WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Boot Lake
2024 Fish Management Report

WBIC 418700

Photo Credit: WDNR

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WISCONSIN
DEPT. OF NATURAL RESOURCES

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Introduction

Boot Lake is a 235-acre seepage lake located in northwestern Oconto County. The lake has a maximum depth of 38 feet but averages 19 feet deep (Table 1). Boot Lake is one of the larger lakes in the immediate area and offers a variety of recreational opportunities in addition to fishing. The United States Forest Service (USFS) owns and operates the boat landing, a beach and campground. Additionally, the USFS owns the entire north shoreline of the lake.

Boot Lake is in the Ceded Territory (22,400 square miles of northern Wisconsin that was ceded to the United States by the Lake Superior Chippewa Tribes in 1837 and 1842) and therefore eligible for tribal, off-reservation spearing harvest of gamefish but most notably, walleye. The Wisconsin Department of Natural Resources (WDNR) stocked small fingerling walleye every other year between 2000 and 2012 (Table 2). Beginning in 2013 large fingerling walleye were stocked under the Wisconsin Walleye Initiative (Table 2).

Muskellunge were stocked by WDNR throughout the 1970's and late 1980's. In 2014, Catch & Release Musky Club from Appleton, Wisconsin approached WDNR staff about stocking Boot Lake with muskellunge. A plan was developed for the club to stock approximately 1 fish per acre for 10 years. All fish to date have been fin clipped before stocking and approximately 10% of the stocked fish were PIT tagged each year.

Table 1: Physical and Chemical Attributes for Boot Lake (DNR, 1977).

Surface acres:	235
Maximum depth (ft):	38
Average depth (ft):	19
Shoreline length (mi):	3.7
Lake type:	Seepage
Lake class:	Complex, Cool, Clear
Basic water chemistry:	Medium hard water seepage lake having slightly alkaline, clear water of moderate transparency.
Littoral substrate:	55% sand, 20% muck, 10% rubble and 5% gravel.
Aquatic vegetation:	Sparse
Other features:	Boot Lake is moderately developed with homes along the south and east shorelines. The north shore is owned by the U.S. Forest Service and includes a boat launch, beach and 36-site campground. Boot Lake is located within the Ceded Territory.

Table 2. Boot Lake stocking history.

Year	Species	Strain Stock	Number Stocked	Average Length	Source Type
1972	MUSKELLUNGE	UNSPECIFIED	700	13.0	DNR HATCHERY
1974	MUSKELLUNGE	UNSPECIFIED	958	5.0	DNR HATCHERY
1975	MUSKELLUNGE	UNSPECIFIED	500	11.0	DNR HATCHERY
1977	MUSKELLUNGE	UNSPECIFIED	500	9.0	DNR HATCHERY
1986	MUSKELLUNGE	UNSPECIFIED	500	10.0	DNR HATCHERY
1988	MUSKELLUNGE	UNSPECIFIED	500	10.0	DNR HATCHERY
1990	MUSKELLUNGE	UNSPECIFIED	500	12.0	DNR HATCHERY
2014	MUSKELLUNGE	UNSPECIFIED	200	10.0	PRIVATE HATCHERY
2015	MUSKELLUNGE	UNSPECIFIED	200	12.0	PRIVATE HATCHERY
2016	MUSKELLUNGE	UNSPECIFIED	275	13.0	PRIVATE HATCHERY
2017	MUSKELLUNGE	UNSPECIFIED	275	13.0	PRIVATE HATCHERY
2018	MUSKELLUNGE	UNSPECIFIED	275	13.0	PRIVATE HATCHERY
2019	MUSKELLUNGE	UNSPECIFIED	275	13.0	PRIVATE HATCHERY
2020	MUSKELLUNGE	UNSPECIFIED	275	13.0	PRIVATE HATCHERY
2021	MUSKELLUNGE	GREAT LAKES SPOTTED	230	10.5	DNR HATCHERY
2024	MUSKELLUNGE	GREAT LAKES SPOTTED	115	11.5	DNR HATCHERY
2016	SMALLMOUTH BASS	UNSPECIFIED	1000	5.0	PRIVATE HATCHERY
2018	SMALLMOUTH BASS	UNSPECIFIED	1000	3.0	PRIVATE HATCHERY
2020	SMALLMOUTH BASS	UNSPECIFIED	1000	4.0	PRIVATE HATCHERY
1973	WALLEYE	UNSPECIFIED	12000	5.0	DNR HATCHERY
1976	WALLEYE	UNSPECIFIED	12000	3.0	DNR HATCHERY
2000	WALLEYE	UNSPECIFIED	10000	1.7	DNR HATCHERY
2003	WALLEYE	LAKE MICHIGAN	9998	1.3	DNR HATCHERY
2004	WALLEYE	MISSISSIPPI HEADWATERS	9995	2.0	DNR HATCHERY
2006	WALLEYE	LAKE MICHIGAN	9203	1.4	DNR HATCHERY
2008	WALLEYE	MISSISSIPPI HEADWATERS	8269	1.4	DNR HATCHERY
2010	WALLEYE	LAKE MICHIGAN	8000	1.4	DNR HATCHERY
2012	WALLEYE	LAKE MICHIGAN	8225	1.6	DNR HATCHERY
2013	WALLEYE	UNSPECIFIED	2347	6.8	DNR HATCHERY
2015	WALLEYE	MISSISSIPPI HEADWATERS	2302	7.7	DNR HATCHERY
2017	WALLEYE	MISSISSIPPI HEADWATERS	2350	3.2	DNR HATCHERY
2017	WALLEYE	UNSPECIFIED	2350	7.3	DNR HATCHERY
2019	WALLEYE	ROCK-FOX	2350	7.0	DNR HATCHERY
2021	WALLEYE	MISSISSIPPI HEADWATERS	2345	7.3	DNR HATCHERY
2023	WALLEYE	LAKE MICHIGAN	2350	7.6	DNR HATCHERY
2025	WALLEYE	LAKE MICHIGAN	2334	7.4	DNR HATCHERY

The last fisheries survey of Boot Lake was conducted in 2016 (Long, 2017). The 2016 survey consisted of 56 net nights (NN) of fyke netting in early May, shoreline electrofishing was conducted in both the spring and fall, and 3 NN of summer panfish netting. The 2016 survey generated a walleye population estimate of 1.1 adult walleye per acre. The panfish population in 2016 was dominated by yellow perch followed by rock bass and bluegill (Long, 2017).

The goal of the 2024 comprehensive fisheries survey was to assess the status of the fishery by characterizing gamefish populations based on relative abundance, proportional stock density (PSD), relative stock density (RSD), catch per unit effort (CPUE) and mean length at capture (age and growth).

Methods

Data Collection

Standard fyke nets (3-foot hoop, $^{3}/_{4}$-bar, 1.5-inch stretch) were tended from March 28 to April 15, 2024 (SN1). The primary objective was to capture, measure, and mark adult walleye for use in estimating their abundance. The SN2 musky survey ran from April 16 to April 28, 2024. Summer panfish netting (SN3) was completed from June 10 to June 13.

A standard WDNR electrofishing boat was used on April 15, 2024 (SE1) to assess walleye abundance and on May 30, 2024 (SE2) to count and measure adult gamefish (e.g. bass) and panfish. Two, 2-mile shoreline segments were surveyed. Each 2-mile segment had 2 stations: a 1.5-mile gamefish station and a 0.5-mile gamefish/panfish station. A fall electrofishing survey was conducted on October 23, 2024 to evaluate walleye and muskellunge recruitment.

All fish collected were measured to the nearest 0.1-inch (in) total length (TL). A sub-sample of scales, dorsal spines, or anal fin rays was collected for age and growth analysis from all gamefish. Aging structures from target species were collected from 5 fish per half inch group in the stock, quality and preferred length groups. Ages were assigned to each fish using standard DNR procedures.

Data Analysis

Catch per unit effort (CPUE) was calculated as catch by gear divided by sampling effort for each species collected. Length frequency distributions were tabulated from fish measured during the electrofishing and fyke net samples; not all panfish were measured. Population estimates for walleye and other gamefish were generated using multiple and single census mark-recapture methods. Proportional stock density (PSD) and relative stock density for preferred length fish (RSD^{P}) were calculated for dominant gamefish (Anderson and Neumann 1996). Preferred lengths of various gamefish have a minimum length between 45 and 55% of the world record length for that species (Anderson and Neumann 1996). Stock, quality, and preferred lengths were used as proposed by Gabelhouse (1984). Mean length at capture data was calculated for dominant gamefish and compared to the average of mean length at age for northern Wisconsin, previous survey data from Boot Lake and Lake Class data.

Results and Discussion

Overall, 1,673 fish representing 11 species and were collected during the 2024 sampling season (Table 3). The five most abundant species collected by number were rock bass *Ambloplites rupestris* (40%), walleye *Sander vitreus* (17%), largemouth bass *Micropterus salmoides* (15%), yellow perch *Perca flavescens* (7%) and bluegill *Lepomis macrochirus* (7%).

Table 3. Species composition of fishes collected during the 2024 comprehensive survey of Boot Lake, Oconto County, WI.

SPECIES COMPOSITION OF FISHES COLLECTED			
*Common Name of Fish	Number	Percent	Length Range (inches)
Rock bass	665	40%	3.5 - 10.4
Walleye**	285	17%	6.0 - 26.9
Largemouth bass	250	15%	6.5 - 20.4
Yellow perch	125	7%	6.0 - 11.4
Bluegill	109	7%	2.5 - 8.9
Smallmouth bass	74	4%	5.5 - 15.9
Northern pike	72	4%	12.0 - 34.9
Pumpkinseed	41	2%	4.0 - 7.9
Black crappie	35	2%	8.0 - 12.9
Muskellunge**	12	1%	37.8 - 48.2
White sucker	5	< 1%	-
TOTAL	1,673		

* Common names of fishes recognized by the American Fisheries Society.

** Includes recaptured fish during spring fyke netting.

Walleye

A total of 217 walleye (169 marked and 48 recaptures) were collected during the spring fyke netting survey (Table 3). Walleye collected in fyke nets ranged in length from 8 to 26 inches and averaged 17 inches (Figure 1). Spring fyke netting (SN1) CPUE increased slightly from 1.3/NN in 2016 to 1.4/NN in 2024. The median fyke netting CPUE for walleye in complex, cool, clear lakes is 3.7 (Figure 2). The adult walleye population estimate was 0.8 adults/acre in 2024 which was down from the 1.1 adults/acre observed in 2016. Four young-of-the-year walleye were collected during the fall recruitment electrofishing survey indicating that natural reproduction is occurring at a low level.

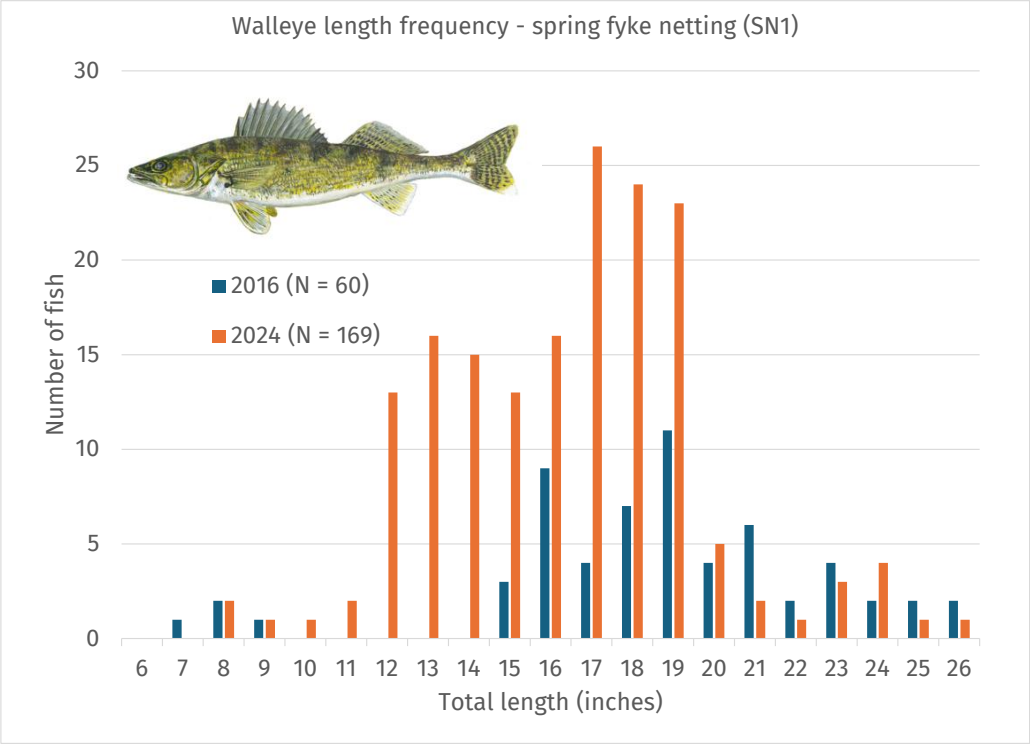

Figure 1. Length frequency of walleye collected during 2016 and 2024 surveys from Boot Lake, Oconto County, WI.

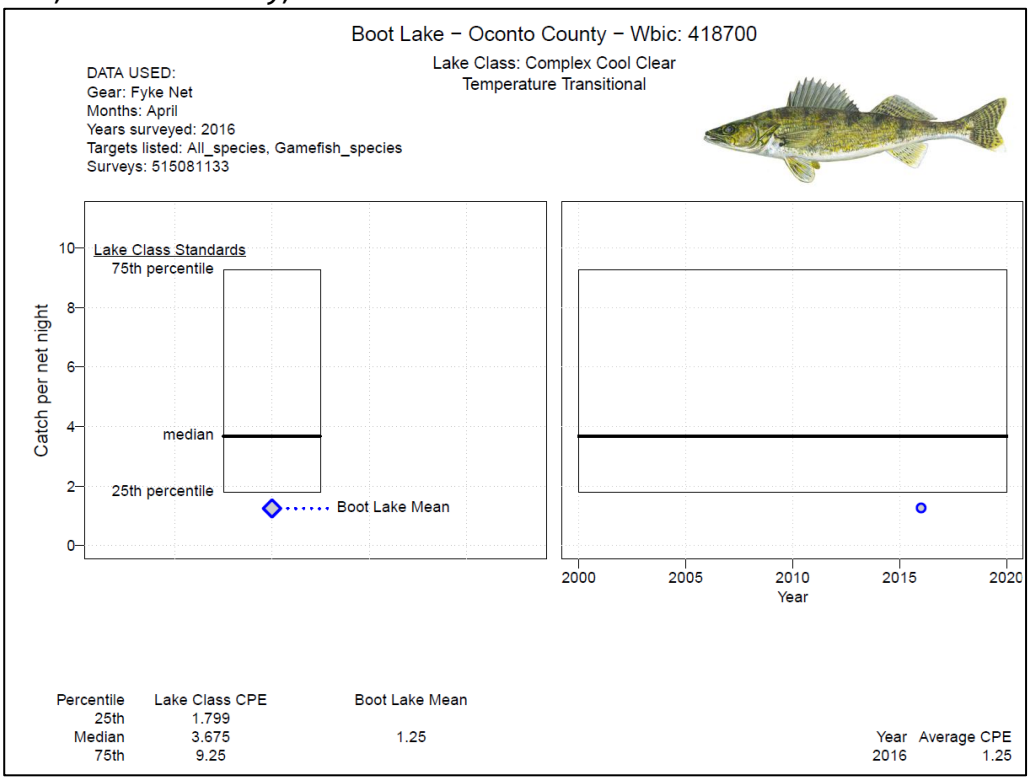

Figure 2. Lake classification walleye fyke netting CPUE for Boot Lake, Oconto County, WI.

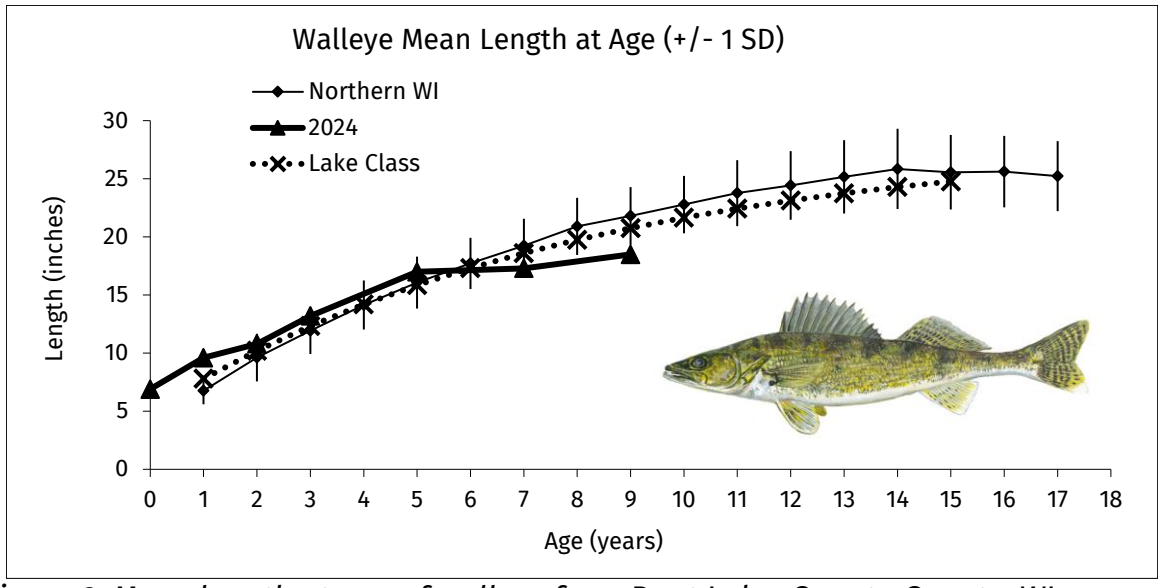

Figure 3. Mean length at age of walleye from Boot Lake, Oconto County, WI.

A subsample of 59 walleye was aged using scales (<12”) and dorsal spines (>12”). Ages ranged from 0 to 9 years old. Walleye growth was average until age 7 and then slightly below average at older ages compared to the mean length at age of walleye in northern Wisconsin (Figure 3).

Northern pike

Northern pike *Esox lucius* accounted for 10% of the fish collected (219 total). A total of 63 pike was collected during SN1 spring fyke netting (Figure 4). Pike ranged in length from 12 to 34 inches and averaged 19 inches (Figure 4). Fyke netting CPUE increased slightly from 0.3/NN in 2016 to 0.4/NN in 2024 which is slightly below the 25th percentile CPUE for lakes within its class (Figure 5). Overall, northern pike abundance and size structure have remained stable. Reproduction is adequate to sustain the population. No pike were aged from this survey. Due to the lack of recaptures during fyke netting, it was not possible to generate a population estimate.

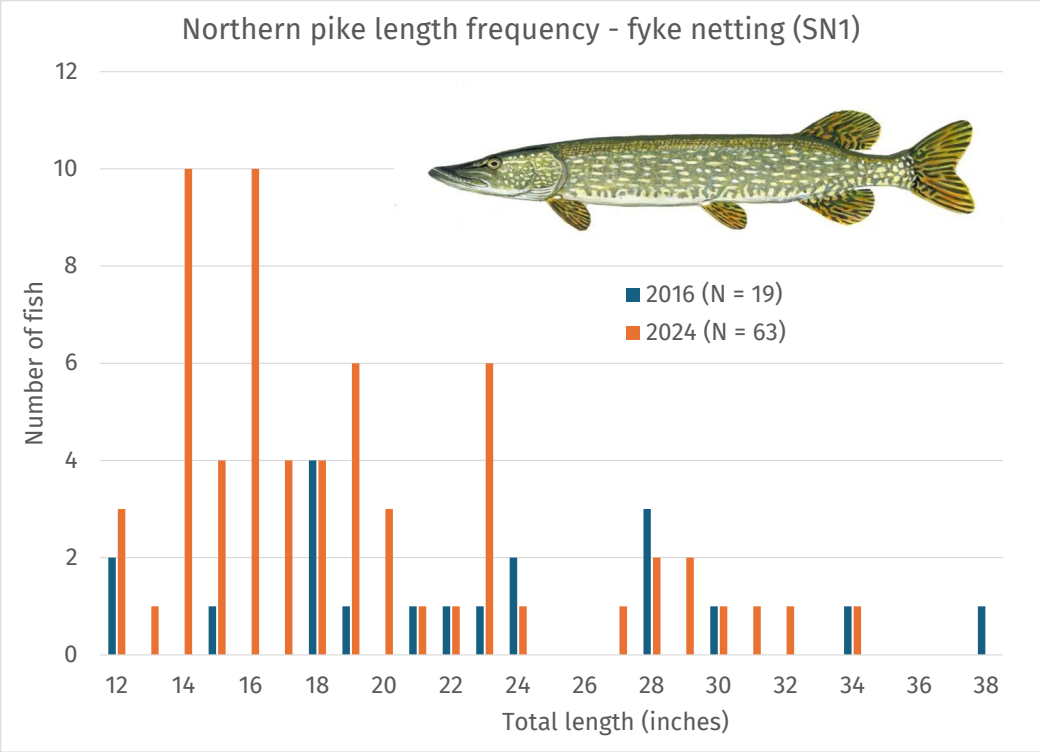

Figure 4. Length frequency of Northern Pike collected during spring fyke netting in 2016 and 2024 from Boot Lake, Oconto County, WI.

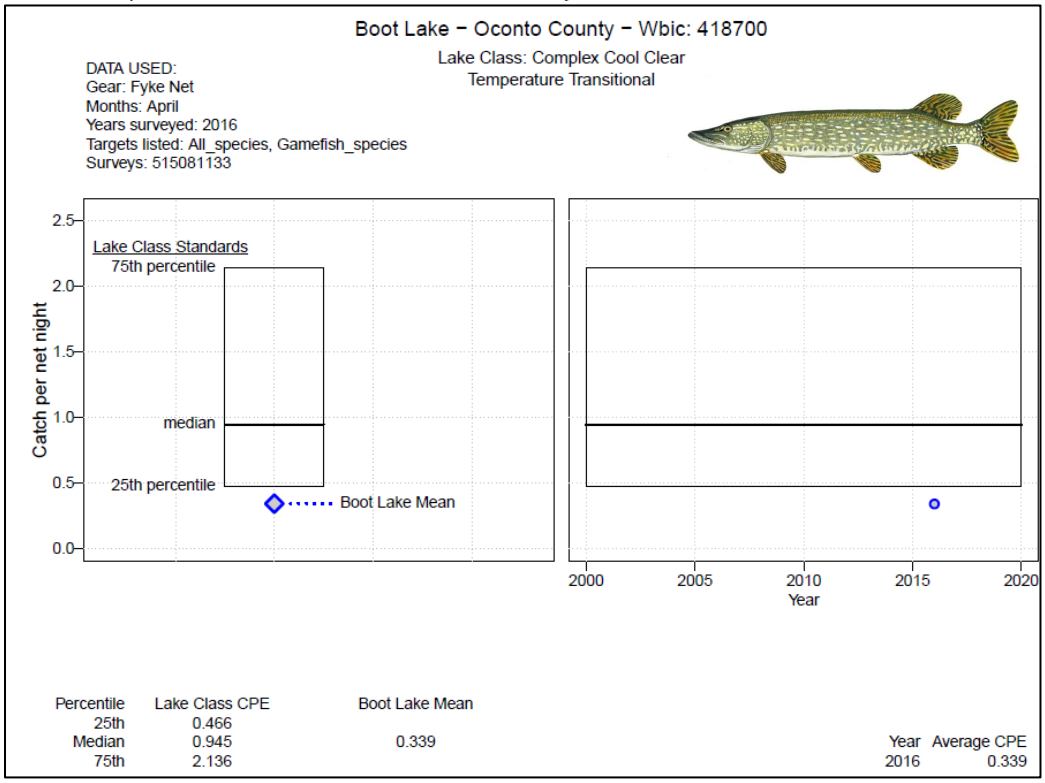

Figure 5. Lake classification northern pike fyke netting CPUE for Boot Lake, Oconto County, WI.

Muskellunge

Muskellunge *Esox masquinongy* were stocked by WDNR in Boot Lake sporadically from the early 1970's and 1980's (Table 2). In 2014, C & R Musky Club (CRMC) from Appleton, Wisconsin approached the WDNR about stocking muskellunge in Boot Lake. Since Boot Lake was already a designated muskellunge lake and had a history of stocking, a plan was developed to revive this portion of the fishery. From 2014 to 2020, CRMC purchased between 200 and 275 muskellunge annually for stocking (Table 2). WDNR staff met the supplier at the landing and fin clipped (LV = left ventral) all fish prior to scatter planting to monitor natural reproduction in future surveys. Approximately 10% of these muskellunge were also PIT tagged each year so that future estimates of growth could be obtained.

In 2024, 12 muskies were collected and ranged in length from 37 to 48 inches (Figure 6). Fyke netting CPUE was 0.04 musky/NN in 2024 and 0.13/NN in 2016 both of which are below the 25th percentile CPUE for other lakes in its classification (complex, cool, clear; Figure 7).

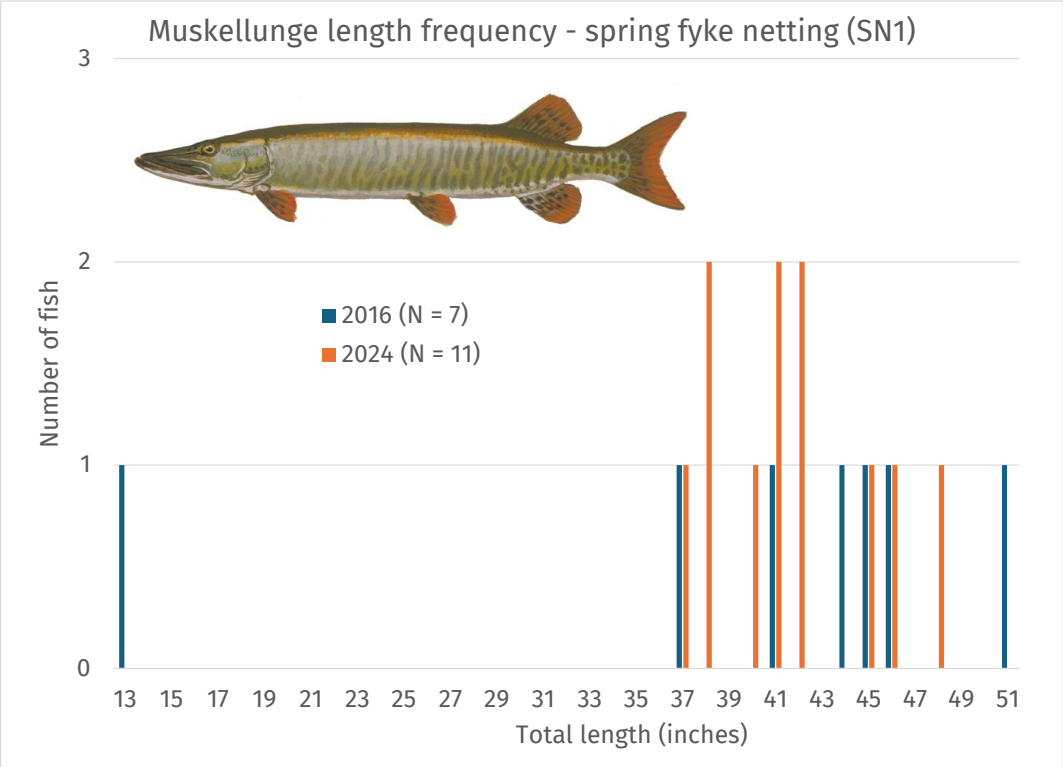

Figure 6. Length frequency of Muskellunge collected during 2016 and 2024 surveys from Boot Lake, Oconto County, WI.

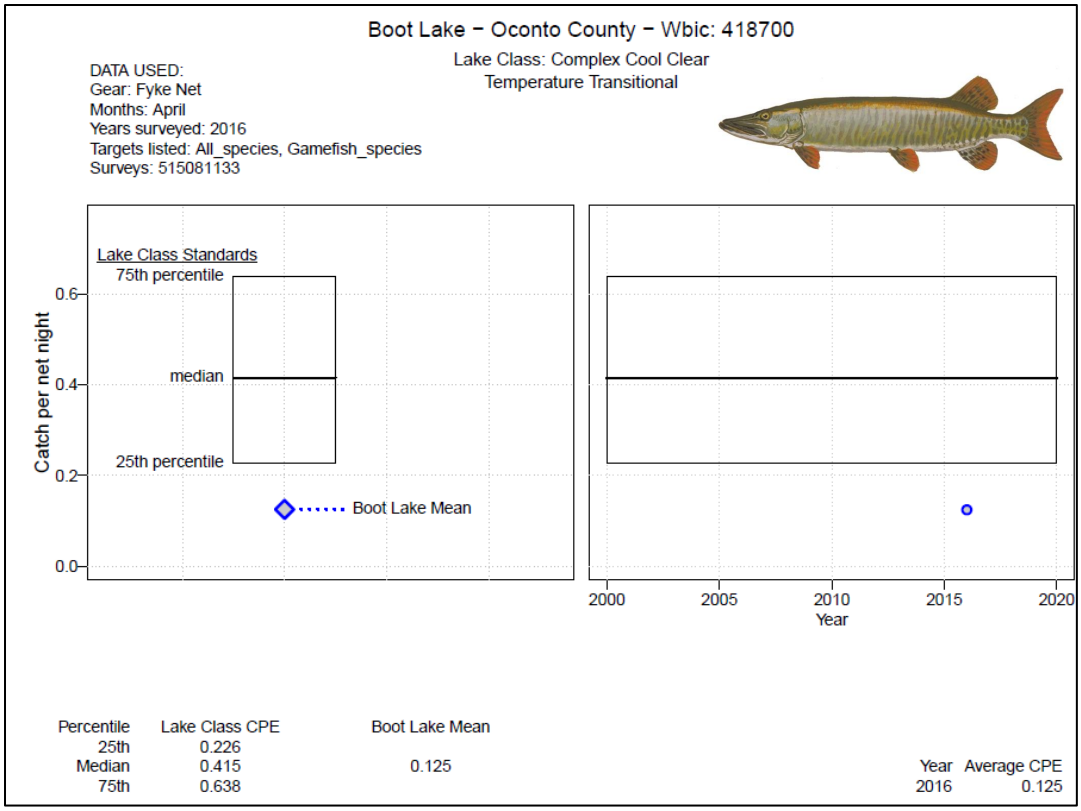

Figure 7. Lake classification muskellunge fyke netting CPUE for Boot Lake, Oconto County, WI.

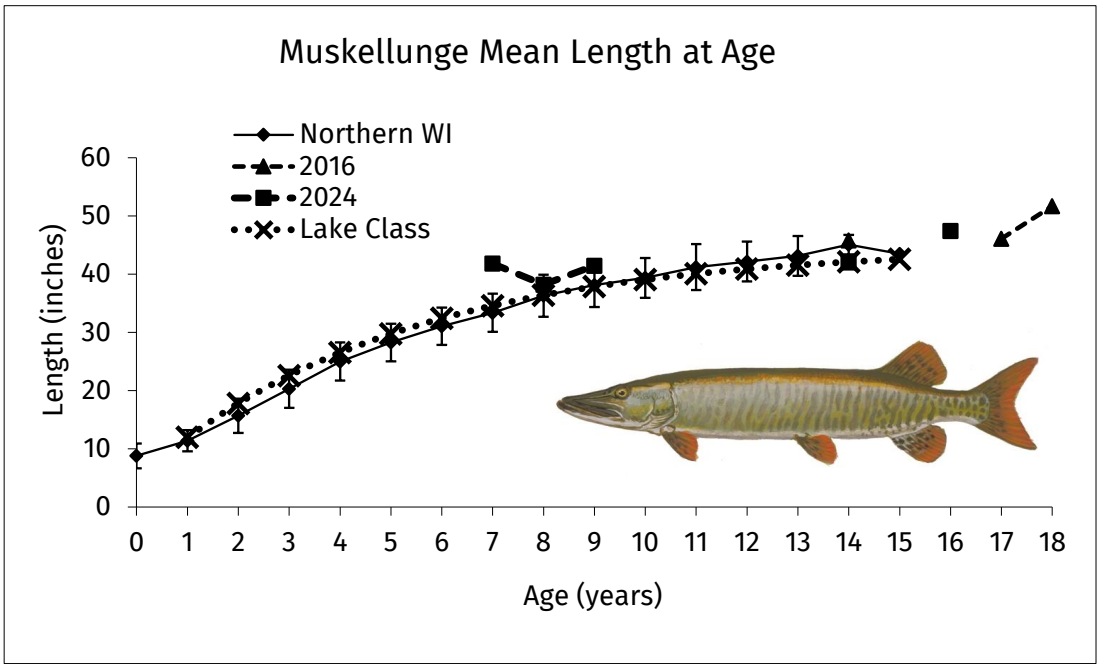

Figure 8. Mean length at age of muskellunge from Boot Lake, Oconto County, WI.

Nine of the muskies collected were aged (Figure 8). Two of the muskies collected were tagged at stocking. A 37.8-inch female was stocked in 2017 at 12.7 inches and was 7 years old. A 41.0-inch unknown fish was stocked in 2016 at 13.0 inches and was 8 years old. Between ages 7 and 9, muskellunge growth was slightly above average compared to the mean length at age in northern Wisconsin and for lakes within its class (Figure 8).

Yellow perch

A total of 125 yellow perch was collected (Table 3 and Figure 9). Perch ranged in length from 6 to 11 inches and averaged 9.4 inches from the spring fyke netting sample (Figure 9). Fyke netting CPUE declined between 2016 and 2024 from 11.4 perch/NN to 0.8/NN, respectively.

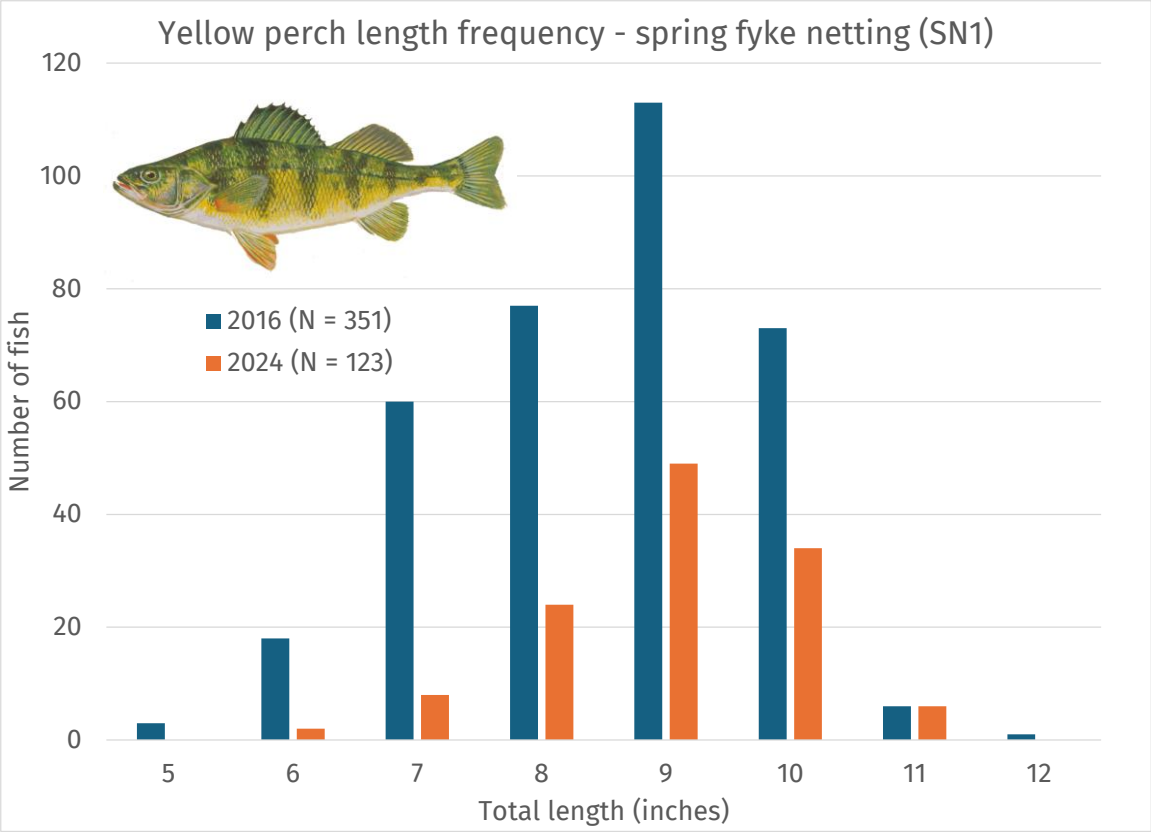

Figure 9. Length frequency of yellow perch collected during 2016 and 2024 SE2 electrofishing surveys from Boot Lake, Oconto County, WI.

Largemouth bass

Largemouth bass were the second most abundant predator species collected during the 2024 survey (Table 3). Overall, 164 largemouth bass were collected during the SE2 electrofishing survey and ranged in length from 6 to 18 inches and averaged 12 inches (Figure 10). PSD increased from 28 to 48 and RSD^{P} increased from 2 to 6 between the 2016 and 2024 surveys. Electrofishing CPUE increased from 12.8 bass/mile in 2016 to 43.2 bass/mile in 2024. This is significantly higher than the median CPUE (6.9/mile) for lakes within its class (Figure 11).

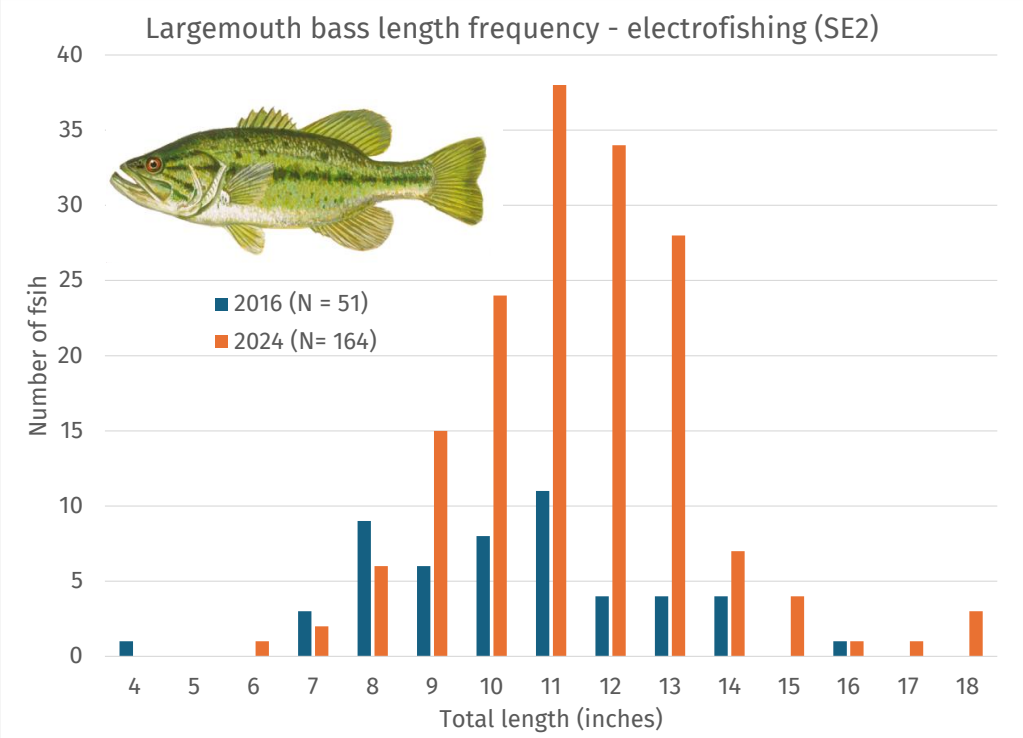

Figure 10. Length frequency of largemouth bass collected during 2016 and 2024 SE2 electrofishing surveys from Boot Lake, Oconto County, WI.

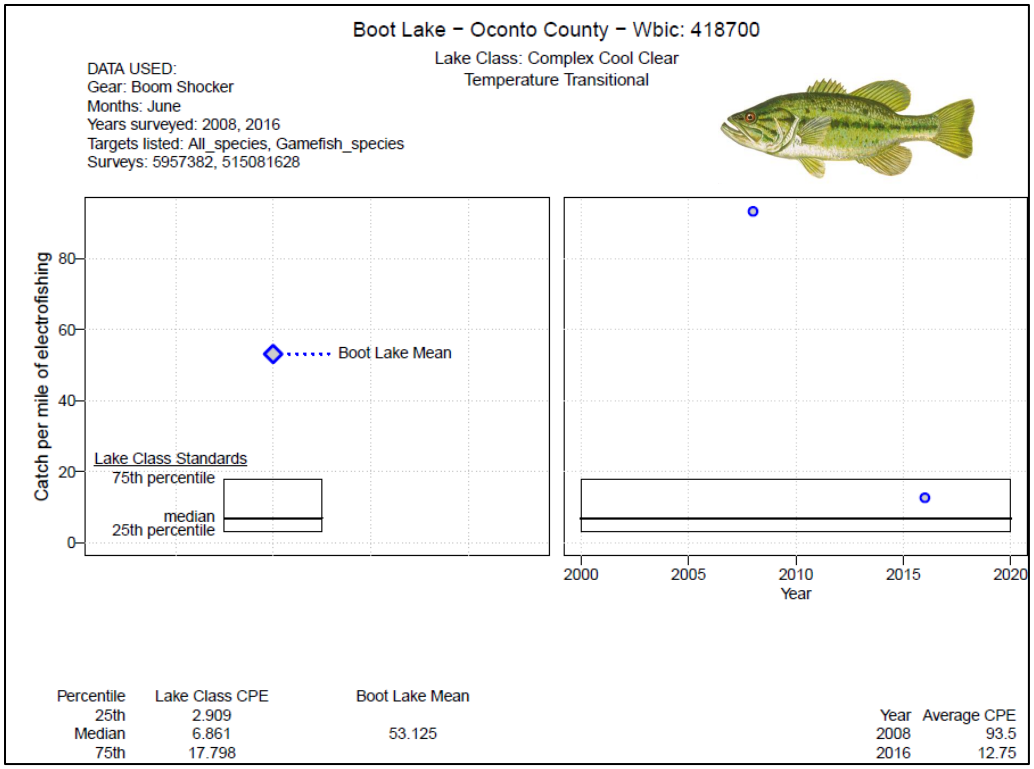

Figure 11. Lake classification largemouth bass electrofishing CPUE for Boot Lake, Oconto County, WI.

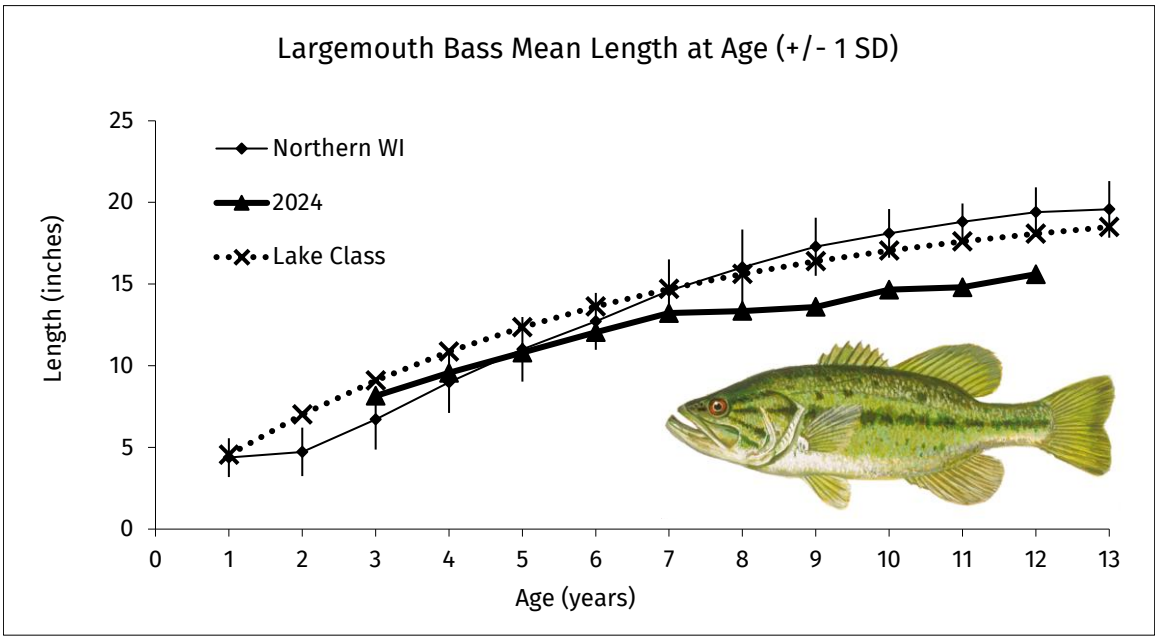

Figure 12. Mean length at age of largemouth bass from Boot Lake, Oconto County, WI.

A subsample of 34 largemouth bass was aged using scales (<12”) and dorsal spines (>12”). Ages ranged from 3 to 12 years old. Largemouth bass growth was average until age 7 but below average at older ages compared to the mean length at age of largemouth bass in northern Wisconsin and for lakes within its class (Figure 12). Largemouth bass were reaching 14 inches at age 7. Good year classes of largemouth bass were present indicating successful reproduction and recruitment.

Bluegill

A total of 29 bluegill was collected during the 2024 SE2 electrofishing survey. Bluegill ranged in length from 2 to 7 inches during the electrofishing (SE2) survey (Figure 13). Electrofishing CPUE declined from 126/mile in 2016 to 29/mile in 2024 which is below the 25th percentile CPUE for lakes within its classification (complex, cool, clear; Figure 14). Bluegill RSD^{P} from the electrofishing sample was not calculated due to the small sample size (< 50 individuals).

A total of 44 bluegill was collected during the SN3 summer fyke netting survey (Figure 15). Bluegill averaged 6.2 inches and CPUE declined from 5.9 bluegill/NN in 2016 to 2.8/NN in 2024.

A subsample of 35 bluegill was aged from 3 to 8 years old. Bluegill growth improved between 2016 and 2024 but was still average compared to the mean length at age in northern Wisconsin and for lakes within its class (Figure 16). Bluegill were reaching 6 inches in length by age 5 (Figure 16).

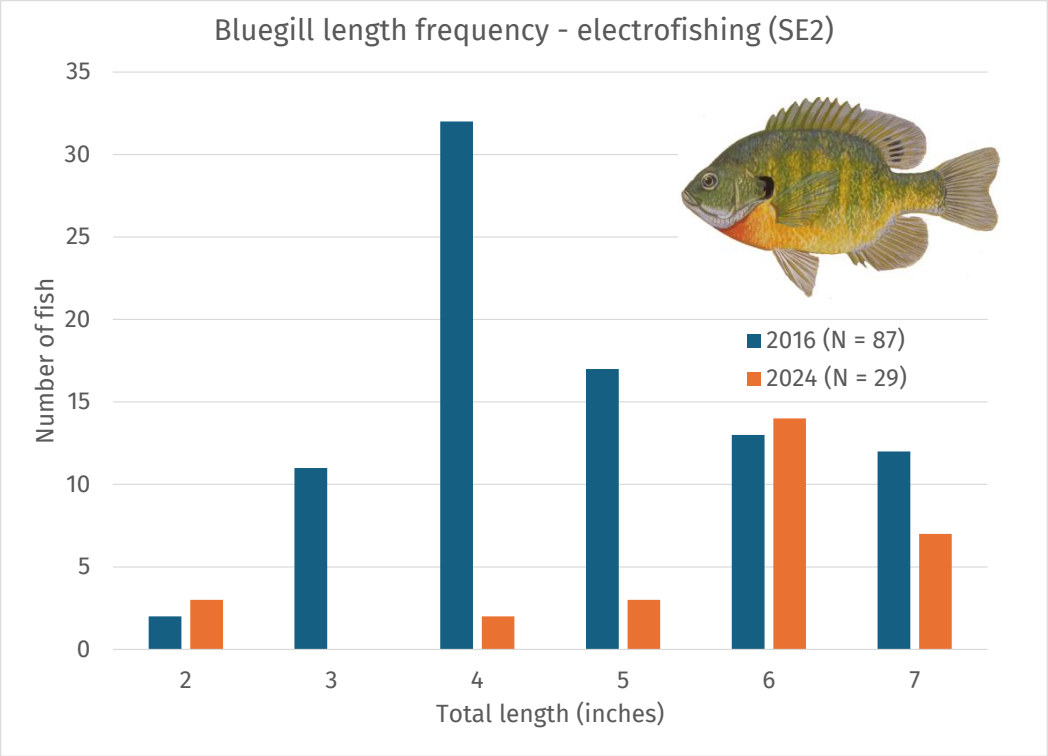

Figure 13. Length frequency of bluegill collected during SE2 electrofishing on Boot Lake, Oconto County, WI.

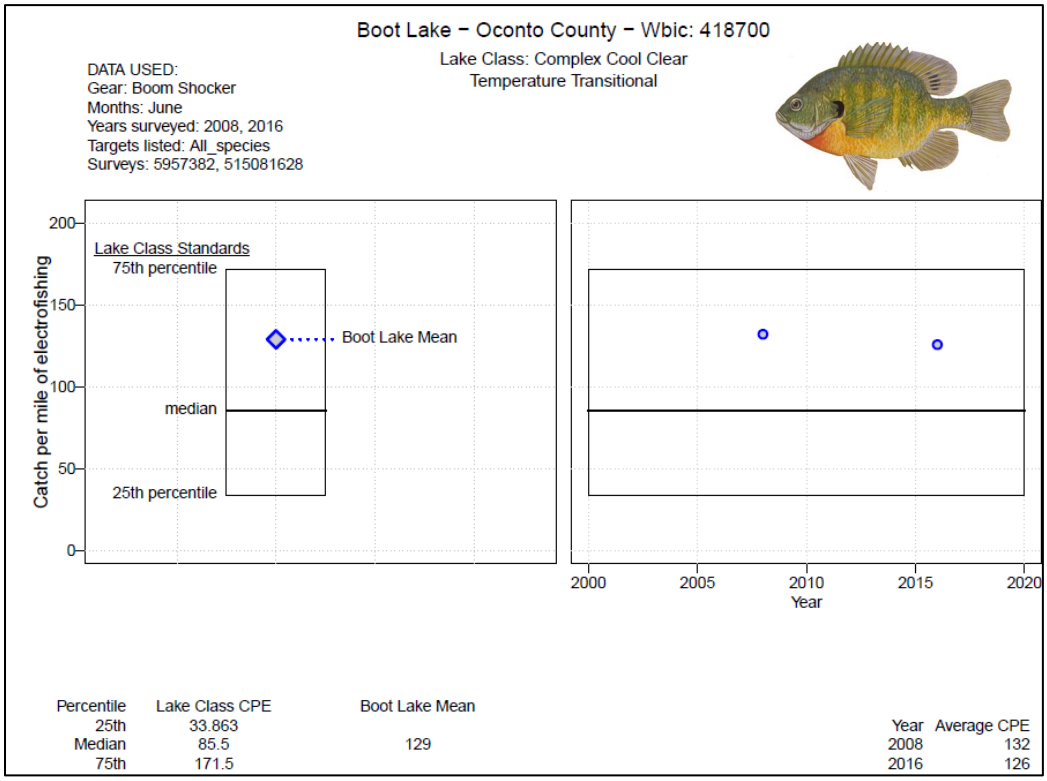

Figure 14. Lake classification bluegill electrofishing CPUE for Boot Lake, Oconto County, WI.

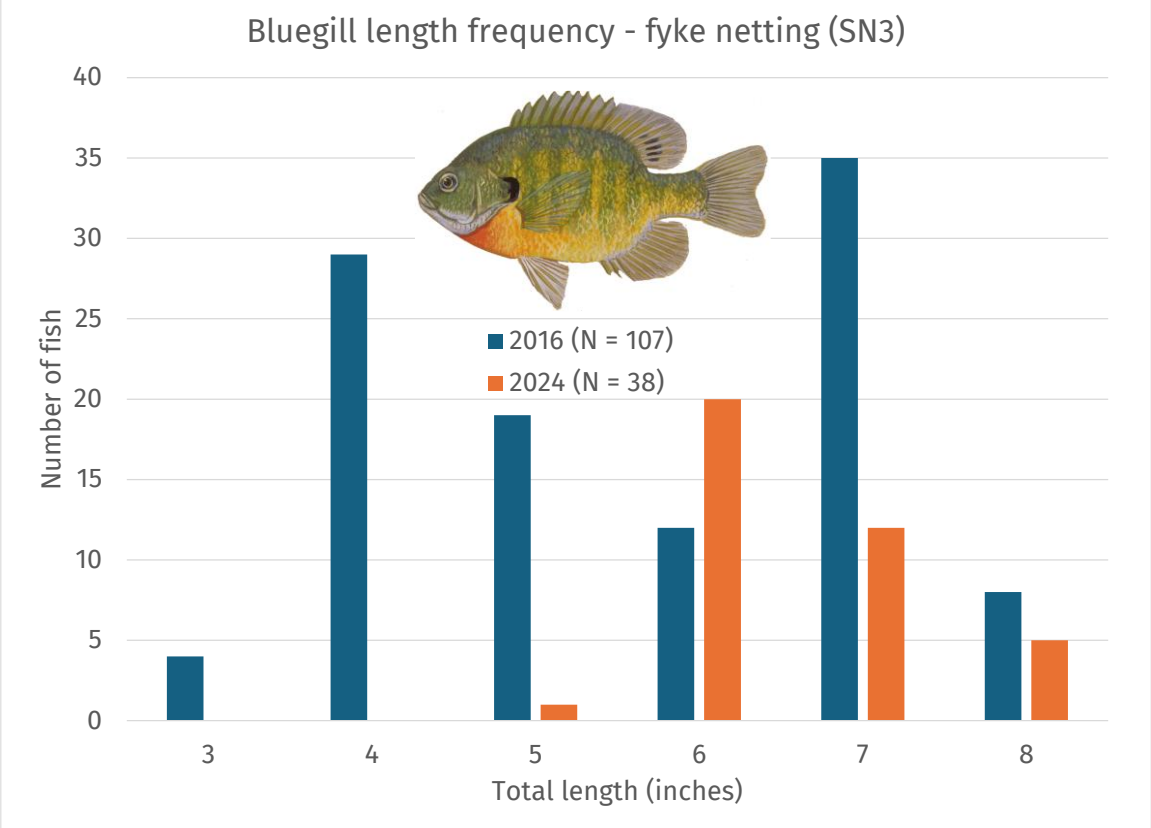

Figure 15. Length frequency of bluegill collected during summer fyke netting (SN3) on Boot Lake, Oconto County, WI.

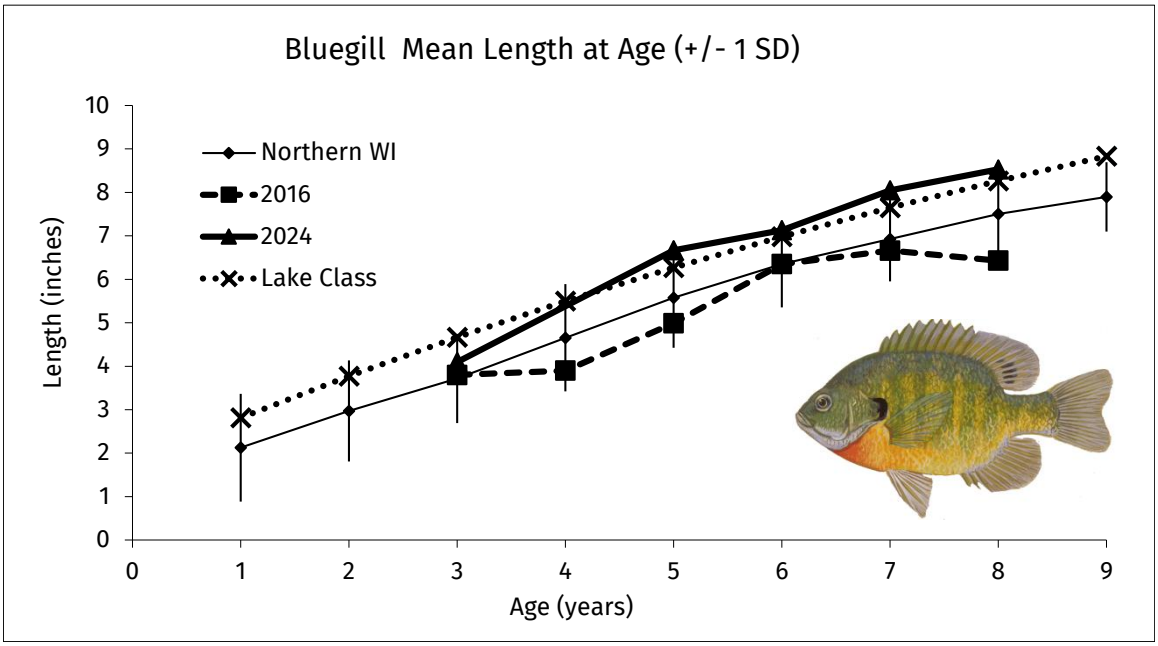

Figure 16. Mean length at age of bluegill from Boot Lake, Oconto County, WI.

Smallmouth bass

Smallmouth bass *Micropterus dolomieu* accounted for 4% of the fish collected during the survey (Table 3). Overall, 53 smallmouth bass were collected during the SE2 electrofishing survey and ranged in length from 5 to 15 inches and averaged 10 inches (Figure 17). PSD increased from 0 to 48 and RSD^{P} increased from 0 to 2 between the 2016 and 2024 surveys. Electrofishing CPUE increased from 0.8 bass/mile in 2016 to 13.9 bass/mile in 2024.

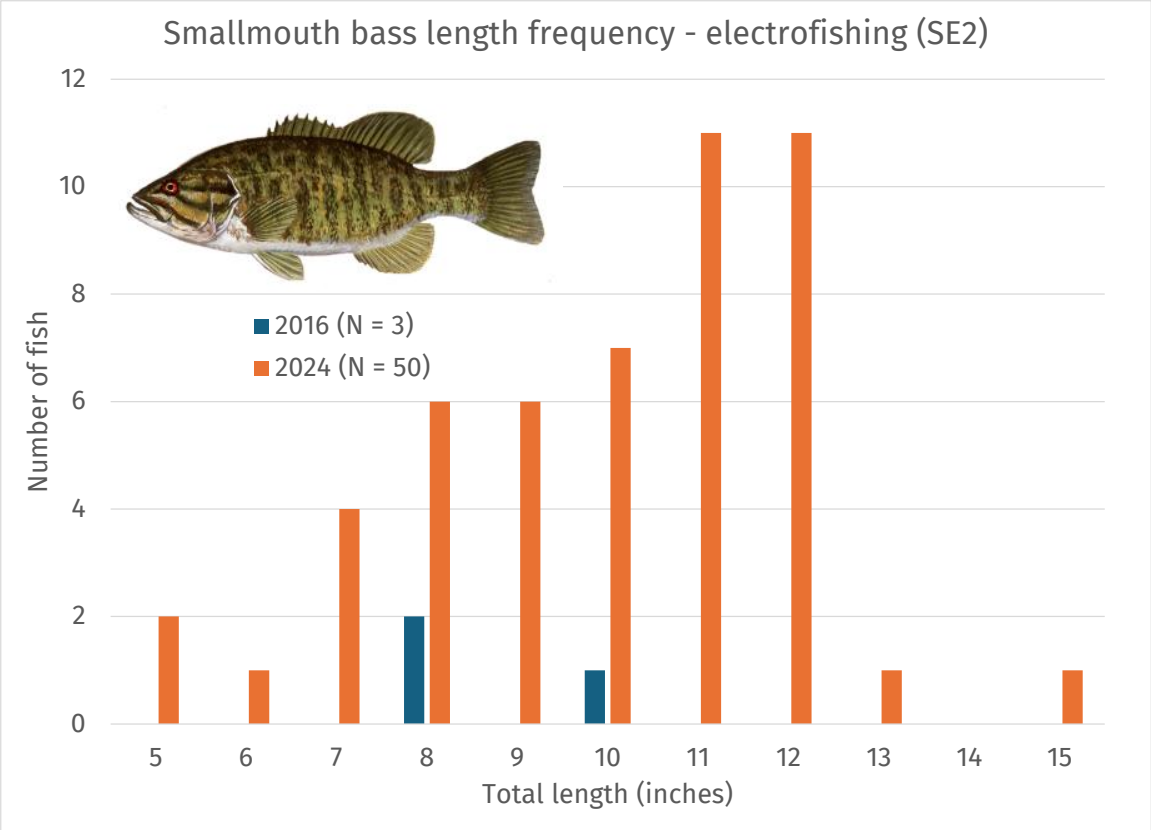

Figure 17. Length frequency of smallmouth bass collected during 2016 and 2024 SE2 electrofishing surveys from Boot Lake, Oconto County, WI.

A subsample of 32 smallmouth bass was aged using scales (<12”) and dorsal spines (>12”). Ages ranged from 3 to 10 years old. Smallmouth bass growth was average until age 6 but below average at older ages compared to the mean length at age of smallmouth bass in northern Wisconsin and lakes within its lake class (Figure 18).

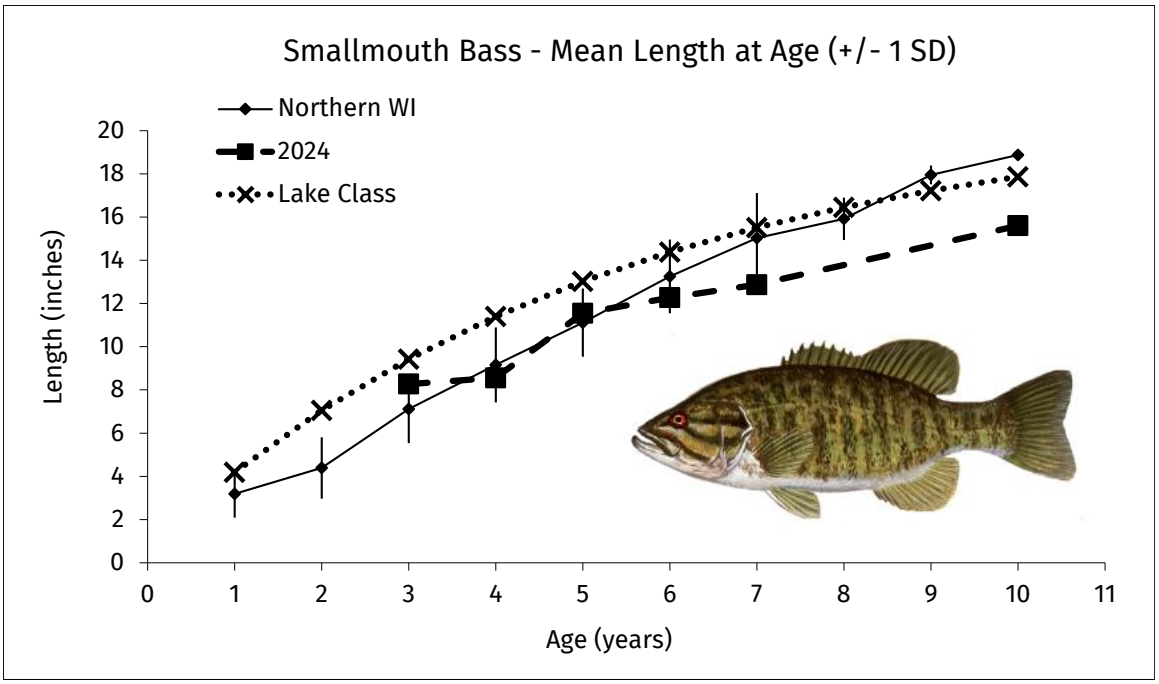

Figure 18. Mean length at age of smallmouth bass from Boot Lake, Oconto County, WI.

Conclusions and Recommendations

Large fingerling walleye stocking was initiated in 2013 at the rate of 10/acre in alternate years (Table 2). Adult density declined slightly between 2016 and 2024 and is below the established goal of 1.5 adults/acre. Spring fyke netting CPUE was nearly identical between the 2016 and 2024 surveys despite extra netting effort in 2024. A total of 56NN of effort occurred in 2016 compared to 157NN in 2024. It's likely that netting in 2024 continued past peak spawning activity. The resulting SE1 recapture survey was also conducted later, leading to fewer fish and recaptures. This resulted in a lower adult density estimate. We feel the current population estimate was underrepresented during this survey due to the timing of the SE1 recap electrofishing survey. Regardless, walleye size structure is good and there should be plenty of harvestable-sized walleye available based on the current length frequency (Figure 1). Natural reproduction is occurring. Therefore, fall electrofishing surveys should also be conducted in alternate years (2026 - when stocking is not scheduled) to monitor walleye reproduction and recruitment to further guide future stocking recommendations.

Muskellunge stockings have provided a modest fishing opportunity in Boot Lake even though fyke netting CPUE has remained relatively low. At the time of the 2024 survey, there were likely only a few stocked year classes that were sexually mature and vulnerable to collection during spring netting. Beginning in 2024, the

muskellunge stocking rate was reduced to 0.5 fish/acre in alternate years because of changes to stocking guidance. The results of this survey suggest that survival is low, and the fishery is underperforming. If stocking 1 fish/acre annually didn't produce the desired abundance, stocking 0.5 fish/acre in alternate years is unlikely to produce better results. Therefore, DNR will no longer manage to stock muskellunge in Boot Lake, however, if a private group/club would like to stock muskellunge, the Department would review that request.

Largemouth bass electrofishing CPUE has fluctuated considerably since 2008. The current largemouth bass CPUE (43.2/mile) is high for this lake classification (Figure 11). Despite the increase in abundance, size structure improved between 2016 and 2024, and growth is average at most ages (Figure 12). Additionally, PSD and RSD^{P} are in the desirable range for a balanced population. Therefore, no regulation change for largemouth bass is recommended at this time but a follow-up SE2 survey should be conducted within the next several years to monitor growth and abundance. Depending on the results of that survey, a regulation change for largemouth bass may be warranted.

The decline in panfish abundance (yellow perch and bluegill) could be the result of increased predation or some other recruitment bottleneck. In 2016, walleye and muskellunge stockings had only just begun in 2013 and 2014, respectively (Table 2). Alternate year stockings of walleye and annual stockings of muskellunge could be creating an imbalance between predator and prey species. Additionally, smallmouth bass were stocked in alternate years between 2016 and 2020 (Table 2). The decline in bluegill abundance likely reduced intraspecific competition explaining the improvement in bluegill growth between 2016 and 2024 (Figure 16). If time permits, additional panfish monitoring (SE2 electrofishing and SN3 panfish fyke netting) should be conducted within the next several years. The results of this sampling effort would also help guide the future walleye and musky stockings.

The smallmouth population was jumpstarted by alternate year stockings between 2016 and 2020 (Table 2). Before 2016, smallmouth bass had not been collected by WDNR since the 1950's. The habitat in Boot Lake is suitable for smallmouth bass. In many parts of the lake, the bottom is littered with rock of various sizes ranging from gravel to boulders. Crayfish are a common prey item for smallmouth and in 2008, rusty crayfish (non-native/invasive) were reported. Therefore, stocking smallmouth bass seemed reasonable. As a result, abundance has increased dramatically. Younger year classes are present which is the result of improved reproduction (Figures 17 and 18).

Northern pike fyke netting CPUE increased but the average size decreased slightly. Northern pike reproduction and recruitment were good. Anglers can expect to readily catch northern pike, but most will be on the small side.

The next comprehensive fisheries survey of Boot Lake is scheduled for 2032 and will focus on the age, growth, abundance, and recruitment of the dominant gamefish. However, a fall walleye survey should be conducted in 2026 to assess survival of stocked fish and evaluate natural reproduction. Also, a SE2 survey in combination with a SN3 (panfish netting) should be conducted within 3 years (by 2029) to monitor changes in largemouth bass and panfish abundance. Access to Boot Lake is adequate. A boat landing is available to anglers from the National Forest and offers ample parking and restrooms. Shore fishing opportunities are available from National Forest property at the campground and the entire north shore of the lake. Boaters are reminded to remove all vegetation from their boat and trailer before leaving to limit the spread of invasive species. A map of Boot Lake can be found at the following internet address; http://dnr.wi.gov/lakes/maps/DNR/0418700a.pdf

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