WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Fishery Survey Report For Ward Lake, Polk County, Wisconsin 2021

WATERBODY IDENTIFICATION CODE: 2599400

Photo by Craig Landes (DNR). Aaron Cole with a 29.7-inch walleye from Ward Lake during the spring 2021 netting survey.

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Introduction

Ward Lake is a 91-acre seepage lake located in northern Polk County, Wisconsin. The lake has a maximum depth of 43 feet and a mean depth of 16 feet. Ward Lake is best characterized by steep sloping shorelines, a small littoral zone, and bottom substrates roughly composed of 30% sand, 10% gravel and 60% muck. Littoral substrates are primarily sand and gravel.

The Wisconsin Department of Natural Resources (DNR) surveyed Ward Lake to assess the status of the fishery during 2021, and this survey represented the first DNR comprehensive survey conducted on Ward Lake. Previous surveys consisted of fall electrofishing surveys. Mark-recapture surveys were completed to estimate adult densities of walleye and largemouth bass. We assessed catch rates of northern pike, bluegill and other panfish species to estimate relative abundance. We characterized population characteristics, size structure and growth for all species when possible. Recent management efforts have focused on walleye stocking, limiting harvest of adult walleye and liberalizing harvest of small largemouth bass through regulation changes, public outreach and maintaining littoral zone habitat and water quality.

LAKE CHARACTERISTICS

Ward Lake is a fertile, eutrophic system classified as a complex-cool-dark lake (Rypel et al. 2019). The July-August mean Trophic State Index (TSI) values for chlorophyll-a, Secchi depth and total phosphorus was 55, 54 and 53, respectively. Mean TSI has generally trended upward over the past decade. There is one public boat launch located near the southwest corner of the lake off 80th Street (45.603, -92.324). More information on water quality and invasive species can be found at the DNR's lake page for Ward Lake.

STOCKING HISTORY

Walleye were first stocked into Ward Lake during 1938 and were sporadically stocked through 1953, including fry and small fingerlings (Cornelius 1999). Walleye stocking was discontinued in 1953 because the population was maintained by natural reproduction (Benike 2006). The stocking of small fingerling walleye was reinitiated during 2000-2004 to improve recruitment to the adult fishery because the 1998 survey results indicated low population abundance and poor natural recruitment (Benike 2006; Cornelius 1999). Recent stockings of small fingerling and large fingerling walleye have occurred at variable rates since 2000 (Appendix Table 1). During 2000-2004, small fingerling walleye were stocked annually at a rate of approximately 75 fish/acre. Additionally, during 2002, three small artificial walleye spawning reefs were installed along the eastern wind-swept shoreline to improve walleye spawning habitat and natural recruitment (Benike 2006). The stocking of small fingerling walleye and the installation of artificial spawning reefs failed to produce any measurable year classes based on surveys in 2003 and 2005 (Benike 2006). As a result, since 2006, large fingerling walleye have been stocked every other year at a rate of 9-10 fish/acre with an average length of 7.0 inches (Appendix Table 1).

FISHING REGULATIONS

Largemouth bass and walleye are managed with special fishing regulations. The fishing regulation for largemouth bass is five fish daily bag limit with no minimum length limit. Similarly, the fishing regulation for walleye is three fish daily bag limit with an 18-inch minimum harvestable length limit. All other species follow statewide or Ceded Territory regulations.

Methods

Ward Lake was sampled during 2021, following the DNR's comprehensive treaty assessment protocol (Cichosz 2021), to estimate the adult walleye and largemouth bass population abundance. Descriptions of standard DNR survey type, gear used, target water temperatures and target species are listed in Appendix Table 2. The spring netting survey (SN1 survey) occurred April 3 – 8, 2021 and all walleye, largemouth bass and northern pike were measured, weighed, sexed and given a mark indicating capture. Catch-per-unit effort (CPUE) was estimated as catch per net night, and length-weight data were used to estimate size structure indices, growth and condition. Adult walleye ≥ 15 inches and all sexable walleye were marked with a fin clip, and juvenile walleye < 15 inches were marked with a different fin clip. A single recapture event occurred on the night of April 8, 2021, via boat electrofishing.

Four days of boat electrofishing during May and early June were conducted to mark largemouth bass for the population estimate. Adult largemouth bass ≥ 8 in were marked with a fin clip and juveniles < 8 inches were marked with a different fin clip. Late spring night electrofishing (SE2 survey) was conducted on June 1, 2021 and served as the recapture event for the largemouth bass population estimate. This survey was also used to assess the status of panfish populations. The SE2 survey consisted of 0.5-mile index stations where all gamefish and panfish were captured and 1.5-mile stations where only gamefish were collected. There were two index stations and one gamefish station completed on Ward Lake. Information collected from captured fish included total length, weight and aging structures were taken from a subsample of fish. The CPUE was estimated as catch per mile.

A fall night electrofishing survey was conducted on Sept. 28, 2021 to assess the relative abundance and survival of age-0 and age-1 walleye and CPUE of other gamefish.

Lake Class Standards CPUE were calculated by comparing Ward Lake catch rates to the CPUEs of the other 196 complex-cool-dark lakes in Wisconsin (Rypel et al. 2019). When data were available, CPUE and size structure indices were also compared to past surveys.

Walleye and largemouth bass were aged with dorsal spines and otoliths, respectively. Bluegills and black crappies were aged with scales. All spines were cut with a Dremel tool and aged under a microscope. Otoliths were transverse thin-sectioned and aged

under a microscope. Mean length-at-age was compared to median length-at-age estimates for similar complex-cool-dark lakes. Size structure was assessed using proportional size distribution (PSD) indices (Neumann et al. 2013). 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. Fish condition was assessed by estimating the relative weight (W_r) of each fish, or the actual weight of a fish divided by its standard weight (Wege and Anderson 1978). The von Bertalanffy growth model (von Bertalanffy 1938) was fitted using mean length-at-age data to assess the growth of largemouth bass.

To assess walleye stocking survival, an age-length key was used to estimate the abundances of walleye in each year class, assuming no natural reproduction and all fish were from stocked origin. Survival was estimated by dividing the population estimate for each age class by the total number of fish stocked for that year and multiplying it by 100. The cost of each stocking event was calculated by multiplying the number of large fingerlings stocked by the average cost per large fingerling ($1.06). The cost per recruit to age-3 and age-5 were estimated by dividing the cost of each stocking event by the estimated abundance of that year class.

Results and Discussion

WALLEYE

There were 176 walleye sampled during the walleye population estimate survey. The population estimate of adult walleye in 2021 was 203 fish (95% confidence interval; CI = 167 – 238 fish) or 2.2 fish/acre (CV = 0.09). The CPUE was 10.4 fish/net night, which was slightly above the 75th percentile (9.7 fish/net night) for complex-cool-dark Wisconsin lakes.

Walleye size structure was good and had the potential for trophy-sized fish. Walleyes collected during the SN1 survey ranged in length from 10.5 – 29.7 inches, and the mean length of females and males was 21.1 inches and 14.6 inches, respectively (Figure 1). Walleye PSD-15 from netting was 54, PSD-20 was 7 and PSD-25 was 2. These PSD index values indicate quality size structure and are within the generally accepted range (PSD = 30-60; Anderson and Weithman 1978) for a balanced walleye population. The male-to-female ratio was 7:1.

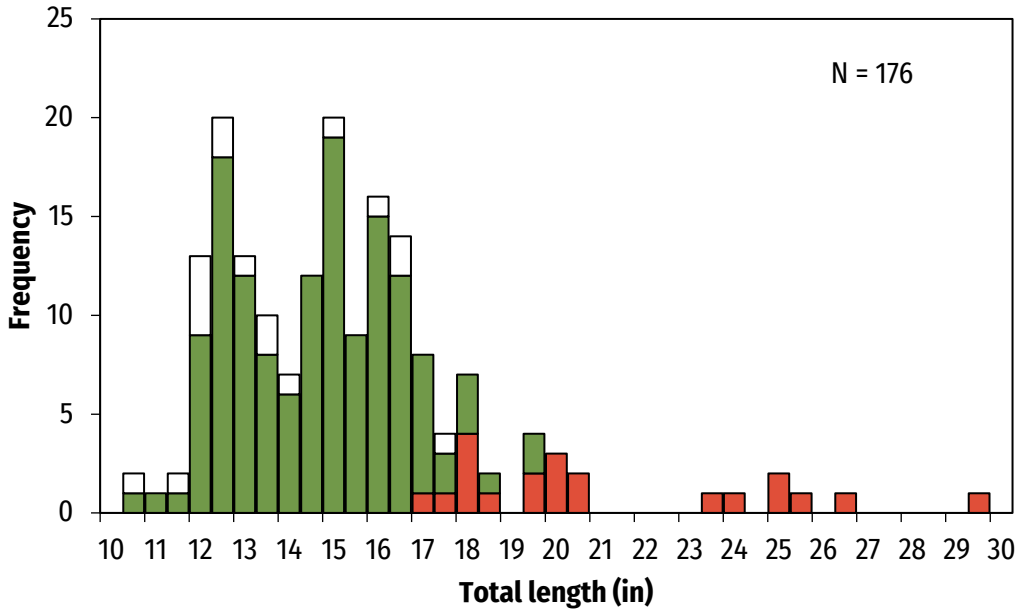

Figure 1. Length frequency of male (green bars), female (red bars) and unknown sex (hollow bars) walleyes captured in Ward Lake during the spring 2021 fishery surveys.

The W_r was 100, which indicated the condition was above average and within the suggested range of 95 – 105 by Anderson (1980) for balanced fish populations.

Walleye growth rates were good, consistently above the median for similar complex-cool-dark Wisconsin lakes, and the mean length-at-age for ages 2 to 12 averaged 2.1 inches greater than the lake class median (Figure 2). Year classes ranged from ages 2 – 12, with 90% of the total catch representing ages 2 – 6. Large fingerling walleye have been stocked into Ward Lake every other year beginning in 2006 at a rate of approximately 9-10 fish/acre. Survival to age-3 was 9.4%, and the cost per age-3 walleye was estimated at $11.30. Survival to age-5 was 10.9%, and the cost per age-5 walleye was estimated at $9.70. Age-5 walleye were slightly below harvestable size (mean length = 17.0 inches) and thus were not yet fully susceptible to recreational fishing harvest. Age-3 walleye were not fully mature; therefore, may have been underrepresented in this survey. The survival rate was likely higher and the cost per recruit lower than estimated for age-3 walleye.

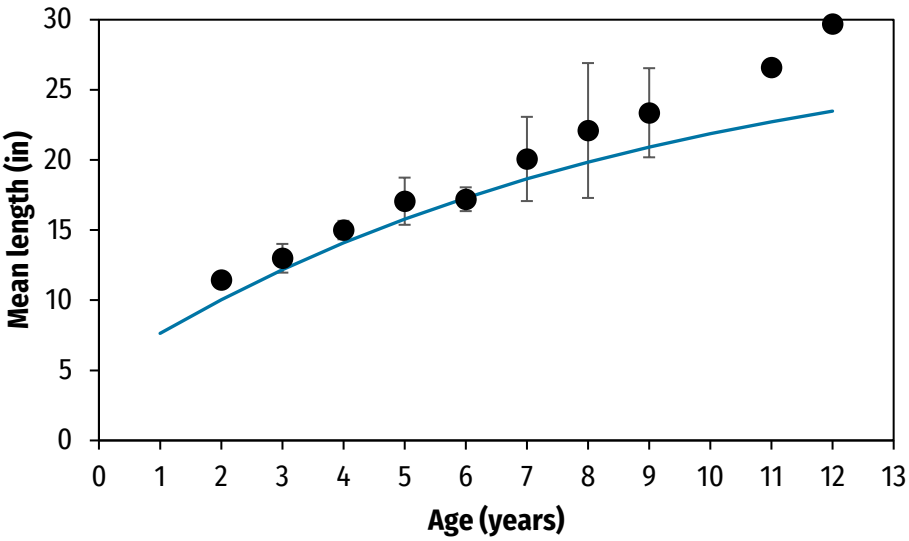

Figure 2. Mean length-at-age of walleye from the Ward Lake 2021 surveys (black circles) ± standard deviation and the median length-at-age for similar complex-cool-dark Wisconsin lakes (blue line).

The age-1 walleye fall CPUE was 11.3 fish/mile and would have corresponded with the 2020 large fingerling stocking (Appendix Table 1). The survival of stocked walleye is good, and stocked fish are contributing to the adult population. Greater relative abundances of age-1 walleye were consistently observed the year following a stocking event (average 8.8 fish/mile) compared to within a stocking year (average 1.4 fish/mile). The age-0 CPUE in 2021 was 0.4 fish/mile, and the average CPUE of age-0 walleye since 2009 was 0.3 fish/mile (excluding 2010 CPUE of 46.8 fish/mile). Based on the low age-0 walleye CPUE and good age-1 walleye CPUE (the year following stockings), the walleye fishery appears driven by stocking. The stocking of large fingerlings began in 2006 and has successfully sustained a high-quality walleye fishery with good adult density and quality size structure.

NORTHERN PIKE

Ward Lake supports a moderate-density northern pike population with a good size structure and potential for trophy-sized fish. Fifty northern pike were sampled during the SN1 survey, and lengths ranged from 17.5 – 42.0 inches, with an average length (sexes pooled) of 23.1 inches (Figure 3). The CPUE of northern pike was 2.0 fish/net night, which is slightly above the 50th percentile (1.7 fish/net night) for similar complex-cool-dark Wisconsin lakes. The ratio of males to females was approximately 3:1. The average length for males and females was 22.4 inches and 27.3 inches. The PSD-21 was 83 and suggestive of good size structure with index values well above the range proposed by Anderson and Weithman (1978) for balanced northern pike populations (PSD-21 = 30-60). PSD-28 was 6 and PSD-34 was 4.

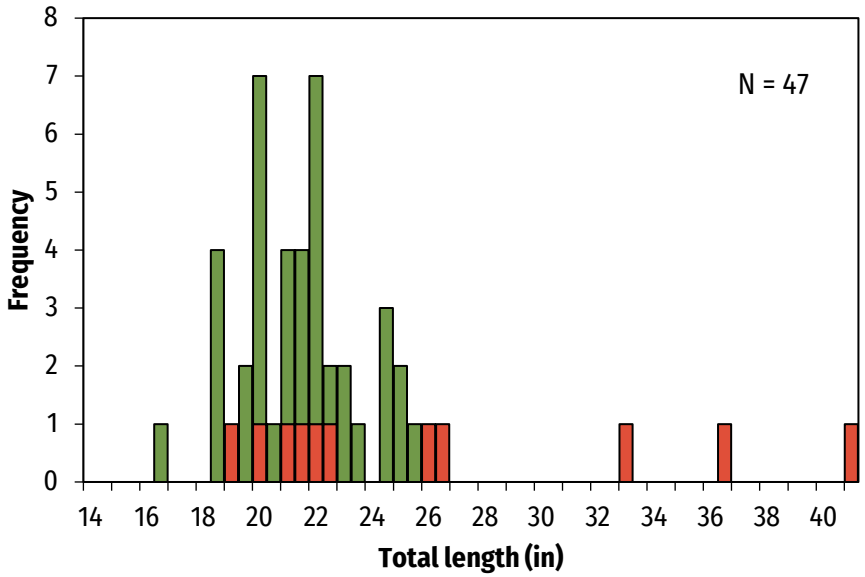

Figure 3. Length frequency of male (green bars) and female (red bars) northern pike collected in Ward Lake during the 2021 SN1 survey.

LARGEMOUTH BASS

Ward Lake currently supports a high-density, low size structure largemouth bass population. There were 657 largemouth bass collected during the bass population estimate survey (Figure 4). The adult (≥ 8 inches) population estimate was 3,447 fish or 37.9 fish/acre (CV = 0.18). Adults ≥ 14 inches were estimated at 55 fish or 0.60 fish/acre. The SE2 survey CPUE of largemouth bass was 98.3 fish/mile, which was well above the 99th percentile (66.3 fish/mile) for similar complex-cool-dark Wisconsin lakes.

The average length was 10.9 inches (Figure 4), which was slightly above the 50th percentile for similar complex-cool-dark Wisconsin lakes. The PSD-12 was 19 and PSD-15 was 3 (Figure 4). These PSD index values indicate a low size structure with lower than generally accepted values for a balanced largemouth bass population (PSD-12 = 40 – 70; Gabelhouse 1984). Despite this, size structure has steadily risen over the past decade (PSD-12 indexed from the fall survey for consistency with previous years; Figure 5).

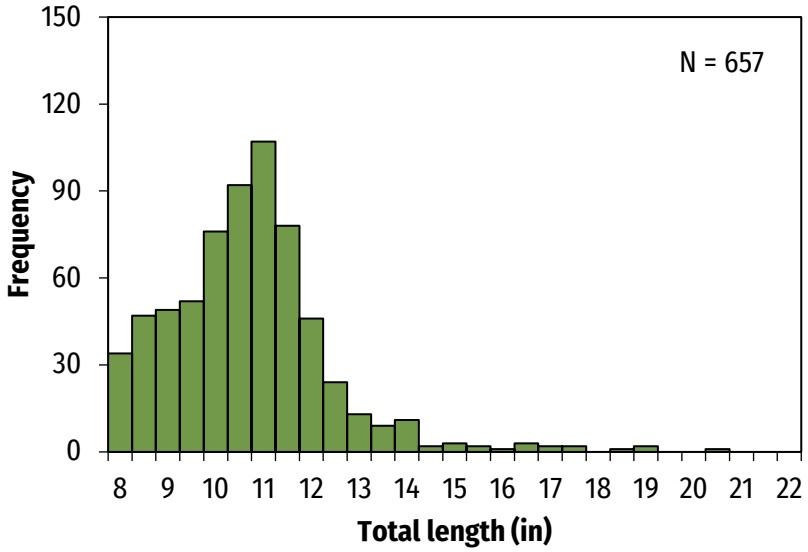

Figure 4. Length frequency of adult (≥ 8 inches) largemouth bass in Ward Lake during the spring 2021 mark-recapture survey.

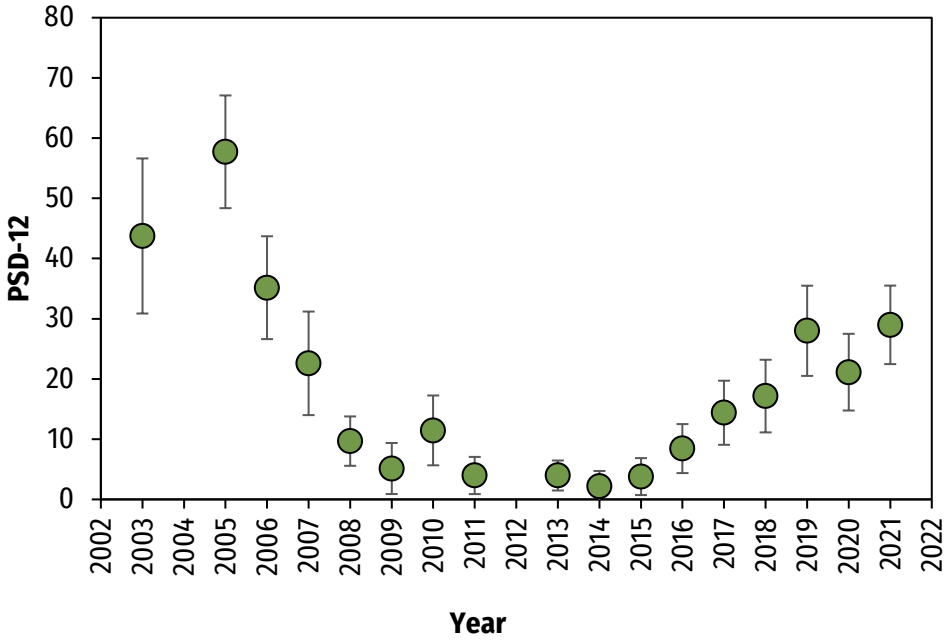

Figure 5. PSD-12 ± 95% CI of largemouth bass during 2003 – 2021 from fall electrofishing surveys.

Mean W_r was 63 and suggested fish were in poor condition (Bennett 1970), which is likely due to high competition from the high density of largemouth bass. Growth was poor, with mean length-at-age estimates lower than similar complex-cool-dark Wisconsin lakes (average differential of -1.7 inches; ages 2 – 9) but similar to the Barron-Polk counties average estimates (average differential of -0.3 inches; ages 2 –

9). Using von Bertalanffy growth models, the predicted theoretical maximum length for largemouth bass was 21.6 inches (Figure 6).

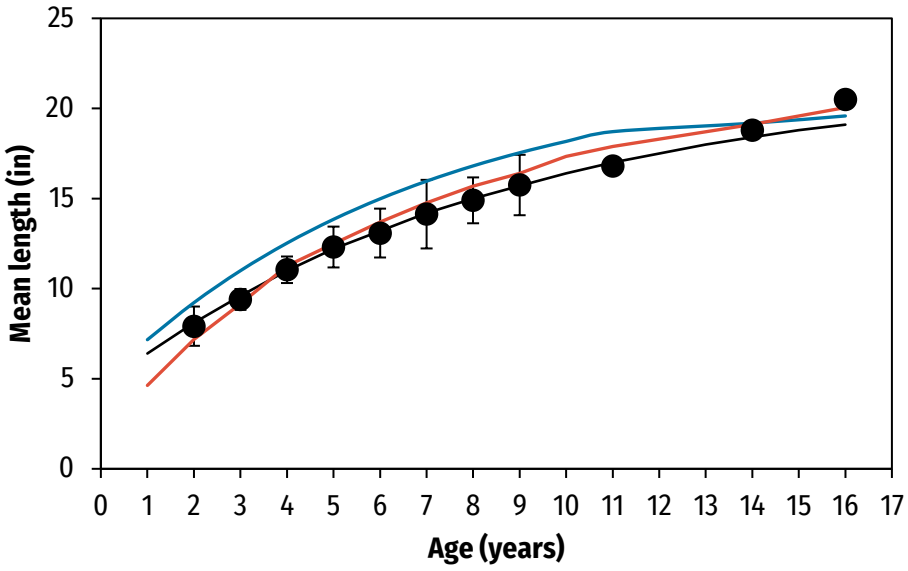

Figure 6. Largemouth bass mean length-at-age (black circles) ± standard deviation from Ward Lake during 2021. The von Bertalanffy growth model is represented by the black line. Median length-at-age estimates for similar complex-cool-dark Wisconsin Lakes are modeled by the blue line, and the Barron-Polk counties average estimates are modeled by the red line.

Total annual mortality estimated from a catch curve regression model was 35% (ages 3 – 16; Z = 0.4, R^2 = 0.80; Figure 7). Annual mortality of largemouth bass in Ward Lake appears low despite the high adult density and liberalized regulation.

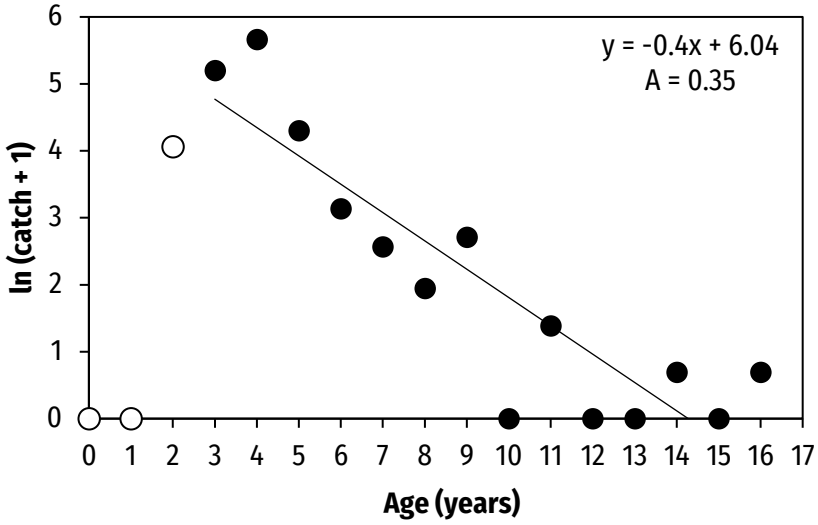

Figure 7. Catch curve analysis plot for the natural logarithm of the catch +1 for each age class of largemouth bass used in the analysis (black circles) and not (white circles). A = annual total mortality rate.

BLUEGILL

A total of 263 bluegills were collected during the SE2 survey (Figure 8). Bluegill CPUE was 114.4 fish/mile, which was slightly above the 50th percentile (105.9 fish/mile) for similar complex-cool-dark Wisconsin Lakes. The CPUE of quality size (≥ 6 inches) and preferred size (≥ 8 inches) fish was 54.8 fish/mile (47.9% of catch) and 3.5 fish/mile (3.0% of catch), respectively (Gabelhouse 1984).

Lengths ranged from 3.0 – 8.4 inches with an average length of 5.9 inches (Figure 8). The mean length was above the 95th percentile (5.5 inches) for similar complex-cool-dark Wisconsin lakes. PSD-6 was 50 and the PSD-8 was 3. The PSD-6 index value was within the generally accepted range for a balanced bluegill population (PSD-6 = 20-60); however, PSD-8 was slightly below the recommendation (PSD-8 = 5-20) by Anderson (1985). Collectively, this represented a bluegill population with an average size structure.

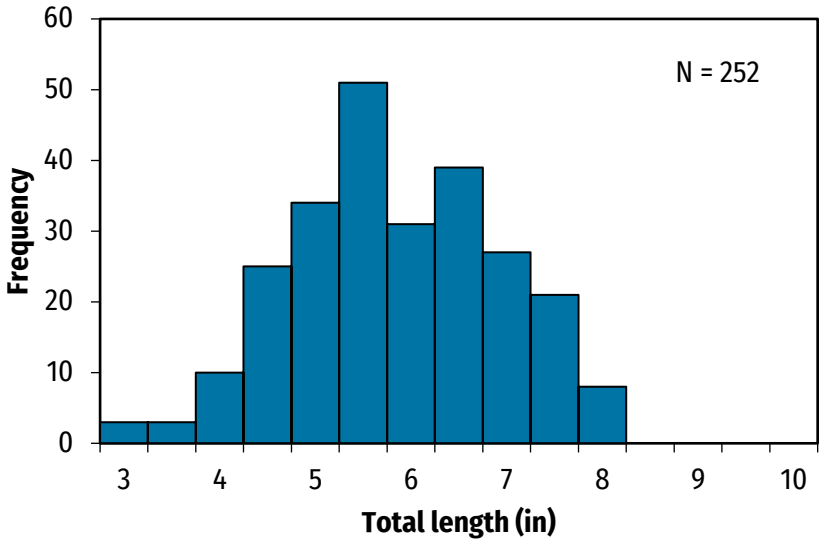

Figure 8. Length frequency of bluegill collected from Ward Lake during SE2 survey. Fish < 3 inches (n = 11) were excluded from the plot.

BLACK CRAPPIE

A total of 11 black crappies were collected during the SE2 survey. The catch rate was 4.8 fish/mile, and the catch rate of quality size (≥ 8 inches) fish was 4.4 fish/mile (90.9% of total catch; Gabelhouse 1984). Lengths ranged in size from 7.8 – 10.2 inches, with an average length of 9.2 inches.

OTHER PANFISH

Two yellow perch and three rock bass were sampled during the SE2 survey. Additionally, seventeen pumpkinseeds were collected, and their lengths ranged from 6.3 – 7.4 inches.

Management Recommendations

1.) Large fingerling walleye stockings have been successful in Ward Lake. The walleye population should be maintained at a target density of 2-3 fish/acre, which is reasonable with the current stocking regime, although, higher densities could be reached if natural reproduction was re-established. The stocking regime of 10 fish/acre every other year should continue. Stocking on an alternate year basis will enable us to continue evaluations of natural reproduction and the survival of stocked large fingerlings. Walleye should continue to be managed with the 18-inch minimum length limit, three fish daily bag limit to maintain or increase adult density. We will continue fall electrofishing every other year to index walleye natural recruitment and age-1 survival.

2.) Ward Lake supports a high-density, low size structure largemouth bass population with slow growth and low mortality. The current fishing regulation

(five fish daily bag limit with no minimum length limit) will be maintained. Anglers are encouraged to harvest small (< 14 inches) largemouth bass. Improvements in largemouth bass size structure and possibly walleye stocking success may occur if the harvest of largemouth bass is increased. We will continue fall electrofishing every other year to index the relative population abundance of largemouth bass.

3.) Ward Lake offers a well-rounded fishery. A moderate-density, high size structure northern pike population provides anglers an opportunity for trophy-sized fish. Similarly, a bluegill population with moderate abundance and size structure provides anglers with a quality, harvestable size fishery. No management actions are necessary for these species.
4.) The next comprehensive survey is planned for 2033. The success of the large fingerling walleye stocking should be further evaluated during that survey by assessing population abundance, age structure, population demographics and stocking survival. Due to the importance of the panfish fishery, the size structure and abundance of panfish populations should continue to be closely monitored as well. The density and size structure of the largemouth bass population should be reevaluated during that survey.
5.) Efforts to increase habitat complexity in Ward Lake should also be encouraged where applicable. Inputs of coarse woody habitat, protection/promotion of aquatic vegetation and maintenance/restoration of vegetative buffers would be beneficial to Ward Lake. This website healthylakeswi.com is a great resource to learn about this recommendation.
6.) Invasive species monitoring and control programs should continue. Efforts to keep aquatic invasive species out of a waterbody are much more effective than controlling invasive species once they are established.

Acknowledgements

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Appendices

Appendix Table 1. Fish stocking records for Ward Lake, 2000 – 2020.

YEAR	SPECIES	AGE CLASS	NUMBER STOCKED	AVG. LENGTH (IN)
2020	Walleye	Large Fingerling	822	6.8
2018	Walleye	Large Fingerling	822	6.2

2016	Walleye	Large Fingerling	821	7.6
2014	Walleye	Large Fingerling	822	6.4
2012	Walleye	Large Fingerling	910	7.5
2010	Walleye	Large Fingerling	910	7.3
2008	Walleye	Large Fingerling	910	7.0
2006	Walleye	Large Fingerling	910	6.8
2004	Walleye	Small Fingerling	7,023	1.3
2002	Walleye	Small Fingerling	8,877	1.4
2000	Walleye	Small Fingerling	4,450	1.7

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