

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
Fishery Survey Report for Duck Lake, Barron County,
Wisconsin 2019

WATERBODY IDENTIFICATION CODE: 2100300



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Introduction

The Wisconsin Department of Natural Resources (DNR) surveyed Duck Lake to assess the status of the fishery during 2019. A mark-recapture survey was performed to estimate the adult density of walleye. We assessed catch rates of largemouth bass, bluegill and black crappie to estimate relative abundance. We characterized population characteristics, size structure and growth for all species when possible.

LAKE CHARACTERISTICS

Duck Lake is a 109-acre drainage lake located in northwest Barron County. The lake has a maximum depth of 26 feet and a mean depth of 14 feet. The lake is best characterized by gradual sloping shorelines with moderate littoral area (7% of area under 3 feet and 75% under 20 feet). There are 1.5 miles of shoreline with 18.2 dwellings per shoreline mile. Duck Lake receives light recreational boating use and angling pressure. There is one small inlet from Granite Lake that enters from the west and an outlet on the south end of the lake to Beaver Dam Lake. Duck Lake is classified as a complex-cool-dark lake (Rypel et al. 2019). There is one public boat launch located along the northeastern shoreline off 24 1/2 Ave (45.562, -91.99). More information on water quality and invasive species can be found on the DNR Lake page for [Duck Lake](#).

STOCKING HISTORY

No fish stocking has occurred in Duck Lake in the last several decades. No walleye have been stocked into Duck Lake. Although, a channel from Duck Lake to Beaver Dam Lake was established during 1951, which permitted walleye passage to Duck Lake.

FISHING REGULATIONS

All species follow statewide or Ceded Territory regulations.

Methods

FIELD SAMPLING

Duck Lake was sampled during 2019 with early spring fyke netting (SN1), early spring (SE1) and late spring (SE2) night electrofishing and fall night electrofishing (FE1) surveys following the DNR's comprehensive Treaty assessment protocol (Cichosz 2021).

Late spring electrofishing (SE2 survey) was conducted 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 only gamefish were collected. There were two index stations and one gamefish station completed on Duck Lake. All fish were measured, but only largemouth bass were weighed. 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 electrofishing survey was conducted to assess the relative abundance of age-0 and age-1 walleye. Descriptions of standard DNR survey type, gear used, target water temperatures and target species are listed in Appendix Table 1.

Lake Class Standards catch per unit effort (CPUE) was calculated by comparing CPUEs of each species to the CPUEs of all other complex-cool-dark lakes in Wisconsin (Rypel et al. 2019).

Walleye and largemouth bass were aged with dorsal spines. Bluegills and black crappies were aged with scales. All spines were cut with a Dremel tool and aged under a microscope. 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). Size structure was assessed using the 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 (1938) growth model was determined using mean length at age data to assess growth. The total annual mortality of largemouth bass was estimated using catch curve analysis (Miranda and Bettoli 2007).

Results and Discussion

WALLEYE

The adult walleye population in Duck Lake during 2019 was 1.7 fish/acre (95% CI = 1.4 – 2.0 fish/acre). Adult walleye density decreased since the 2009 and 2012 surveys and was below management recommendations for naturally reproducing walleye populations (> 3.0 fish/acre; Donofrio et al. 2022; Figure 1).

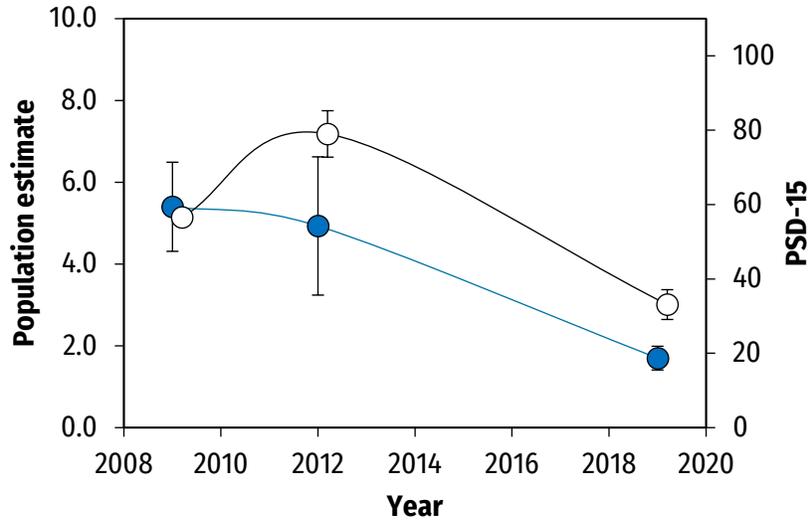


Figure 1. Walleye population estimates (number of fish per acre \pm 95% CI; blue circles) and PSD-15 (\pm 95% CI; hollow circles) during the 2009, 2012 and 2019 Duck Lake fishery surveys.

There were 147 walleyes collected during the SN1 and SE1 surveys (Figure 2). Walleye CPUE was above the 90th percentile (18.5 fish/net night) for complex-cool-dark Wisconsin lakes. Walleyes ranged in length from 11.2 – 24.7 inches and had an average length of 15.0 inches (Figure 2). The mean lengths of females and males were 19.7 and 14.6 inches, respectively. The sex ratio was male-biased, with a male-to-female ratio of 10:1.

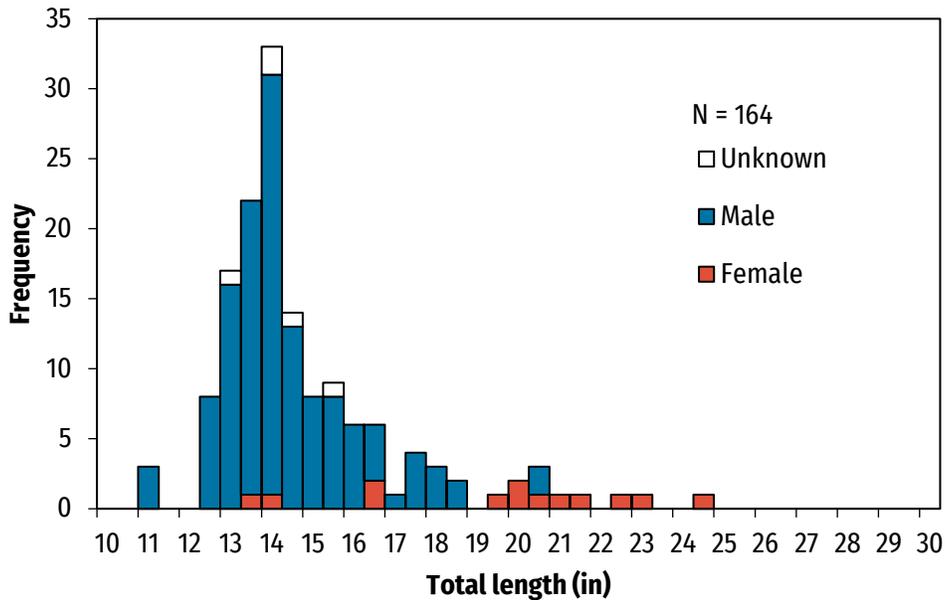


Figure 2. Length frequency histogram of walleye collected during the SN1 and SE1 surveys in Duck Lake, Barron County, WI, 2019.

Walleye PSD-15 from netting was 33, and PSD-20 was 6. The PSD indices were low and suggested below average size structure (PSD-15 = 30 - 60; Anderson and Weithman 1978). Size structure indices declined since 2009 (PSD-15 = 57) and 2012 (PSD-15 = 79), which resulted in a lower percentage of the population susceptible to harvest during 2019 (27.9% susceptible to harvest during 2019 compared to 50.1% during 2009).

Walleye growth rates were average and similar to the median for complex-cool-dark lakes (average difference in length at age: +0.8 inches; ages 3 - 8) and increased since 2012 (average difference in mean length at age: +1.7 inches; ages 3 - 8). Faster growth rates during 2019 compared to 2012 likely resulted from lower population density and factors related to density dependence such as competition. Population age structure was composed primarily of age-3 fish (42.7%), and nine year classes represented the adult spawning stock (assuming maturity by age-4; 57.3% of the population). Recruitment of walleye to the adult population appeared good based on consistent representation of adult age classes.

Nine age-0 walleyes were collected during the 2019 FE1 survey and had a CPUE of 6.0 fish/mile, and no age-1 walleyes were collected. Age-0 walleyes ranged in length from 5.6 - 6.8 inches. Walleye recruitment during 2019 was comparable to 2017 and 2009 but lower than 1998 (Figure 3). Age-0 walleye CPUE during 2019 was below average compared to other naturally reproducing walleye lakes in Barron County (11.8 ± 8.1 fish/mile; mean \pm mean error; indexed using 20 fall surveys from Red Cedar Lake, Granite Lake and Silver Lake during 2009 - 2022; Figure 3). In general, the catch rates of age-0 walleye have been low in Duck Lake, but year classes have been present. The walleye fishery in Duck Lake should continue to be supported by natural recruitment (NR).

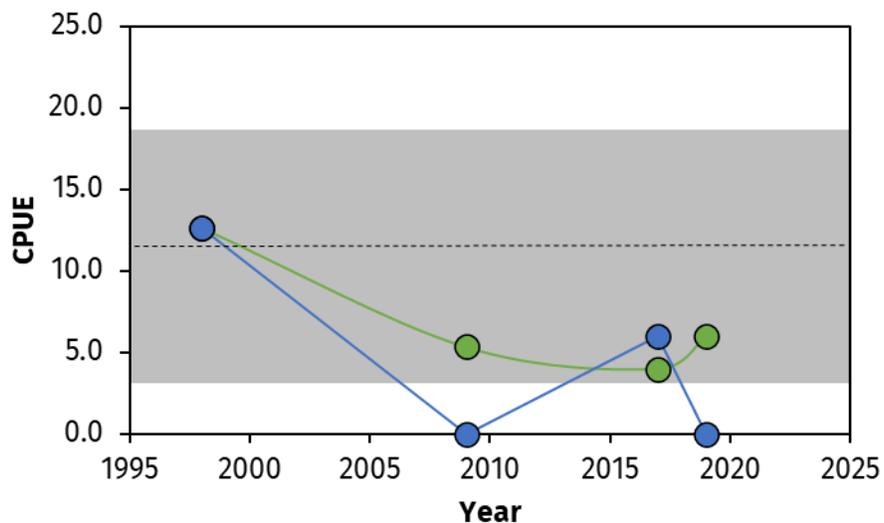


Figure 3. Age-0 (green circles) and age-1 (blue circles) walleye CPUE (fish/mi) indexed from fall electrofishing surveys during 1998 - 2019. The Barron County average age-0 walleye CPUE from naturally

reproducing lakes (indexed using 20 fall surveys from Red Cedar Lake, Granite Lake and Silver Lake during 2009 – 2022) is represented by the grey dashed line and shaded areas represent mean error.

The current walleye population was lower than in previous surveys and was below management recommendations for naturally reproducing walleye fisheries regarding adult abundance, but growth rates have increased. Population size structure remained low with a male-biased sex ratio and consistent natural recruitment, which are typical of naturally reproducing walleye fisheries. The walleye management goal in Duck Lake is to maintain an abundant, resilient and naturally reproducing adult population and provide quality angling opportunities. Objectives are to maintain adult densities above 3 fish/acre which will be assessed on a 9-year rotation. Secondly, age-0 walleye catch rates during FE1 surveys should be maintained above 5 fish/mile, which will be assessed at least every other year. The current walleye harvest regulation (15-in 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.

NORTHERN PIKE

A total of 23 northern pike were collected during the SN1 survey. Northern pike CPUE was 1.9 fish/net night, which was near the 50th percentile (1.7 fish/mi) for similar complex-cool-dark Wisconsin Lakes. Other biological information for northern pike was not collected during the 2019 survey.

LARGEMOUTH BASS

Duck Lake supports a low-density largemouth bass population with good size structure and condition. A total of 19 largemouth bass were collected from Duck Lake during the SE2 survey (Figure 4). Largemouth bass CPUE was 9.5 fish/mile, which was below the 75th percentile (13.2 fish/mile) for similar complex-cool-dark Wisconsin lakes. The mean length was 15.0 inches and above the 99th percentile (14.3 inches) for complex-cool-dark Wisconsin lakes. The proportion of the population susceptible to harvest by anglers (≥ 14 inches) was 53%. The mean W_r of largemouth bass was 100, which indicated fish were in above-average overall condition (Bennett 1970). The von Bertalanffy growth and catch curve models were not included due to too few fish sampled.

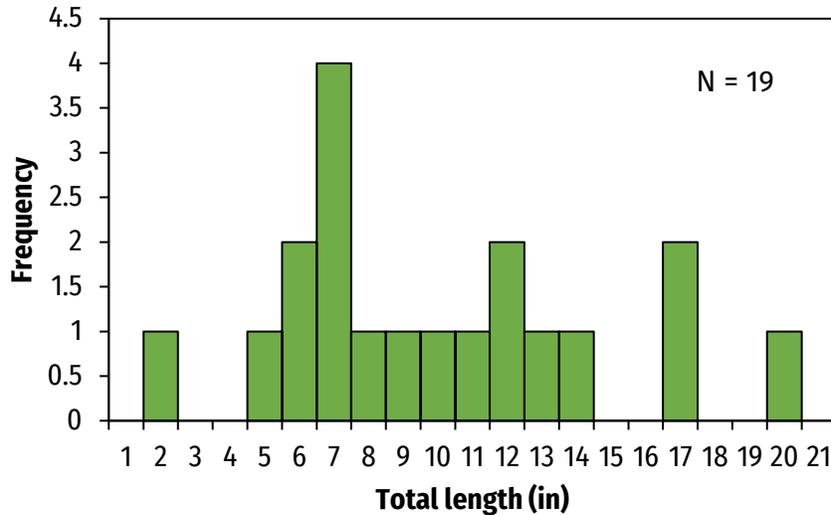


Figure 4. Length frequency of largemouth bass in Duck Lake during the 2019 SE2 survey.

The current harvest regulation (14-inch MLL, five fish daily bag limit) will be maintained and should continue to support both a quality largemouth bass population and limited harvest opportunities for anglers. With the habitat and current fish community in Duck Lake, largemouth bass will likely continue to have a low density and high size structure. However, the largemouth bass population should be closely monitored in the future and management actions applied accordingly to support the persistence of a naturally recruiting walleye fishery.

BLUEGILL

A low-density bluegill population with good size structure was present in Duck Lake. A total of 107 bluegills were collected during the SE2 survey. Bluegill CPUE was 53.5 fish/mile, which was below the 50th percentile (105.9 fish/mile) for similar complex-cool-dark Wisconsin lakes but resembled the mean bluegill CPUE for lakes in Barron and Polk counties (54.0 ± 4.7 fish/mile; \pm SE). Lengths ranged from 4.6 to 8.5 inches, with an average length of 6.7 inches, which was greater than the 99th percentile (6.5 in) for similar complex-cool-dark Wisconsin lakes (Figure 5). The PSD-6 was 84, which increased since 2009 (PSD-6 = 54) and was well above the generally accepted range for balanced bluegill populations (PSD-6 = 20-60; Anderson 1985). This is suggestive of a quality overall size structure (Figure 5).

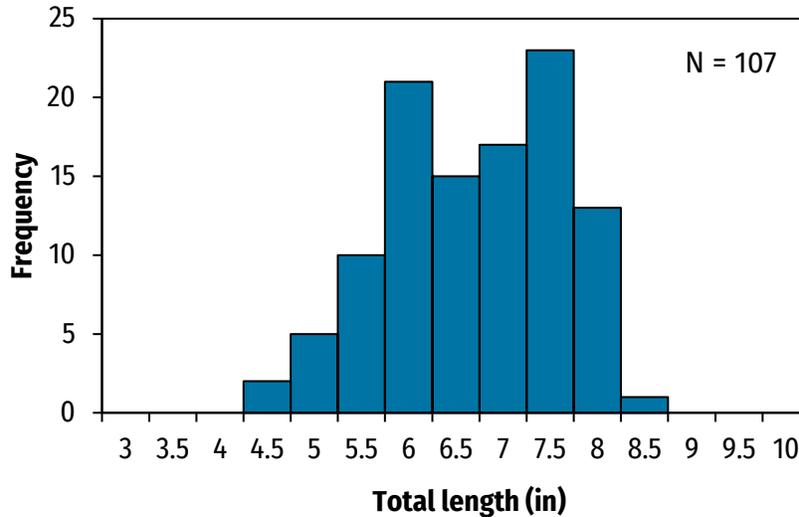


Figure 5. Length frequency of bluegill from Duck Lake during the 2019 SE2 survey.

Bluegill ages ranged from 3 – 8 years old and 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: 0.0 inches), the northern region estimates (average difference in mean length at age estimates: 0.0 inches) and median length at age standards for similar complex-cool-dark Wisconsin lakes (average difference in length at age estimates: -0.1 inches; Figure 6). All growth comparisons used fish ages 4 – 8. The von Bertalanffy growth model could not be fit to the observed age-length data.

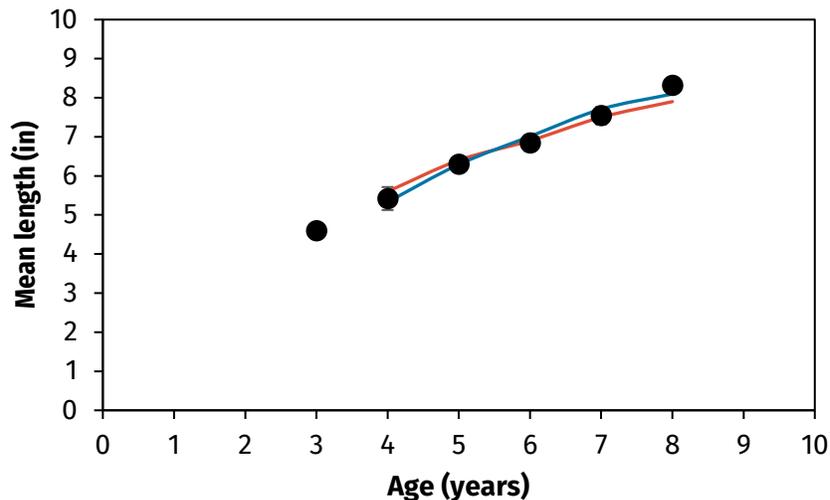


Figure 6. Bluegill mean length at age \pm standard deviation during the 2019 SE2 survey on Duck Lake. The blue line represents the mean length at age estimates for the northern region and the red line

represents mean estimates for Barron and Polk counties. Lake Class estimates were similar to the northern region estimates and not represented in the plot.

BLACK CRAPPIE

Duck Lake supports a moderately abundant black crappie population with a good size structure. A total of 31 black crappies were collected during the 2019 SE2 survey. Black crappie CPUE was 15.5 fish/mile, which was above the mean black crappie CPUE for lakes in Barron and Polk counties (9.6 ± 1.9 fish/mile; \pm SE). The CPUE of quality-size fish (≥ 8 inches) was 13.5 fish/mile and well above-average for lakes in Barron and Polk counties (5.8 ± 1.3 fish/mile; \pm SE; Gabelhouse 1984). Lengths ranged from 7.1 to 11.9 inches, with an average length of 9.0 inches, which was greater than the 95th percentile (8.8 inches) for similar complex-cool-dark Wisconsin lakes (Figure 7). The PSD-8 was 87, which increased since 2009 (PSD-8 = 50) and was indicative of a quality overall size structure (Figure 7). The black crappie population should provide quality angling opportunities.

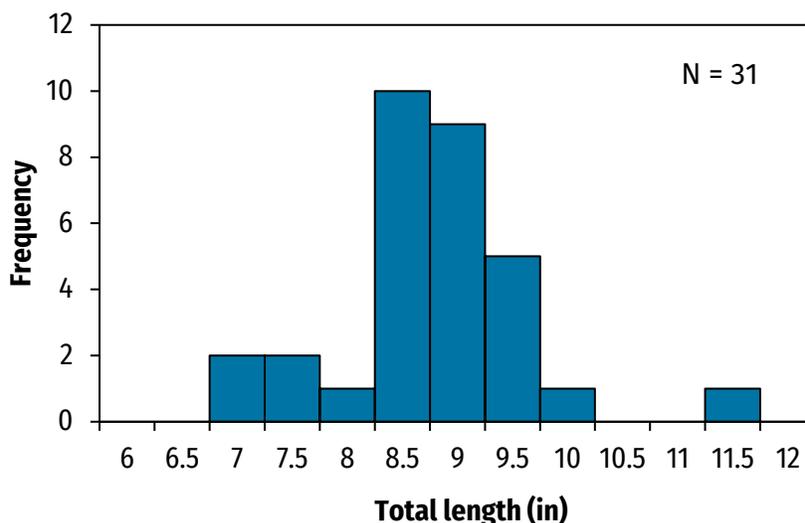


Figure 7. Length frequency of black crappie from Duck Lake during the 2019 SE2 survey.

YELLOW PERCH

A total of seven yellow perch were collected during the 2019 SE2 survey. Yellow perch CPUE was 3.5 fish/mile, but late spring electrofishing is generally not an effective survey method to index yellow perch population metrics. Lengths ranged from 6.4 to 8.3 inches, with an average length of 7.3 inches.

Management Recommendations

1. Maintain a naturally reproducing walleye population with a density > 3 fish/acre and fall catch rates should be > 5 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 five fish daily bag limit. The relative abundance of largemouth bass should be closely monitored in the future, and management actions applied accordingly to support the persistence of a naturally recruiting walleye fishery. 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 bluegill and black crappie during the next survey to improve age and growth estimation.
4. The next comprehensive fisheries survey is scheduled for 2029. Population abundance, size structure, age structure and NR of walleye should be closely monitored as Duck 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. 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