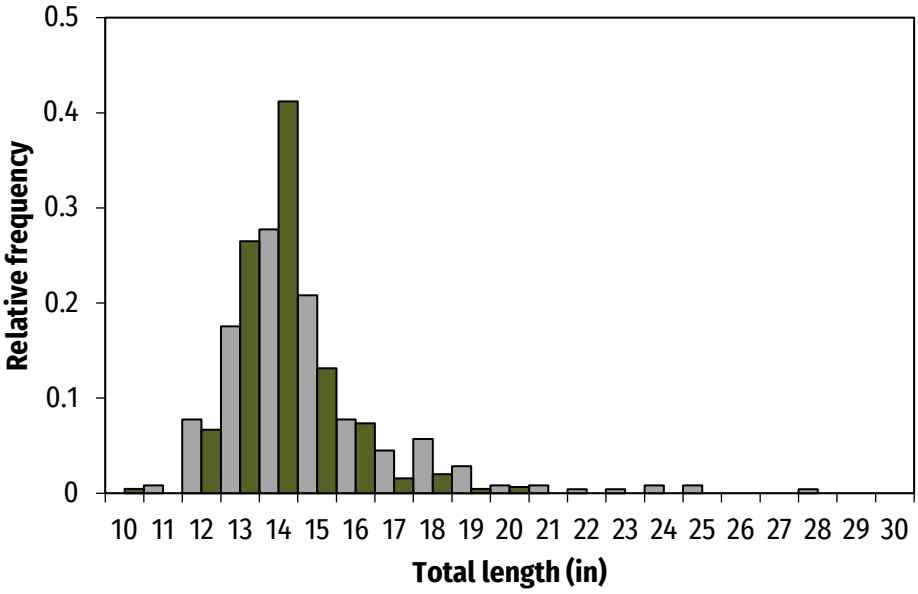


*Figure 3. Walleye relative length frequency histogram during the 2005 (grey bars) and 2019 (green bars) SN1 surveys in Granite Lake, Barron County, WI.*

Walleye growth rates were average. Walleye ages ranged from 2 to 11, while females ranged from 3 to 6 and males from 2 to 11. However, only walleye collected during the SN1 survey were used for aging. Many of the largest walleye were collected in the SE1 survey and not aged. Mean lengths at age during 2019 were similar to the 2005 survey (average difference in mean length at age: +0.7 inches), complex-cool-dark Wisconsin lakes (average difference in length at age: +0.4 inches) and the northern region estimates (average difference in mean length at age: +0.2 inches; Figure 4). Mean lengths at age were lower than the Barron/Polk counties average (average difference in mean length at age: -1.4 inches). All comparisons used ages 3 - 7 fish. The predicted theoretical maximum length for walleye using von Bertalanffy growth models was 19.7 inches, with k and $t_0$ estimated to be 0.39 and 0.18, respectively (Figure 4). Despite

this, larger fish were observed during the 2019 SE1 survey (the largest walleye was 27.2 inches).

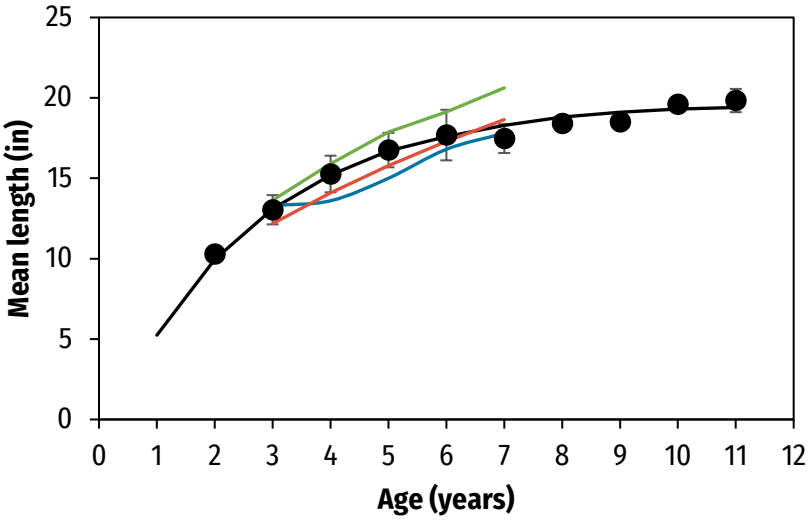


*Figure 4. Mean length at age ± standard deviation of walleye (black circles) in Granite Lake and the von Bertalanffy growth curve (black line). Mean length at age estimates during the 2005 survey are represented by the blue line, Barron/Polk counties by the green line and the median length at age for similar complex-cool-dark Wisconsin lakes by the red line. Northern region estimates were similar to the Lake Class estimates and not represented in the plot.*

Multiple age classes of walleye were present. Walleye age structure was composed primarily of age 3 – 5 fish (83.2%), but age classes up to age 11 were present (Figure 5). Recruitment of naturally reproduced walleye appeared good, evidenced by consistent annual contributions to adult age classes. Overall, the Granite Lake walleye population had high adult density with average size structure, growth and multiple year classes present, which should yield consistent angling action and harvest opportunities.

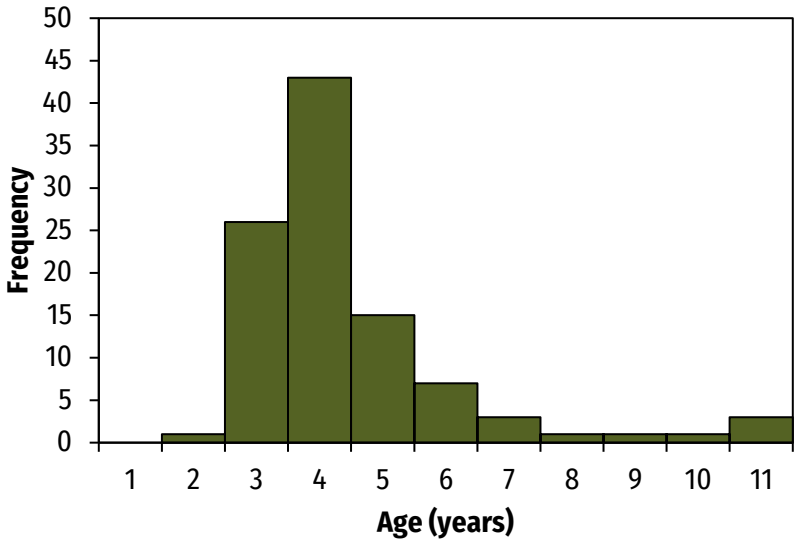


*Figure 5. Age structure of Granite Lake walleye during the SN1 survey.*

## LATE SPRING ELECTROFISHING

### LARGEMOUTH BASS

There were 25 largemouth bass collected during the SE2 survey with a CPUE of 7.1 fish/mile, which was similar to 2005 (5.1 fish/mile). The CPUE was near the 50$^{th}$ percentile (5.4 fish/mile) for similar complex-cool-dark Wisconsin lakes and indicative of a moderate-density population. The CPUE of largemouth bass ≥ 14 inches was 4.6 fish/mile, which increased slightly since 2005 (1.5 fish/mile).

Largemouth bass ranged in length from 12.6-19.2 inches, and the mean length was 14.8 inches, which was above the 99$^{th}$ percentile (14.3 inches) for similar complex-cool-dark Wisconsin lakes. The PSD-12 was 100 and PSD-14 was 64, which indicated excellent size structure (Figure 6), and both indices have improved since the 2005 fishery survey (PSD-12 = 86 and PSD-14 = 30). The proportion of the population susceptible to harvest by the recreational fishery (≥ 14 inches) was 62%.

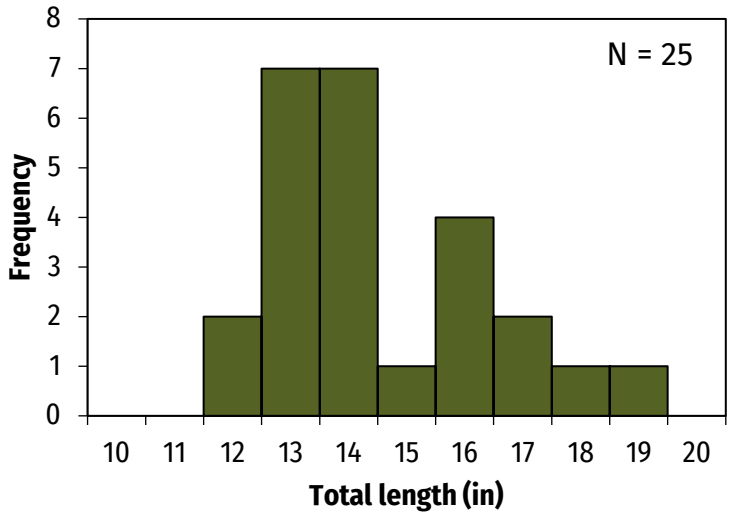


*Figure 6. Length frequency of largemouth bass in Granite Lake during the 2019 SE2 survey.*

Largemouth bass had above-average growth rates. Mean length at age has increased since 2005 (average difference in mean length at age estimates: +2.0 inches) and was greater than the median length at age standard for similar complex-cool-dark Wisconsin lakes (average difference in length at age estimates: +2.8 inches) and the northern region estimates (average difference in mean length at age estimates: +2.5 inches; Figure 7). All comparisons used ages 3 - 7 fish. The von Bertalanffy growth model was not included due to too few age classes present. The mean $W_r$ of largemouth bass was 98, which indicated fish were in average overall condition (Bennett 1970).

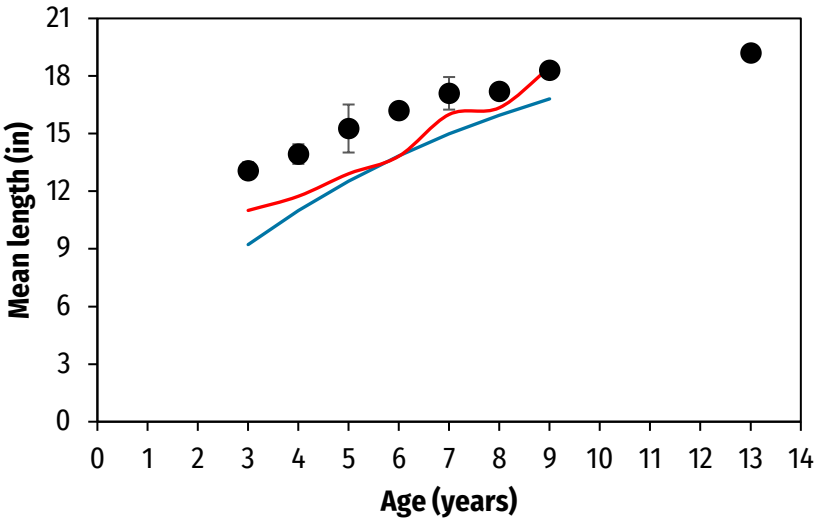


*Figure 7. Largemouth bass mean length at age ± standard deviation during the 2019 SE2 survey on Granite Lake. Blue line represents the median length at age estimates for complex-cool-dark Wisconsin lakes, and the red line represents the 2005 survey mean length at age estimates. Mean length at age estimates for the northern region were similar to the Lake Class estimates and not represented in the plot.*

Total annual mortality estimated from a catch curve regression model was 17.7% (ages 3 – 9; $R^2$ = 0.86; Figure 8).

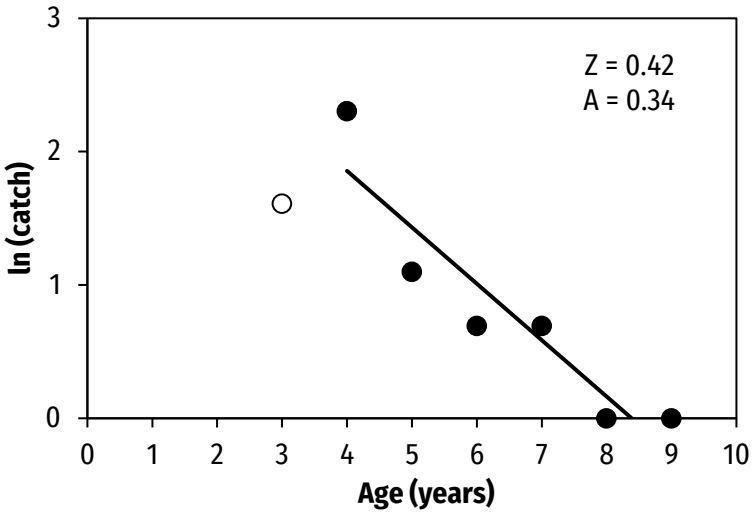


*Figure 8. Catch curve analysis plot representing the natural logarithm of the catch for each largemouth bass age class used in the analysis (black circles) and not (white circles). Z = instantaneous total mortality, A = annual total mortality rate.*

**BLUEGILL**

A low-density bluegill population with good size structure was present in Granite Lake. A total of 61 bluegills were collected during the SE2 survey. Bluegill CPUE was 17.4 fish/mile, which was below the 25th percentile (42.1 fish/mile) for similar complex-cool-dark Wisconsin lakes and less than the mean bluegill CPUE for lakes in Barron and Polk counties (54.0 ± 4.7 fish/mile; ± SE). The CPUE of quality size (≥ 6 inches) and preferred size (≥ 8 inches) fish was 16.3 fish/mile and 2.9 fish/mile, respectively (Gabelhouse 1984).

Bluegill lengths ranged from 5.3 – 8.9 inches, with an average length of 7.2 inches (Figure 9). The mean length of bluegill was above the 99th percentile (6.5 in) for similar complex-cool-dark Wisconsin lakes. The PSD-6 was 93, and the PSD-8 was 16. The PSD-6 index value was well above the generally accepted range for a balanced bluegill populations (PSD-6 = 20-60), and PSD-8 was within recommendations (PSD-8 = 5 - 20) by Anderson (1985). The PSD-6 was well above the mean PSD-6 for lakes in Barron and Polk counties (PSD-6 = 47 ± 3; SE). This is suggestive of a quality overall size structure (Figure 9).

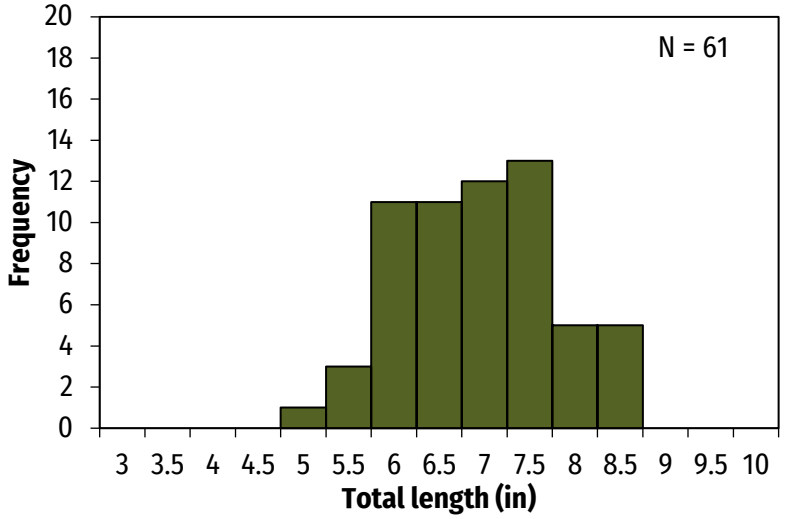


*Figure 9. Length frequency of bluegill captured from Granite Lake during the 2019 SE2 survey.*

Bluegill in Granite Lake had average growth rates. Mean length at age was similar to the Barron and Polk counties estimates (average difference in mean length at age estimates: +0.2 inches; ages 4 - 7), the northern region estimates (average difference in mean length at age estimates: +0.1 inches; ages 4 - 7) and median length at age standards for similar complex-cool-dark Wisconsin lakes (average difference in length at age estimates: +0.1 inches; ages 4 – 8; Figure 10). Mean length at age estimates were slightly lower than in 2005 (average difference in mean length at age

estimates: -0.8 inches; ages 4 - 7). The von Bertalanffy growth model could not be fit to the observed age-length data.

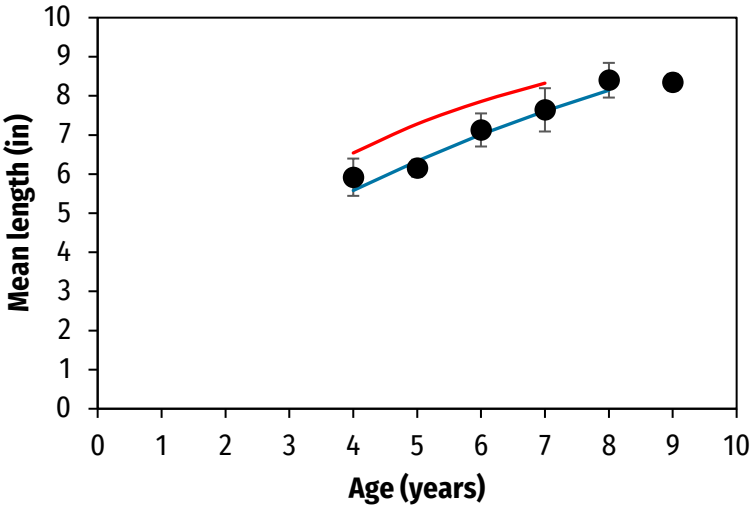


*Figure 10. Bluegill mean length at age ± standard deviation during the 2019 SE2 survey on Granite Lake. Blue line represents the median length at age estimates for complex-cool-dark Wisconsin lakes, and the red line represents the 2005 survey mean length at age estimates. Mean length at age estimates for Barron and Polk counties, and the northern region were similar to the Lake Class estimates and not represented in the plot.*

### BLACK CRAPPIE

Granite Lake supports a moderately abundant black crappie population with a good size structure. A total of 22 black crappies were collected during the 2019 SE2 survey with a CPUE of 6.3 fish/mile, which was below the mean black crappie CPUE for lakes in Barron and Polk counties (9.6 ± 1.9 fish/mile; ± SE). The CPUE of quality size fish (≥ 8 inches) was 6.0 fish/mile and above average for lakes in Barron and Polk counties (5.8 ± 1.3 fish/mile; ± SE; Gabelhouse 1984).

Lengths of black crappie ranged from 7.2 – 10.9 inches with an average length of 9.3 inches. The mean length of black crappie was near the 99$^{th}$ percentile (9.5 inches) for similar complex-cool-dark Wisconsin lakes. The PSD-8 was 96 and PSD-10 was 27. The PSD-8 index value was well above the mean PSD-8 for lakes in Barron and Polk counties (PSD-8 = 65 ± 4; SE). These PSD values indicate a good overall size structure of black crappie in Granite Lake and should provide quality angling opportunities.

## FALL ELECTROFISHING

### AGE-0 AND AGE-1 WALLEYE

Walleye recruitment during 2019 was low compared to previous fall surveys (Figure 11). Twenty age-0 walleye were collected during the 2019 fall electrofishing survey with a CPUE of 5.9 fish/mile, and 11 age-1 walleye were collected with a CPUE of 3.2

fish/mile. Age-0 walleye ranged in length from 5.2 – 7.3 inches and age-1 walleye from 8.0 – 10.6 inches. The catch of age-0 walleye was also lower in 2021 but returned to a higher level during 2022 and was greater than average for other naturally reproducing walleye lakes in Barron County (11.3 ± 7.7 fish/mile; mean ± mean error; indexed using 18 fall surveys from Red Cedar Lake, Duck Lake and Silver Lake during 2009 – 2022; Figure 11). Catch rates of age-1 walleye have been relatively constant over the past decade, indicating good survival of age-0 fish. The walleye fishery in Granite Lake should continue to be supported by natural recruitment (NR).

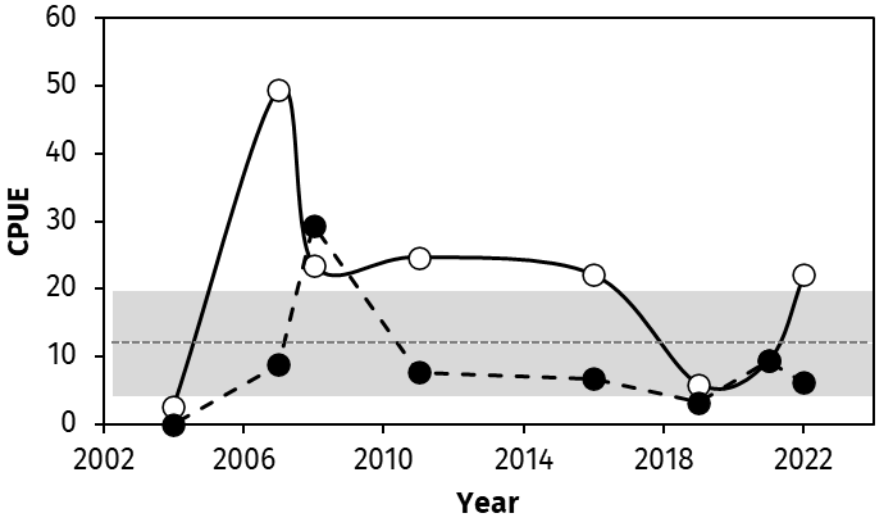


*Figure 11. Age-0 (white circles, solid line) and age-1 (black circles, dashed line) walleye CPUE (fish/mile) indexed from fall electrofishing surveys during 2004 - 2022. The Barron County average age-0 walleye CPUE from naturally reproducing lakes* (indexed using 18 fall surveys from Red Cedar Lake, Duck Lake and Silver Lake during 2009 – 2022) *is represented by the grey dashed line and shaded areas represent mean error.*

## RECREATIONAL CREEL AND TRIBAL SPEARING

Projected angling effort amounted to 3,759 hours (24.4 hours/acre) on Granite Lake where 2,931 hours (19.0 hours/acre) occurred during open water and 827 hours (5.4 hours/acre) occurred during the ice fishing seasons. Angling effort during 2019 on Granite Lake was lower than the mean projected angling pressure (42.5 ± 18.5 hours/acre; ± SD) for lakes in Barron and Polk counties (indexed using 16 creel surveys during 2004 – 2021, including the most recent creel survey for each lake). Angling effort was highest during May (5.5 hours/acre), June (5.5 hours/acre) and July (3.7 hours/acre) and lowest during October (< 0.1 hours/acre) and December (0.7 hour/acre). Angling effort during the open water season decreased from spring to fall. Angling effort during the ice fishing season was consistently low (< 2 hours/acre per month) but was greatest during February (1.7 hours/acre). Directed fishing effort

was greatest for walleye (12.5 hours/acre), black crappie (6.0 hours/acre), largemouth bass (5.7 hours/acre) and bluegill (4.4 hours/acre).

**WALLEYE**

Walleye were the most targeted species by anglers, with 1,919 hours of directed effort, and composed 40.6% of the recreational fishery. Fishing effort for walleye (12.5 hours/acre) was above average for lakes in Barron and Polk counties (7.0 hours/acre). There were 1,462 walleyes estimated to be caught (specific catch rate of 0.73 fish/hour), and 248 were estimated to be harvested (17% harvest rate; specific harvest rate of 0.13 fish/hour; Figure 12). Directed fishing effort was greatest during the spring (May and June) and declined throughout the summer. Specific effort targeting walleye was greatest during May (667 hours) and June (384 hours), followed by July (268 hours) and February (260 hours). Both catch and harvest rates were greatest during May – June and subsequently declined through February (Figure 12). Specific catch rates (fish/hour) were greatest during September (1.7 fish/hour), June (1.2 fish/hour) and August (1.0 fish/hour).

Adult walleye harvested from the recreational fishery was moderately high compared to other Barron and Polk counties lakes, with an angling exploitation rate of 16.8%. No tribal exploitation of walleye occurred during 2019 by off-reservation tribal spearers. The total adult walleye exploitation rate during 2019 was 16.8%.

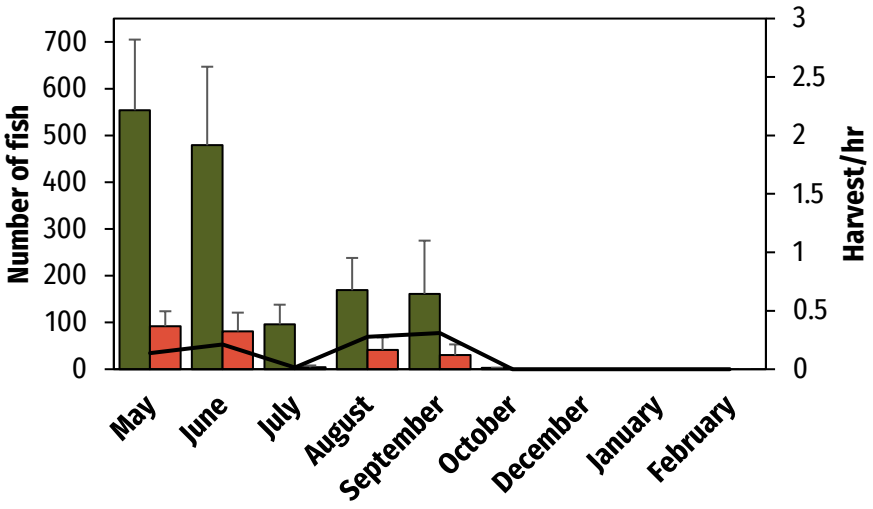


*Figure 12. Estimated number of walleyes caught (green bars ± standard deviation) and harvested (red bars ± standard deviation) by anglers during May - February. The specific rate of harvest (fish/hour) is represented by the solid line.*

**LARGEMOUTH AND SMALLMOUTH BASS**

Directed fishing effort for largemouth bass accounted for 873 hours and was the third most targeted species by anglers and composed 18.5% of the recreational fishery. Fishing effort for largemouth bass (5.7 hours/acre) was lower than average for lakes in Barron and Polk counties (12.3 hours/acre). There were 1,579 largemouth bass estimated to be caught (specific catch rate of 1.6 fish/hour), and 19 were estimated to be harvested (1.2% harvest rate). The mean length of harvested fish was 16.8 inches and ranged from 15.7 – 17.8 inches. Directed fishing effort was greatest during June – August (81.0% of effort), and catch rates were highest during August (2.2 fish/hour) and September (5.1 fish/hour).

**NORTHERN PIKE**

Directed fishing effort for northern pike accounted for 169 hours and composed a small part of the recreational fishery (3.6% of total angling effort). Fishing effort for northern pike (1.1 hours/acre) was lower than average for lakes in Barron and Polk counties (7.4 hours/acre). There were 491 northern pike estimated to be caught (specific catch rate of 0.53 fish/hour), and 11 were estimated to be harvested (2.2% harvest rate). Targeted effort was greater during winter (81 hours; February) than summer (55 hours; May – August). Despite this, catch rates and total harvest were greater during the open water season. The mean length of harvested fish was 26.8 inches and ranged from 24.2 – 30.1 inches.

**BLUEGILL**

Bluegill was the fourth most targeted species, with 683 hours of directed effort, and composed 14.5% of the recreational fishery. Fishing effort for bluegills (4.4 hours/acre) was well below average for lakes in Barron and Polk counties (22.3 hours/acre). There were 1,172 bluegills estimated to be caught (specific catch rate of 1.71 fish/hour), and 429 were estimated to be harvested (37.0% harvest rate; specific harvest rate of 0.06 fish/hour; Figure 13). Directed angler effort was higher during the ice fishing season (395 hours) compared to the open water season (288 hours). Open water fishing effort was relatively equally distributed during May – August, with the greatest targeted effort during May (93 hours) and August (95 hours). Ice fishing effort was concentrated during January - February (94.0%). Estimated angler catch and harvest was greater during the open water season, with relatively high catches observed during May - August. Specific harvest rates were similarly high during the open water season compared to the ice fishing season. (Figure 13). The mean length of harvested bluegill was 8.0 inches and ranged from 6.0 – 9.4 inches. Fish ≥ 7 inches composed 89.7%, and fish ≥ 8 inches composed 51.3% of harvested fish. Fish ≥ 9 inches composed 15.4% of the harvested fish.

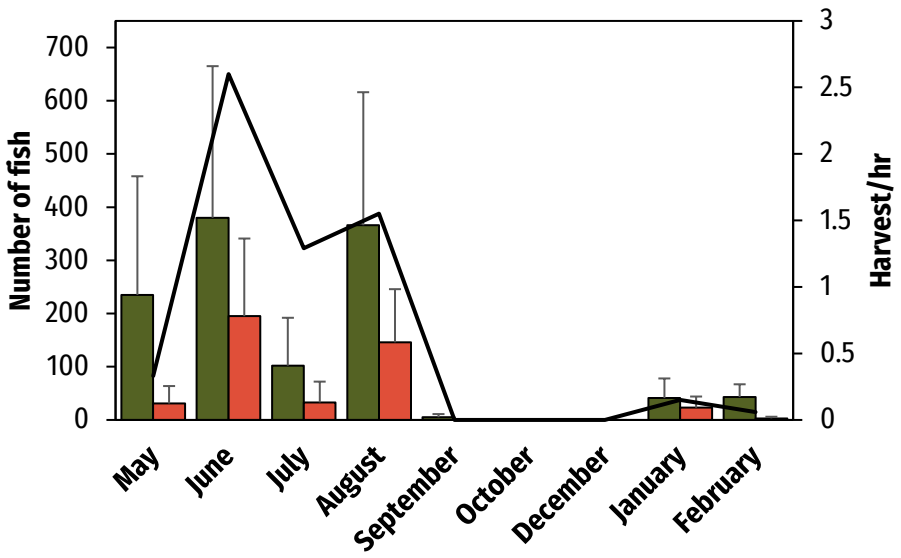


*Figure 13. Estimated number of bluegill caught (green bars ± standard deviation) and harvested (red bars ± standard deviation) by anglers during May - March. The specific rate of harvest (fish/hour) is represented by the solid line.*

**BLACK CRAPPIE**

Black crappie was the second most targeted species, with 920 hours of directed effort, and composed 19.5% of the recreational fishery. Fishing effort for black crappies (6.0 hours/acre) was below average for lakes in Barron and Polk counties (16.0 hours/acre). There were 1,067 black crappies estimated to be caught (specific catch rate of 1.16 fish/hour), and 424 were estimated to be harvested (39.7% harvest rate; specific harvest rate of 0.46 fish/hour; Figure 14). Angler effort was greater during the open water season (547 hours) compared to the ice fishing season (372 hours). Open water fishing effort was greatest during May (221 hours). The highest catch and harvest rates during the open water season occurred during June and September (Figure 14). Ice fishing effort was concentrated during January – February (94.0%). Estimated angler catch and harvest rates were highest during December. The mean length of harvested black crappie was 9.8 inches and ranged from 8.6 – 11.5 inches. Fish ≥ 9 inches composed 83.3%, and fish ≥ 10 inches composed 45.2% of harvested fish. Fish ≥ 11 inches composed 7.0% of harvested fish.

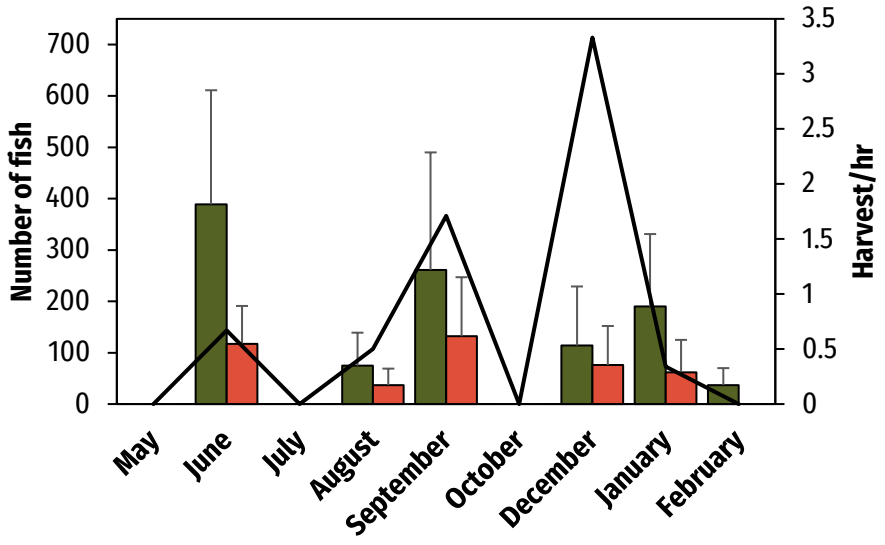


*Figure 14. Estimated number of black crappies caught (green bars ± standard deviation) and harvested (red bars ± standard deviation) by anglers during May - March. The specific rate of harvest (fish/hour) is represented by the solid line.*

# Discussion

Granite Lake is a quintessential northern Wisconsin lake with natural shorelines, stained waters and an excellent naturally reproducing walleye fishery. A quality adult walleye population is present in Granite Lake, representing one of the few remaining naturally reproducing populations in Barron and Polk counties. The fishery is healthy with desirable sportfish populations, but angling effort was low compared to other popular fishing lakes in the area. Targeted effort for walleye, however, was above average for walleye fisheries in Barron and Polk counties. Walleyes are the main focus of the recreational fishery with relatively high exploitation rates. Lower density populations of largemouth bass, black crappie and bluegill with high size structures offer quality fisheries as well.

Walleye are not native to Granite Lake but are likely descendants of hatchery fish stocked into Beaver Dam Lake (stocked as early as 1933; the first walleye stocking in Granite Lake occurred during 1984) following the hydrological connection during the early 1950's. Despite this, the habitat in Granite Lake proved suitable for walleye, leading to temporal increases in population size driven by consistent natural reproduction. The walleye population in Granite Lake has increased since stocking was discontinued in 2008, and the current population is largely from NR, as only the oldest age class (age 11) observed in this survey could have been from stocking.

Granite Lake had the second-highest adult walleye density estimated in the Ceded Territory during 2019 (Cichosz 2021) and was well above previous density estimates

during 1994 and 2005. An adult density of 8.0 fish/acre well exceeded management recommendations for naturally reproducing walleye populations (> 3.0 fish/acre; Donofrio et al. 2022). The adult population was composed of eight year classes, which was above management recommendations set forth by the 2022 Wisconsin Walleye Management Plan (Donofrio et al. 2022). The breadth of adult year classes was good and likely beneficial for reproductive success and, ultimately, population resiliency. Overall, the Granite Lake walleye population was in a desirable state in 2019. Abundance of walleye in Granite Lake increased greatly during a time when many NR walleye lakes have decreased in abundance.

Adult walleye growth was average and similar to estimates during 2005, northern region estimates and lake class standards, but lower than the Barron/Polk counties estimates. Walleye fisheries in Barron and Polk counties are primarily stocking-dependent systems. Comparisons between naturally recruiting and stocking-dependent systems are generally not appropriate as stocking-dependent systems typically have lower adult densities with faster growth rates (Cichosz 2021). Size structures of walleye populations tend to respond similarly, where higher density populations such as Granite Lake typically exhibit slower growth rates and lower size structures. The current walleye fishery resembles that of historic populations and a typical naturally reproducing walleye fishery characterized by moderate-high abundance, low size structure, male-biased sex ratio and slow growth rates.

A high-density adult population composed of multiple spawning stock year classes is likely reflective of consistent annual NR. NR has been good since 2005, evidenced by strong year classes (> 20 age-0 fish/mile) well above average for other naturally reproducing walleye lakes in Barron County (11.3 ± 7.7 age-0 fish/mile). Additionally, survival of walleye to age-1 appears good, evidenced by the consistency of fall catch rates through time. Low recruitment year classes were observed during 2003 and 2019. Numerous factors can influence NR, but generally, spring water temperatures, spawning stock abundance and predator population abundances have been shown to regulate age-0 walleye abundance (Hansen et al. 1998). High-quality spawning habitat is likely the most important contributor to the reproductive success of the population, which is readily available nearshore along both eastern and western shorelines and composed primarily of loosely embedded gravel and mixed sandy stretches. Naturally stained waters of Granite Lake also likely benefit foraging success and juvenile walleye survival and is a relatively unique environmental feature of this lake compared to other NR walleye lakes in Barron and Polk counties. Efforts to preserve existing natural shorelines and walleye spawning habitat are encouraged.

The walleye fishery during 2019 likely provided consistent angling action and harvest opportunities. The quality of the fishery was evident by high angler effort and harvest. The exploitation rate of 16.8% was high compared to other popular Ceded

Territory walleye fisheries. For reference, the mean angler exploitation rate of walleye during 2019-2020 (on 15 Ceded Territory lakes including Granite Lake) was 8.8% and during 1995-2018 was 8.4% (Cichosz 2021). Total exploitation of walleye during 2019 was well below concerning levels (≥ 35%) and represented only that of angler harvest, as no tribal walleye exploitation occurred during 2019. However, the tribal harvest of walleye increased during 2020 to 13.6% (168 fish) and in 2021 to 5.7% (70 fish). Angler exploitation during 2020 and 2021 is unknown, but it is probable that total walleye exploitation rates were higher during 2020 and 2021 compared to 2019.

The walleye management goal in Granite Lake is to maintain an abundant, resilient and naturally reproducing adult population and provide quality angling opportunities. Objectives are to maintain adult densities above three fish/acre, which will be assessed on a 9-year rotation. Secondarily, observe age-0 catch rates above 20 fish/mile, which will be assessed at least every other year. Despite a high density, the current walleye harvest regulation (15-inch minimum length limit (MLL), fish between 20-24 inches may not be kept, three fish daily bag limit with only one fish > 24 inches allowed) will be maintained as this regulation is conservative in managing harvest, promotes greater population size structure and reproductive potential by protecting larger fish, but also allows some harvest opportunity. More liberal harvest regulations were not considered due to high angler catch and harvest rates and the potential to overharvest. If management objectives are not met, alternate management actions may be considered.

Biological information for northern pike was not collected during the 2019 survey, but a recreational fishery was present, suggesting the population was presumably in good condition. Northern pike were primarily targeted during the ice fishing season, and fish upwards of 30 inches were observed.

Granite Lake supports a low-density largemouth bass population with excellent size structure, well above the generally accepted range of values for a balanced largemouth bass population (Gabelhouse 1984). Population abundance and size structure remained similar to 2005. Growth and body condition were both above average, indicating a robust, healthy population with fast growth rates was present. Fishing effort targeting largemouth bass was lower than average for lakes in Barron and Polk counties but contributed to the overall Granite Lake fishery. The largemouth bass fishery occurred primarily during June – August and, unsurprisingly, harvest rates were low, which is typical of bass fisheries. The largemouth bass population remains healthy, supports a recreational fishery and no management actions are recommended at this time. Population relative abundance, size structure, condition and growth should be evaluated again during the next survey. Otoliths should be collected during the next survey to improve growth and mortality estimates.

The current harvest regulation (14-inch MLL, five fish daily bag limit) will be maintained as population abundance and size structure remained unchanged from 2005, and 64% of the population was susceptible to harvest. With the habitat and current fish community in Granite Lake, largemouth bass will likely continue to have a low-density and high size structure population.

Granite Lake supports good panfish populations with quality size structure, offering anglers quality harvest opportunities. Panfish composed 34% of the Granite Lake recreational fishery during 2019 but directed effort targeting black crappie and bluegill were both below average compared to other fisheries in Barron and Polk counties. Low-density panfish populations corresponded with low fishing effort, but fish caught and harvested were of quality size and representative of quality population size structures. Panfish populations have historically been at low densities with excellent size structure and resemble that of the current fishery. Although, electrofishing surveys are typically not the best approach to index black crappie population metrics. Black crappies were important contributors to the recreational fishery, with a relatively even distribution of angling effort throughout the year, whereas angling effort targeting bluegill was concentrated during the open water season, primarily during June and August. Alternative methods to better index the black crappie population may be considered in the future.

These panfish populations are also likely important contributors to the fish community as a primary forage base for predatory fishes. Future fishery surveys should continue to monitor population abundance and size structure of black crappie and bluegill due to their importance to the overall fish community. This was the first creel survey conducted on Granite Lake, and future management should closely monitor directed fishing effort, catch rates and harvest rates for each panfish species. The current panfish regulation (25 fish daily bag limit in aggregate) should continue to promote both quality recreational fisheries and sustainable population dynamics. No specific management actions for black crappie and bluegill are recommended at this time.

# Management Recommendations

1. Maintain walleye density at > three fish/acre and fall catch rates > 20 age-0 walleye/mile. Fall assessments of NR will be conducted at least every other year.
2. Largemouth bass will continue to be managed with a 14-inch MLL and daily bag limit of five fish. Otoliths should be collected during the next survey to improve estimates of age, growth and mortality.
3. No specific management actions regarding northern pike, bluegill and black crappie are recommended at this time. Otoliths should be collected from

bluegills and black crappies during the next survey to improve age and growth estimation.

4. The next comprehensive fisheries survey is scheduled for 2029. The stock abundance, size structure, age structure, exploitation and NR of walleye should be closely monitored as Granite Lake is one of the few remaining self-sustaining populations in Barron and Polk counties.
5. Efforts to protect and maintain natural shorelines and nearshore walleye spawning habitat are encouraged where applicable. Inputs of coarse woody habitat are also encouraged, but locations should be carefully considered as to not fragment walleye spawning habitat. The maintenance/restoration of vegetative buffers would be beneficial. This website healthylakeswi.com is a great resource to learn about this recommendation.
6. Invasive species monitoring and control programs should continue.

# Acknowledgements

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# Appendices

*Appendix table 1. Walleye stocking records for Granite Lake, 1992 – 2008.*

| YEAR | SPECIES | AGE CLASS | NUMBER STOCKED | AVG. LENGTH (IN.) |
|---|---|---|---|---|
| 1992 | Walleye | Small Fingerling | 7,700 | 2.0 |
| 1994 | Walleye | Small Fingerling | 7,700 | 1.9 |
| 1996 | Walleye | Small Fingerling | 7,700 | 2.4 |
| 1997 | Walleye | Small Fingerling | 1,540 | 3.8 |
| 1998 | Walleye | Small Fingerling | 1,908 | 2.3 |
| 2000 | Walleye | Small Fingerling | 7,448 | 2.4 |
| 2002 | Walleye | Small Fingerling | 7,700 | 1.6 |
| 2004 | Walleye | Small Fingerling | 7,700 | 1.2 |
| 2006 | Walleye | Small Fingerling | 5,432 | 1.7 |
| 2007 | Walleye | Fry | 300,000 | 0.3 |
| 2008 | Walleye | Small Fingerling | 5,499 | 1.5 |

*Appendix Table 2. Survey types, gear used, target water temperature and target species.*

| SURVEY TYPE | GEAR USED | TARGET WATER TEMPERATURE (°F) | TARGET SPECIES |
|---|---|---|---|
| Spring Netting 1 (SN1) | Fyke Net | ~45 | Walleye, northern pike |
| Spring Electrofishing 1 (SE1) | Boat Electrofishing | 45-50 | Walleye |
| Spring Netting 2 (SN2) | Fyke Net | 50-55 | Muskellunge, black crappie, yellow perch |
| Spring Electrofishing 2 (SE2) | Boat Electrofishing | 55-70 | Largemouth bass, smallmouth bass, bluegill and other panfish, non-game species |
| Spring Netting 3 (SN3) | Fyke Net | 65-80 | Bluegill, black crappie |
| Fall Electrofishing (FE) | Boat Electrofishing | 50-60 | Juvenile walleye and muskellunge |