WISCONSIN DEPARTMENT OF NATURAL RESOURCES

2024 Lake Menomin Fisheries Survey Report

Waterbody Code 2065900

Photo Credit: Kasey Yallaly

Kasey Yallaly
DNR Senior Fisheries Biologist
March 2025

Table Of Contents

Executive Summary

Lake Menomin is a large hypereutrophic flowage on the Red Cedar River in Dunn County located within the city of Menomonie. The lake supports a diverse and productive gamefish and panfishery which are highly popular with anglers. The lake was recently upgraded to a High Profile Lake which will increase the monitoring frequency to every 4 years. A comprehensive fisheries survey was conducted in the spring and fall of 2024. Fyke nets and boat electrofishing gear were used to evaluate the current status and health of the fishery. Walleye were present in high densities while northern pike, largemouth bass, smallmouth bass, bluegill and black crappie were present in densities. Size structure and natural reproduction and recruitment of most fish populations was excellent. Bluegill growth and size structure was particularly impressive. Yellow perch and muskellunge were present in low densities and a decline in yellow perch populations has been documented throughout previous surveys. No stocking is recommended but a potential regulation change may be warranted to reduce harvest of yellow perch. Continued habitat improvements within the littoral zone are recommended to enhance near shore habitat for multispecies benefits.

Introduction

Lake Menomin is a 1,405 acre flowage located in the City of Menomonie in central Dunn County. The flowage is formed by a hydropower dam on the Red Cedar River in Menomonie. The lake is hypereutrophic and suffers from frequent algal blooms in the summer due to nutrient inputs from upstream sources within the watershed. Water quality is poor and the lake is classified as Impaired due to excessive algal growth, elevated pH and eutrophication. Lake Menomin has a maximum depth of 34 feet. Lake Menomin is classified as a Complex Riverine lake within Wisconsin's lakes classification system. There are four public boat landings on Lake Menomin within the city limits and include Point Comfort Park, La Point Park, Lakeside Park and Wakanda Park. Several of these parks offer handicapped fishing access. Another boat landing is located near the Village of Cedar Falls below the Cedar Falls Dam and a DNR carry-in landing provides year-round access to the Cut-Off Slough.

Lake Menomin is one of three major lakes in Dunn County and therefore receives heavy fishing pressure during open water and ice fishing seasons. An angler creel survey was recently completed in 2022 and found that angler effort on Lake Menomin was within the upper third quartile for angler effort when compared to lakes statewide. The lake supports a robust and diverse fishery that includes walleye *Sander vitreus,* largemouth bass *Micropterus salmoides,* smallmouth bass *Micropterus dolomieu,* northern pike *Esox lucius,* muskellunge *Esox masquinongy,* bluegill *Lepomis macrochirus,* black crappie *Pomoxis nigromaculatus* and yellow perch *Perca flavescens.* Bluegill and black crappie were the most popular fish species to target by anglers in 2021-2022, followed by yellow perch, northern pike and walleye. Currently no fish stocking occurs or is required in the lake due to naturally reproducing populations.

Fish habitat within Lake Menomin is diverse and varies greatly throughout the system. A riverine portion of the lake exists directly below the Cedar Falls dam and continues from the spillway downstream to the I-94 bridge where the riverine portion transitions to a more lake-like environment. The riverine portion consists of a main river channel with many backwater bays and sloughs in off channel areas. Substrates throughout this portion of the waterbody

include boulder, gravel and sand within the main channel to sand, muck and silt within the bays. Large woody debris and aquatic macrophyte beds are prevalent. Within the lake portion, several islands exist and depths vary greatly. Several fish crib and tree drop projects have been completed throughout the past several decades. Fish cribs are located within the main basin and tree drops are located along Cemetery Island and along the southeast shoreline. Aquatic macrophytes are also prevalent throughout the lake and can form dense beds. The majority of shoreline consists of natural vegetation but most of the area surrounding the lake is developed.

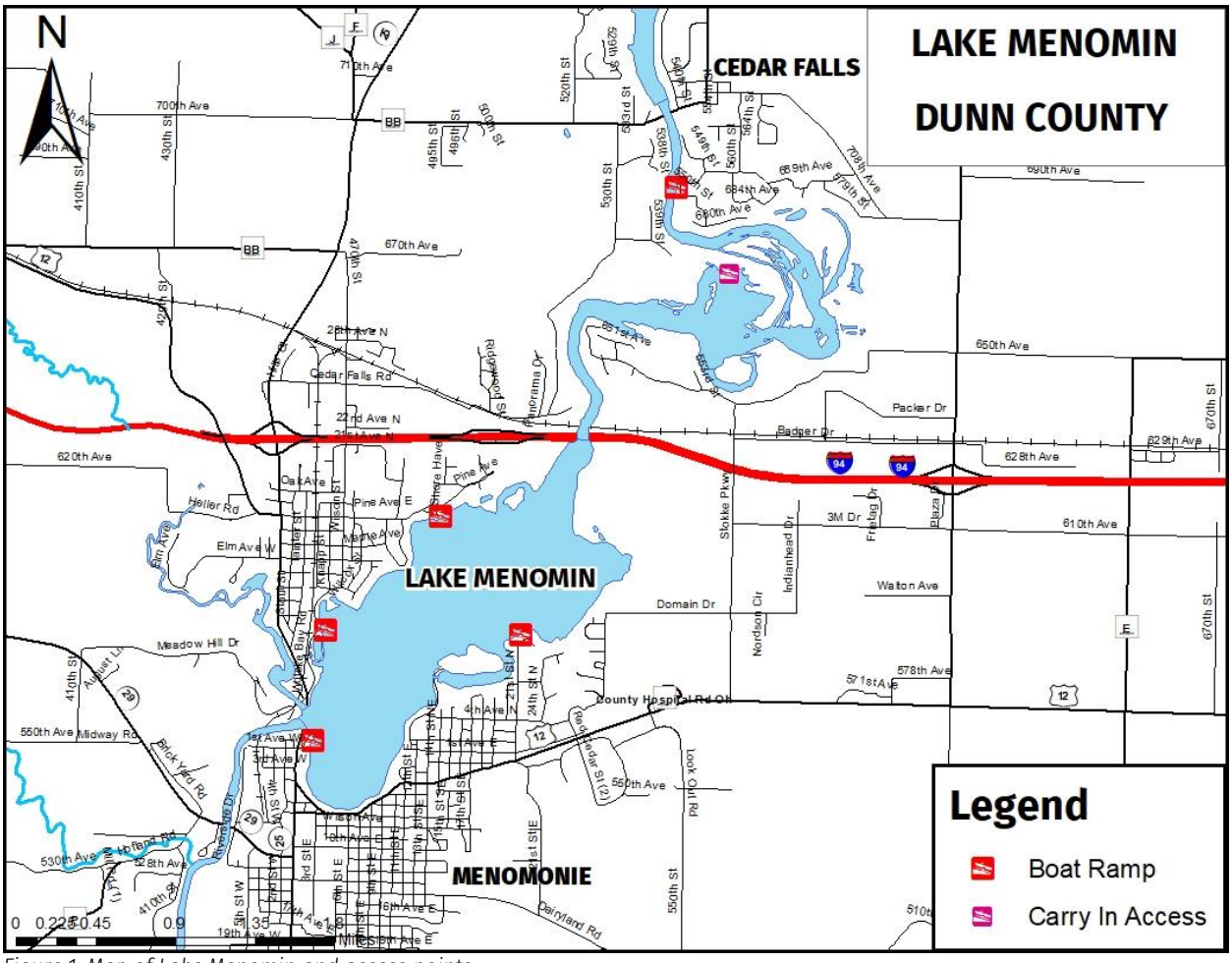

Figure 1. Map of Lake Menomin and access points.

Methods

SURVEY EFFORT

Lake Menomin was surveyed according to standard Spring Netting I, Spring Electrofishing I (SEI), Spring Electrofishing II (SEII) and Fall Electrofishing (FE) protocols as outlined in DNR Fisheries Monitoring Protocols. The primary objective for the Spring Netting I survey was to estimate the size of the adult population of walleye and evaluate size structure and estimate northern pike abundance and size structure. A total of 10 fyke nets were set on March 6th and were ran until March 15th for a total of 74 net nights. Fyke nets were deployed in areas of the lake that contained spawning habitat or were likely travel areas for northern pike and

walleye. All newly captured northern pike and walleye were given a partial fin clip. All gamefish, panfish and non-game species caught during this portion of the survey were counted, measured and weighed.

Boom shockers were used to electrofish the fish refuge and riverine portion of the lake to mark walleye for the marking portion of the population estimate. The refuge was shocked for nine days from March 3rd to March 31st. A recapture run was completed on April 2nd and included the entire shoreline of the riverine section down to I94. The Spring Electrofishing II survey was completed on May 12th and May 14th in which five two-mile stations were electrofished at night after water temperatures exceeded 70°F. Gamefish were collected and measured throughout, and panfish were collected and measured within five one-mile sub stations. Aging structures and weights were collected from a subsample of each species and were processed in a lab to estimate ages and obtain recruitment, growth and mortality of gamefish and panfish species.
The FE survey was conducted during two nights on October 15th and 16th. A total of five two-mile stations were surveyed to target juvenile walleye. All walleye less than 15 inches were sampled and dorsal spines were removed from a subsample of fish for later aging in the lab to determine age breaks and catch rates of age-0 and age-1 walleye.

ANALYSIS

Catch per unit effort (CPUE) is an index used to measure fish population relative abundance, which simply refers to the number of fish captured per unit of distance or time. For netting surveys, CPUE is quantified by the number and size of fish per net night. For electrofishing, CPUE is quantified as the number caught per mile of shoreline electrofished. CPUE indexes are compared to statewide data by percentiles and within lake trends. For example, if a CPUE is in the 90th percentile, it is higher than 90% of the other CPUEs in the state.
Proportional Stock Density (PSD) is an index used to describe the size structure of fish populations. It is calculated by dividing the number of quality size fish by the number of stock size fish for a given species. PSD values between 40 - 60 generally describe a balanced fish population.
Length frequency distribution is a graphical representation of the number or percentage of fish captured by half-inch or one-inch size intervals. Smaller fish (or younger age classes) may not always be represented in the length frequency due to different habitat usage or sampling gear limitations.
Mean length at age is an index used to assess fish growth. Calcified structures (e.g., otoliths, spines or scales) are collected from a specified length bin of interest (e.g., 7.0-7.5 inches for bluegill). Mean age is compared to statewide data by percentile with growth characterized by the following benchmarks: slow (<33rd percentile); moderate (33rd to 66th percentile); and fast (>66th percentile).
Relative weight is an index used to assess the plumpness (i.e., condition) of fish. It is calculated by comparing the observed weight of a fish to the standard weight (i.e., predicted average weight) of that fish, given its length. A relative weight of 93 means it has average plumpness/weight compared to other fish of the same length. Relative weights above 93 mean it is plumper than average.
A population estimate was conducted for the walleye population using the Schnabel method of population estimation with the formula (sum of (Ct x Mt))/R.

Recruitment was evaluated through residual analysis where the sign and magnitude of residuals from a catch-curve regression indicate relative year-class strength. Larger, positive residuals indicate years of higher recruitment and zero or negative residuals indicate years of poorer recruitment.
Growth rates of walleye were calculated using the von Bertalanffy growth model in Fishery Analysis and Modeling Simulator software (FAMS; Slipke and Maceina 2010) and mean length at age for each species was compared to the median mean length at age for lakes across the state within the same lakes classification (Complex Riverine). Growth rates of Northern Pike were estimated by calculating the mean age at 18-18.9 inches for male and female Northern Pike and categorized into percentiles of statewide distributions of growth rates for both sexes.
Total annual mortality was estimated with the formula $1 - e^{(-Z)}$ and instantaneous mortality (Z) was calculated from the slope of the regression from the descending right limb of the age-frequency distribution.

Results

WALLEYE

A total of 812 adult walleye were captured and marked during the electrofishing marking phase of the population estimate. Only five walleye were captured in fyke nets. Catch rates of walleye during the marking phase ranged from 19.6 fish per hour on March 3rd to 213 fish per hour on March 13th for an average catch rate of 65 fish per hour. The adult walleye population was estimated at 3.1 adults per acre (95% C.L. 2.6 to 4.1 per acre; CV=11.6%) or 4,399 individual adults. The current adult population estimate was higher than previous surveys conducted in 1999 (2.6 adults per acre), 2005 (2.4 adults per acre) and 2011 (1.4 adults per acre; Figure 2). Walleye ranged in length from 11.5 to 26 inches with a mean length of 16.3 inches (95th percentile; Figure 3). PSD of walleye during the Spring Electrofishing I survey was 60 while RSD-P was 10. Walleye were in excellent condition with a mean relative weight of 106. A total of 174 walleye were sampled during the SEII survey for a catch rate of 17.4 fish per mile of shoreline. Lengths of walleye during the SEII survey ranged from 4.5 to 21 inches.

During the FE survey, walleye ranged in length from 5.3 to 22.5 inches (Figure 3). Catch rates of age-0 walleye were low at 1.3 per mile and lengths ranging from 5.3 to 8.4 inches and average length was 7.2 inches. Age-1 walleye ranged in length from 7.4 to 10.9 inches with an average length of 9.2 inches. CPUE of age-1 walleye was 7.9 fish per mile. Average length of age-2 fish was 12.7 inches.

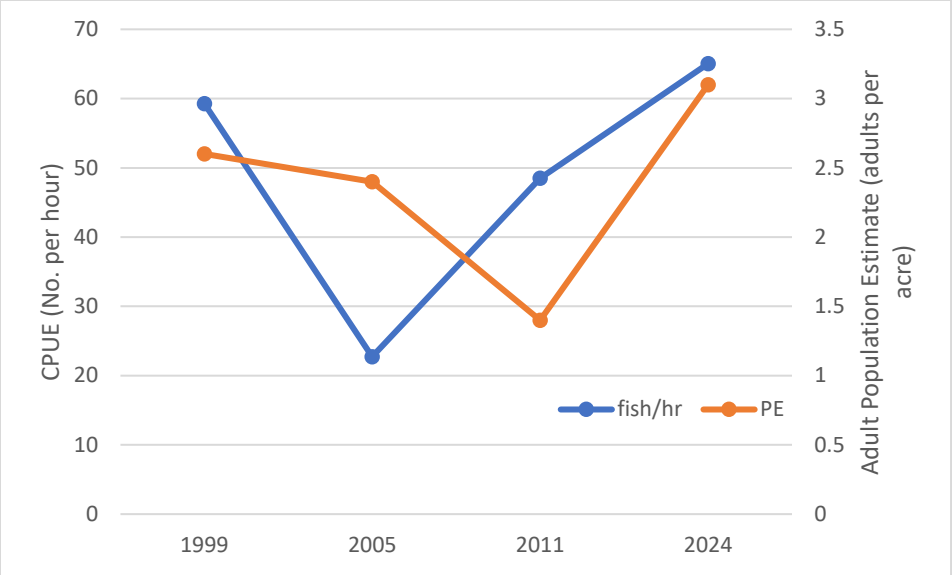

Figure 2. Walleye catch rates (CPUE) and adult population estimates from 1999 to 2024 in Lake Menomin.

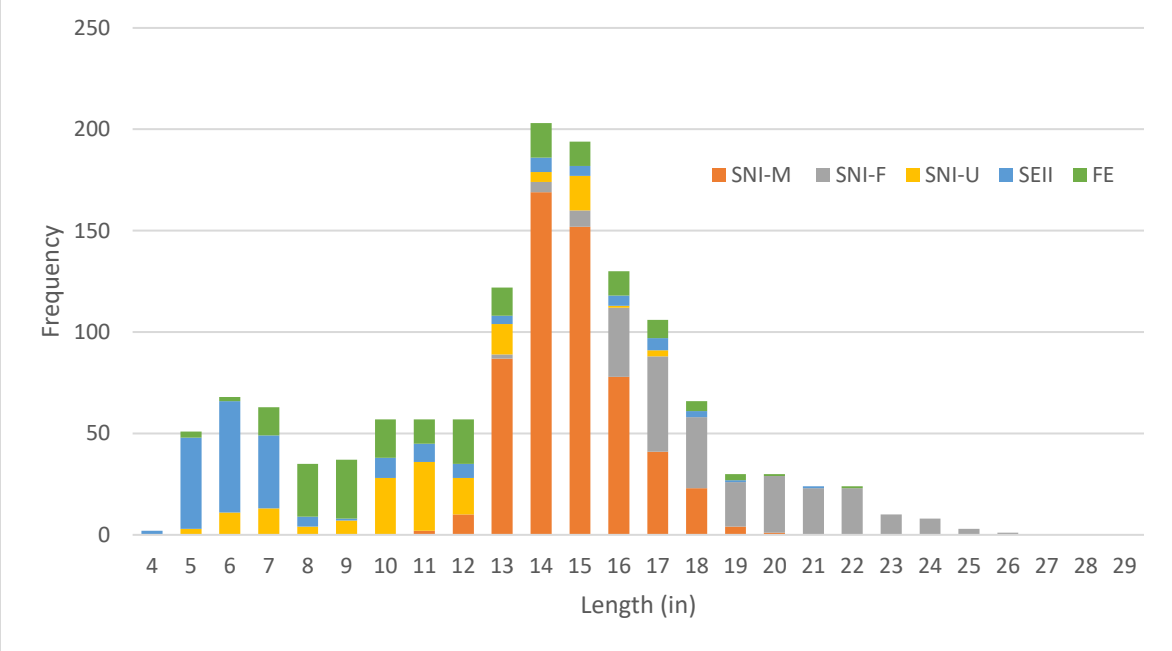

Figure 3. Length frequency distribution of walleye collected during the SNI (spring netting I) survey by sex (M-male, F-female, U-unknown sex), SEII (Spring Electrofishing II) survey and FE (Fall Electrofishing) survey in Lake Menomin in 2024.

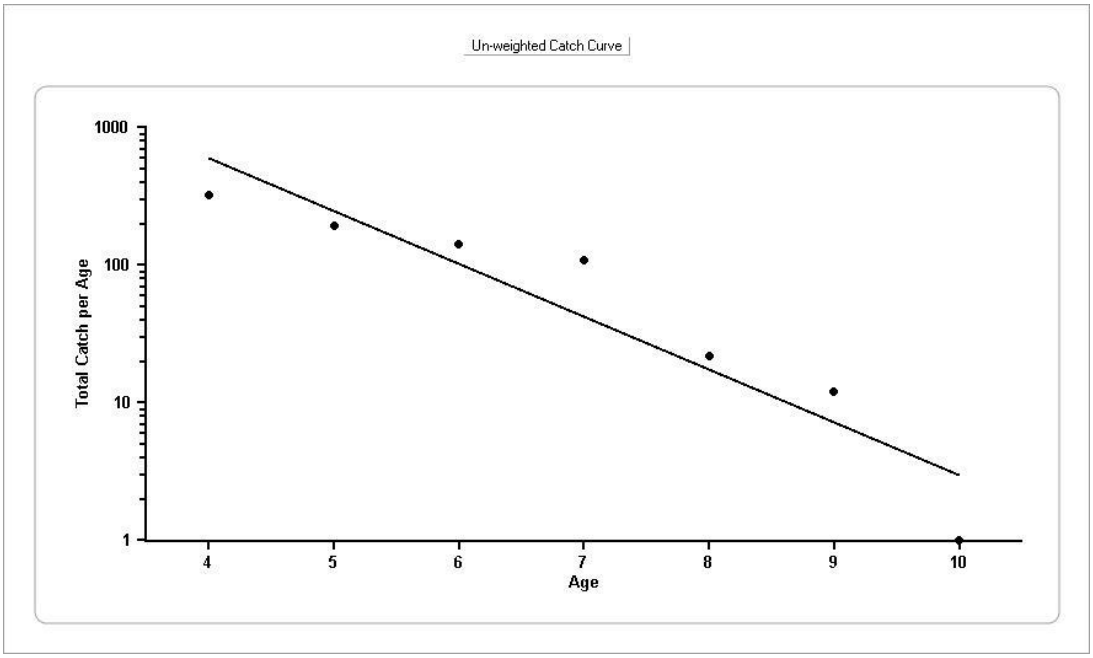

Figure 4. Catch curve of walleye ages collected from Lake Menomin in 2024.

Walleye recruitment was consistent but consisted of strong year classes in 2018, 2017, 2016 and 2015 while weak year classes resulted from the years of 2020, 2019 and 2014 (Figure 4 & 5). Maximum age of walleye within the sample was 10 years old while mean age of mature fish was 5.1 years old (Figure 4). Overall walleye growth was average when compared to statewide averages in similar lakes. Sex specific growth rates differed considerably with females growing approximately 3.8 inches per year faster than males (Figure 6). Males reached 15 inches in 4.4 years on average. Growth coefficients estimated by the von Bertalanffy growth model described mean length at age (L_{inf}= 690, K= 0.161, t_0=-0.901, n=802, P < 0.0001, r^2= 0.96,). The female to male sex ratio was 1:4 during the SEI survey. The total annual mortality of adult walleye was 58.7% (r^2=0.88, n=802, P=0.0001).

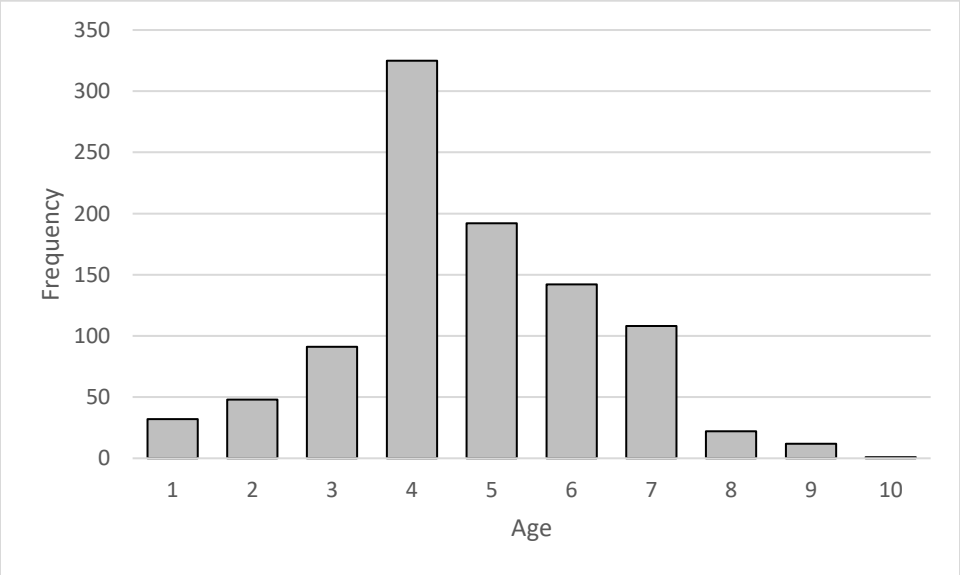

Figure 5. Age frequency distribution of walleye collected from Lake Menomin during spring 2024.

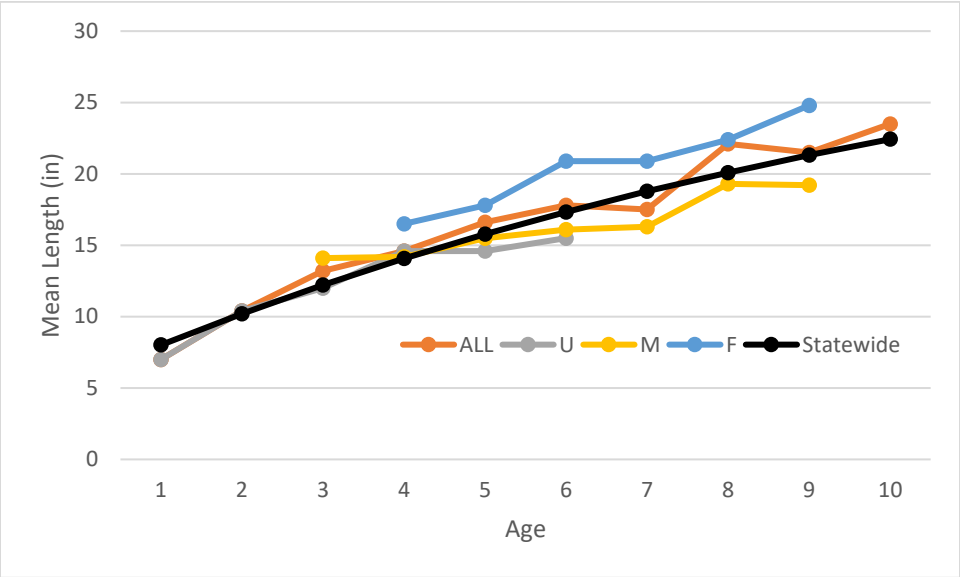

Figure 6. Mean length at age of walleye collected from Lake Menomin in Dunn County in 2024 and median mean length at age of walleye in Complex Riverine lakes across Wisconsin. All fish represents unknown, male and female walleye combined, U-Unknown sex fish, M-Males, F-Females.

NORTHERN PIKE

Northern pike were present in moderate abundance with a CPUE of 2.2 fish per net night (50th percentile). Catch rates of northern pike have declined substantially since 2011 during which CPUE was 22.3 fish per net night (Figure 8). A total of 162 northern pike were captured in fyke nets and 38 were captured with electrofishing gear during the SEII survey. Within the fyke net survey, 33 females, 89 males and 40 unknown sex fish were sampled. Lengths of northern pike ranged from 9 to 35.9 inches with a mean length of 17.9 inches (Figure 7). Female pike ranged in length from 16.8 to 35.9 inches, males ranged from 9 to 25.4 inches and unknown sex pike ranged from 9 to 17.1 inches. PSD of northern pike was 49 and RSD-P was 8 and five memorable size fish (> 34 inches) were sampled during the survey. Relative weight of pike was good with a mean W_r value of 93. Growth rates of male northern pike as predicted by mean age at 18-19 inches were within the 50th percentile of growth rates for northern pike statewide (3.25 years old at 18-19 inches).

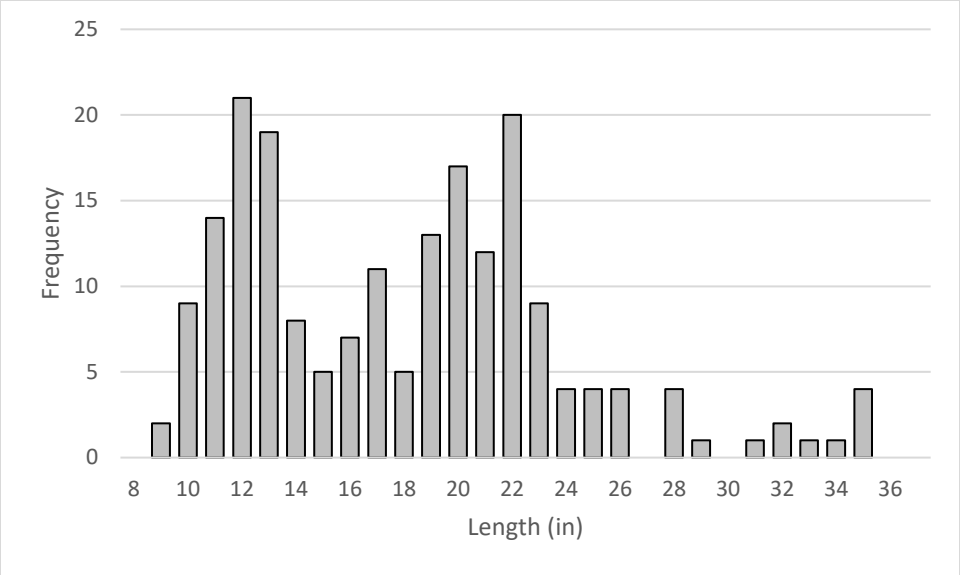

Figure 7. Length frequency distribution of northern pike collected from Lake Menomin, Dunn County in 2024.

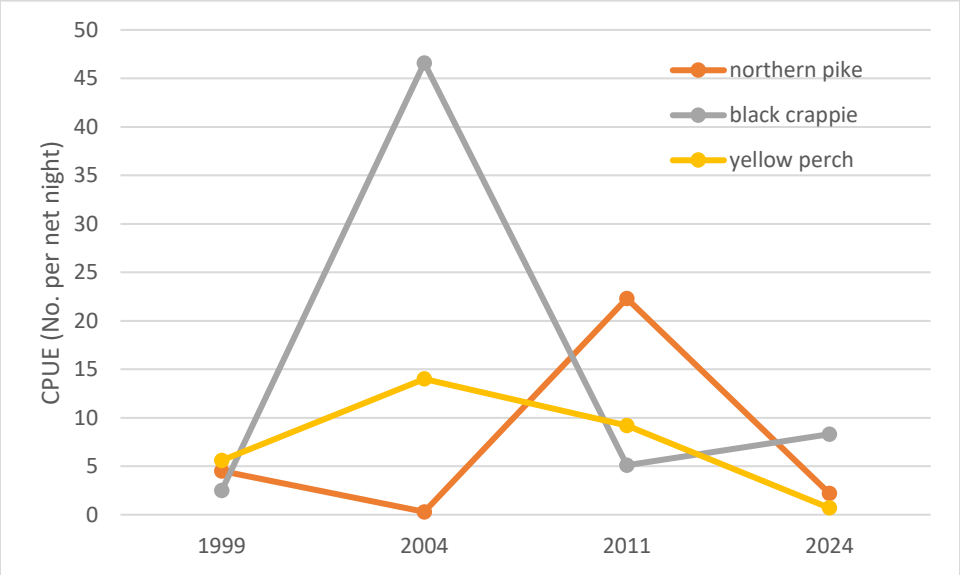

Figure 8. Fyke net catch rates (CPUE) of northern pike, black crappie and yellow perch from 1999 to 2024 in Lake Menomin.

LARGEMOUTH BASS

A total of 111 largemouth bass were sampled throughout the surveys in 2024. A total of 78 fish were sampled during electrofishing surveys which resulted in CPUE of 10.2 fish per mile (50th percentile). The 2024 catch rate was the lowest CPUE documented since 1999 (Figure 10). Mean catch rates during the 2004, 2011 and 2019 surveys was 16.1 fish per mile. Lengths of largemouth bass ranged from 4 to 19.5 with a mean length of 13.3 inches (Figure 9). PSD of largemouth bass was 95 and RSD-P was 53. No memorable size (> 20 inches) or trophy size (> 25 inches) fish were sampled and 45% of fish were larger than 15 inches. Mean relative weight of largemouth bass was excellent at 123.

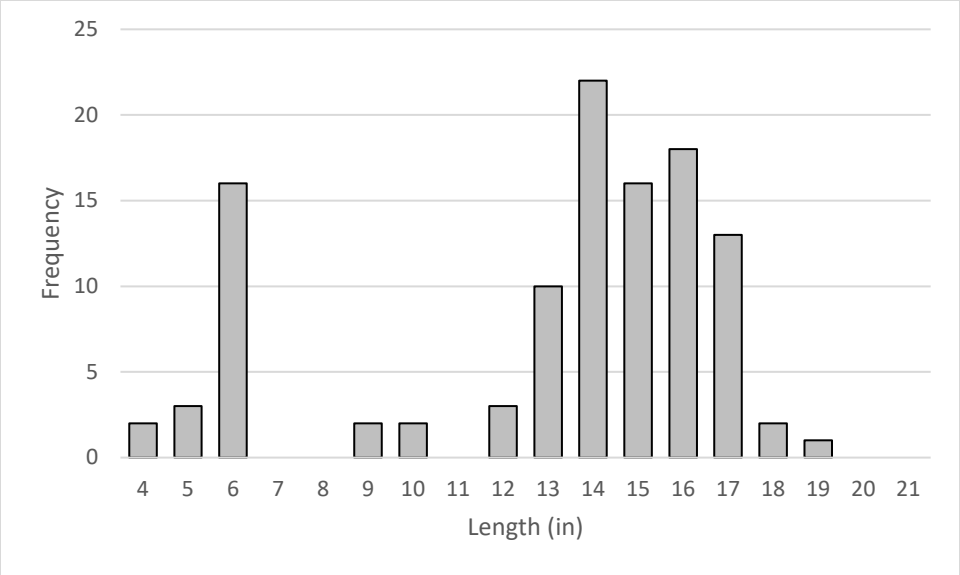

Figure 9. Length frequency distribution of largemouth bass collected from Lake Menomin, Dunn County in 2024.

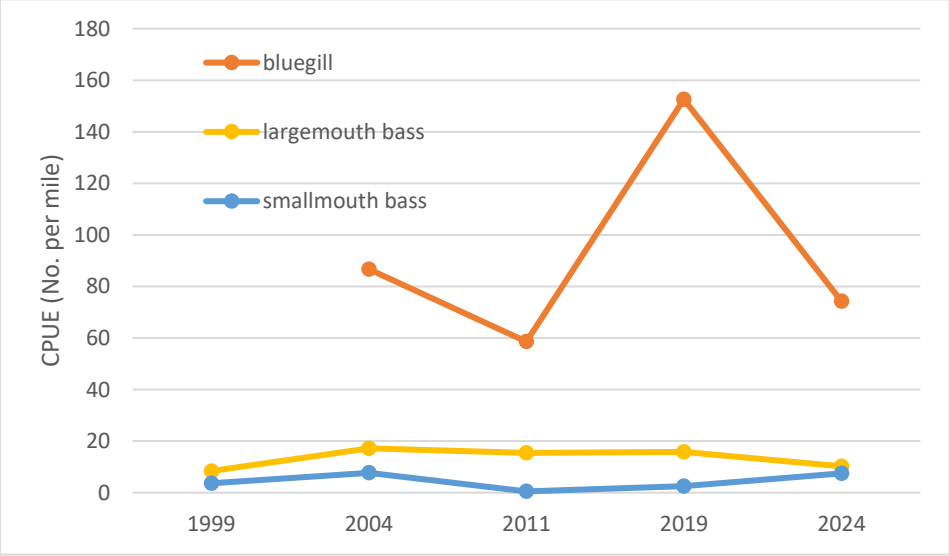

Figure 10. Electrofishing catch rates (CPUE) of bluegill, largemouth bass and smallmouth bass from 1999 to 2024 in Lake Menomin.

Recruitment of largemouth bass was erratic with several weak year classes in 2018, 2017 and 2016 and an exceptionally strong year class in 2015 (Figure 11). Growth rates of largemouth bass were comparable to the statewide average growth rates for largemouth bass in similar lakes (Figure 12). Low mean length at age at age-6 and age-14 were due to small sample sizes of the those age classes. On average, largemouth bass reached harvestable length (14 inches) in 4.25 years. Growth coefficients estimated by the von Bertalanffy growth model described mean length at age (L_{inf}= 503, K= 0.191, t_0=-0.596, n=117, P < 0.0001, r^2= 0.90,). Maximum age of largemouth bass was 14 years of age.

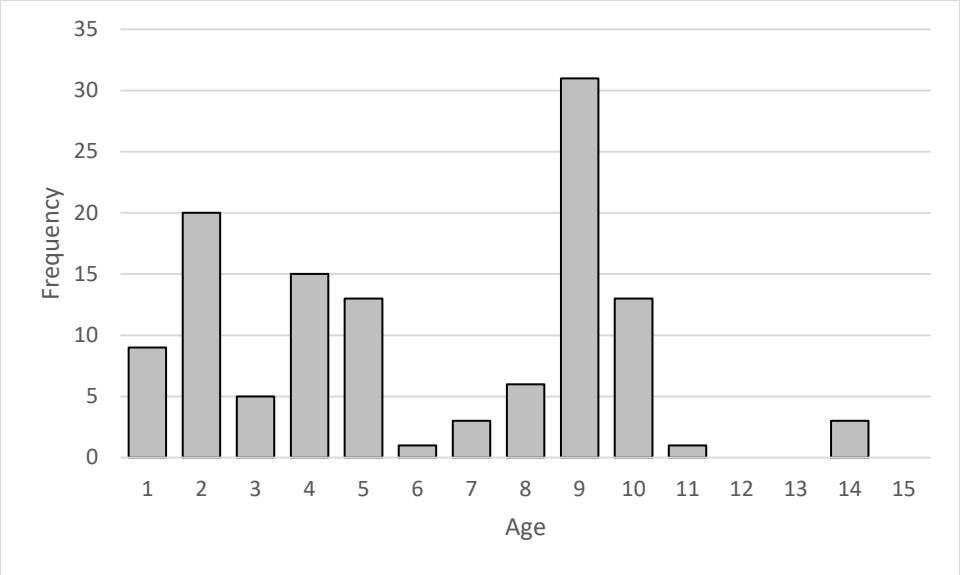

Figure 11. Age frequency distribution of largemouth bass collected from Lake Menomin during spring 2024.

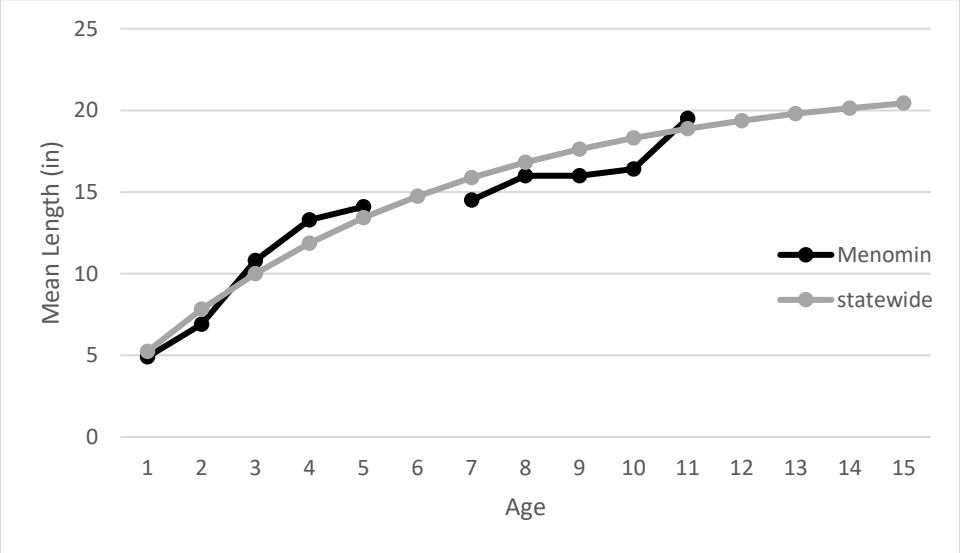

Figure 12. Mean length at age of largemouth bass collected from Lake Menomin in Dunn County in 2024 and median mean length at age of largemouth bass in Complex Riverine lakes across Wisconsin.

SMALLMOUTH BASS

A total of 75 smallmouth bass were captured during electrofishing surveys for a CPUE of 7.5 fish per mile (50th percentile). CPUE of smallmouth bass has increased since the 2004 survey (Figure 10) and was the highest catch rate for smallmouth bass in all previous surveys except for 2004 (7.7 fish per mile). Lengths of smallmouth bass ranged from 8 to 18.5 inches with a mean length of 12.6 inches (Figure 13). PSD of smallmouth bass was 87 and RSD-P was 25. Only one fish was of memorable size (17 inches) and no fish were trophy size (20 inches) or larger. Approximately 25% of fish were larger than 14 inches. Mean relative weight of smallmouth bass was 103.

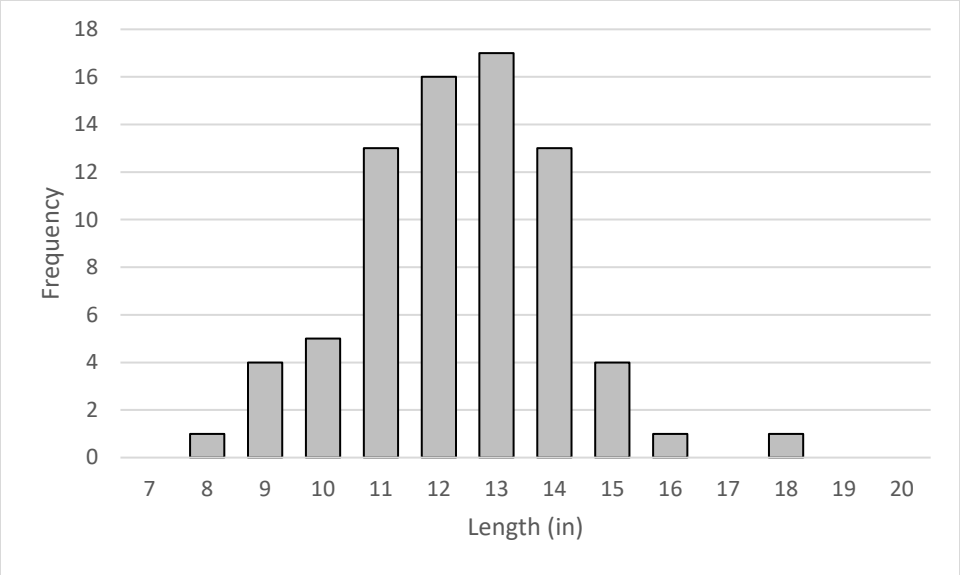

Figure 13. Length frequency distribution of smallmouth bass collected from Lake Menomin, Dunn County in 2024.

In terms of recruitment, weak year classes of smallmouth bass resulted from the years of 2022, 2021 and 2020. A total of seven year classes were present in the sample with maximum age at 9 years old (Figure 14). Average age of smallmouth was 4.75 years of age. Growth of smallmouth bass was comparable to average growth rates in similar lakes across the state (Figure 15) with smallmouth reaching harvestable size in 6 years. Growth coefficients estimated by the von Bertalanffy growth model described mean length at age (L_{inf}= 500, K= 0.23, t_0=-0.181, n=75, P < 0.0001, r^2= 0.99*).*

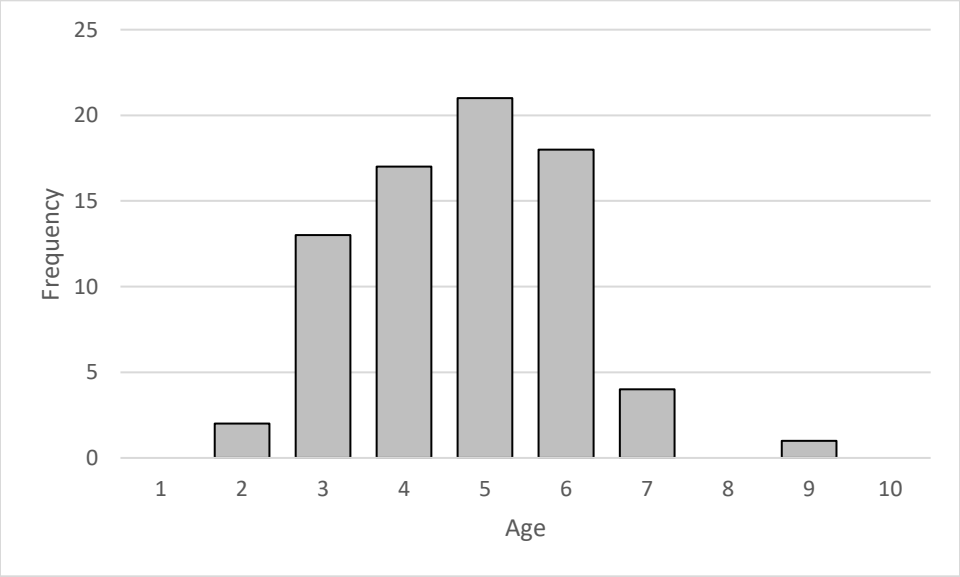

Figure 14. Age frequency distribution of smallmouth bass collected from Lake Menomin during spring 2024.

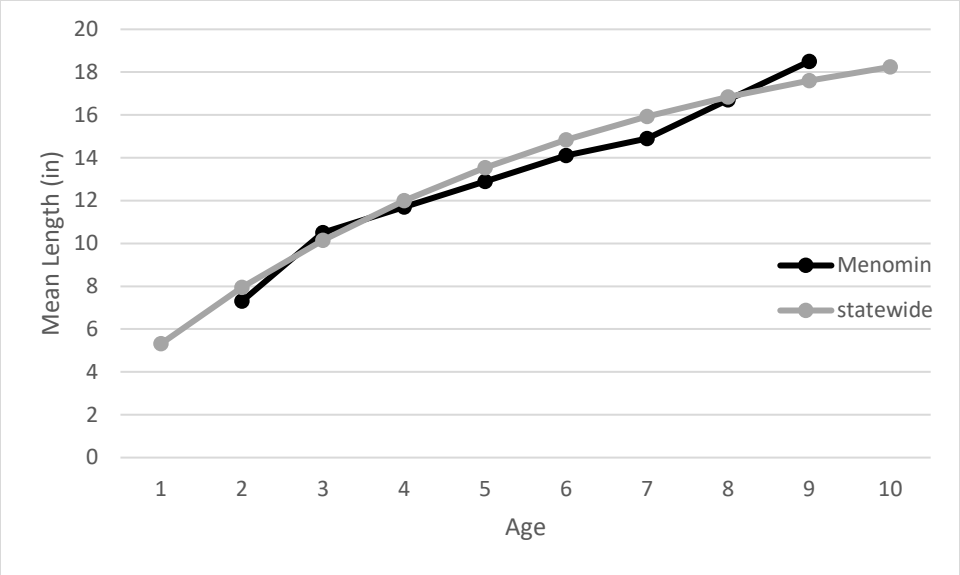

Figure 15. Mean length at age of smallmouth bass collected from Lake Menomin in Dunn County in 2024 and median mean length at age of smallmouth bass in Complex Riverine lakes across Wisconsin.

BLUEGILL

Bluegill were the most numerous panfish species sampled during 2024 with a total of 1,322 captured throughout surveys. The electrofishing catch rate of bluegill was 74.3 fish per mile (50th percentile) which was slightly below the long-term average (93 fish per mile) since 2004. Size structure of bluegill was excellent with mean length at 6.8 inches (99th percentile) and lengths ranging from 1 to 9.9 inches (Figure 16). Mean length of bluegill has increased from 6.4 inches in 2019 and 6.2 inches in 2011. PSD was also excellent at 76 and RSD-P was 36. Approximately 31% of bluegill were larger than 8 inches. Bluegill were in excellent condition with a mean relative weight of 114.

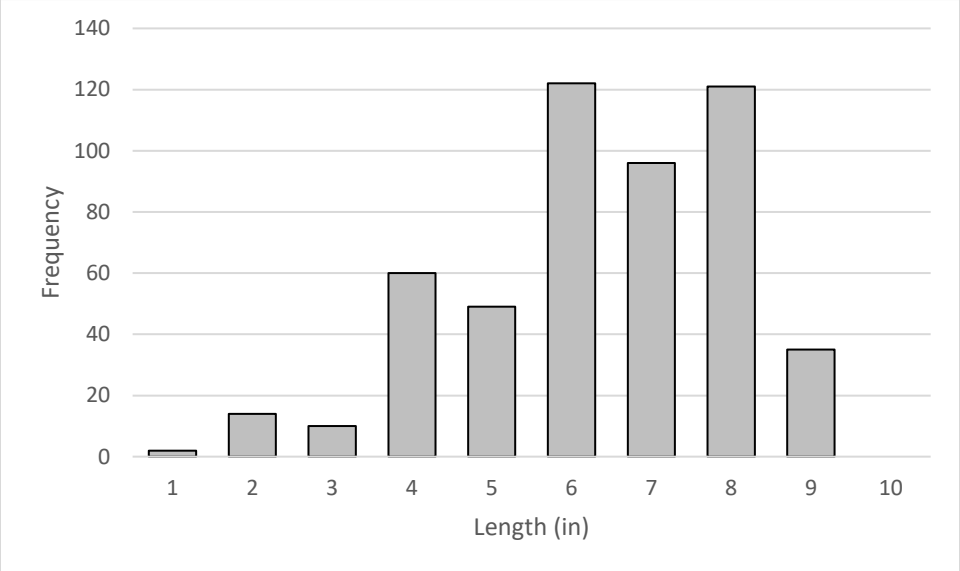

Figure 16. Length frequency distribution of bluegill collected from Lake Menomin, Dunn County in 2024.

Ages of bluegill ranged from 1 to 9 years old and average age was 3.4 years old (Figure 17). Recruitment of bluegill was variable but a strong year classes was observed in 2020 while weak year classes were documented in 2021 and 2019. Growth rates of bluegill were high and well above the upper quartile when compared to bluegill in similar lakes across the state (Figure 18). On average, bluegill reached 7 inches in 3 years and 9 inches in 5 years. Growth coefficients estimated by the von Bertalanffy growth model described mean length at age (L_{inf}= 258, K= 0.39, t_0=-0.18, n=503, P < 0.0001, r^2= 0.99). Total annual mortality of bluegill was 45.9% (r^2=0.80, n=387, P=0.0001).

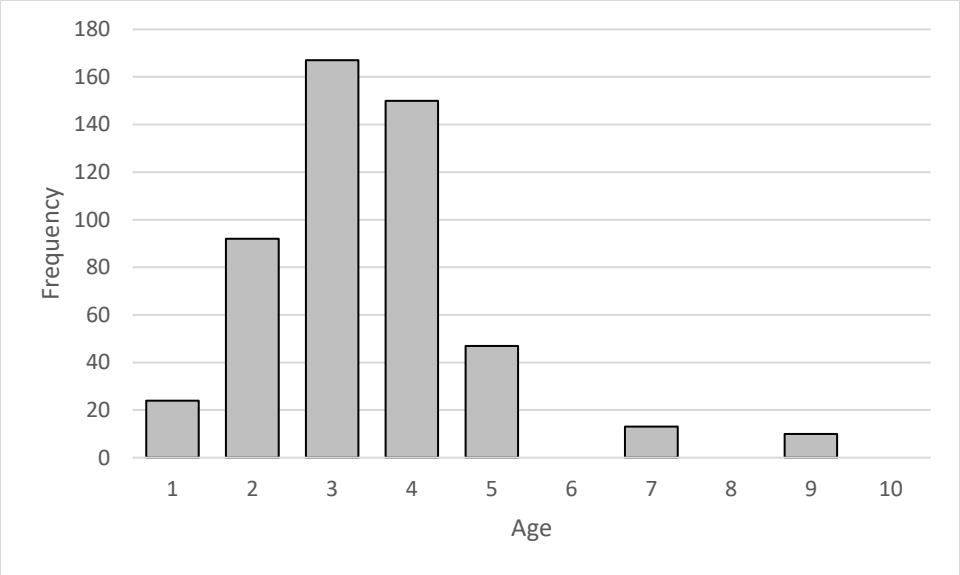

Figure 17. Age frequency distribution of bluegill collected from Lake Menomin during spring 2024.

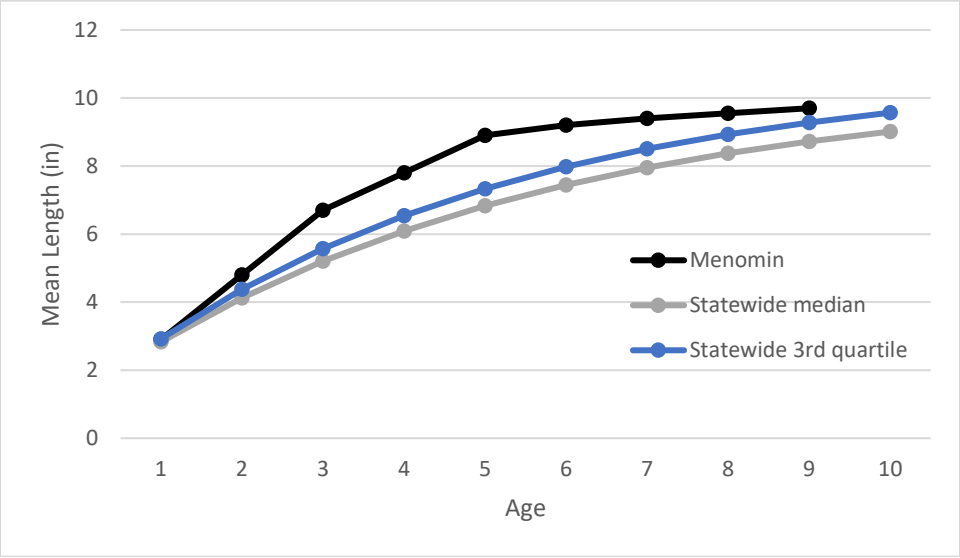

Figure 18. Mean length at age of bluegill collected from Lake Menomin in Dunn County in 2024 and median mean length at age of bluegill in Complex Riverine lakes across Wisconsin.

BLACK CRAPPIE

A total of 693 black crappie were collected throughout surveys in 2024 which resulted in a fyke net CPUE of 8.3 fish per net night (50th percentile) and an electrofishing CPUE of 20.5

fish per mile. Based on previous surveys, fyke netting CPUE has increased since 2011 (5.1 fish per net night; Figure 8). Black crappie ranged in length from 2.8 to 12.7 inches and had a mean length of 7.1 inches (Figure 19). PSD was 43 and RSD-P was 30. Approximately 27% of black crappie were larger than 10 inches and only three fish were of memorable size (> 12 inches) or larger. Black crappie were in excellent condition with a mean relative weight of 111.

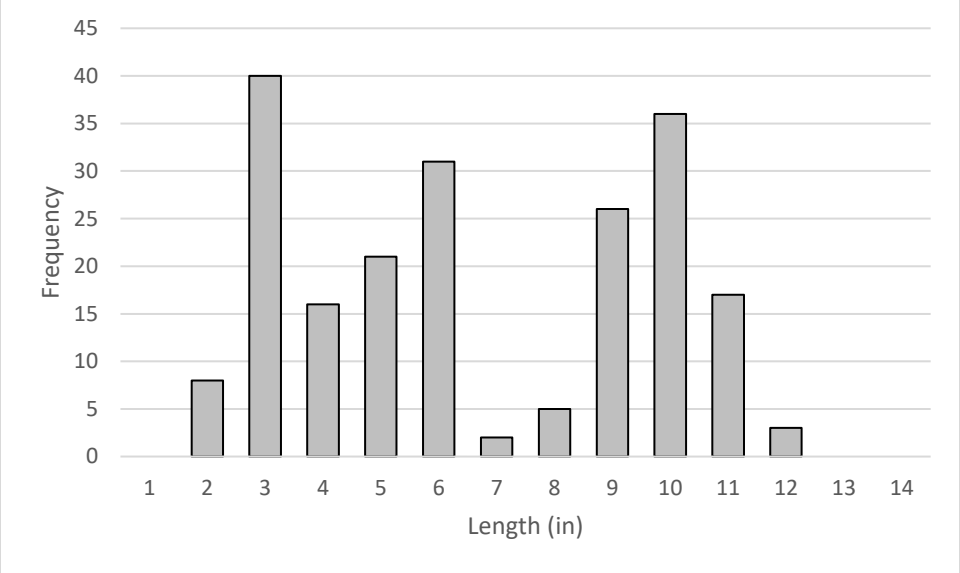

Figure 19. Length frequency distribution of black crappie collected from Lake Menomin, Dunn County in 2024.

Recruitment of black crappie was variable based on age-frequency analysis (Figure 19). The age-4 (2020) year class represents a strong year class with average length of these fish at 9.6 inches. Maximum age of black crappie was 12 years of age (Figure 20). Growth rates of black crappie were average overall but black crappie experience a relatively large increase in growth between ages 3 and 4 (Figure 21). Growth coefficients estimated by the von Bertalanffy growth model described mean length at age (L_{inf}= 324, K= 0.31, t_0=-0.22, n=205, P < 0.0001, r^2= 0.96*).* Total annual mortality of black crappie for ages 4 to 10 was 38.9% (r^2=0.52, n=87, P=0.0001) and was 72.5% for ages 4 to 6 (r^2=0.98, n=77, P=0.0001).

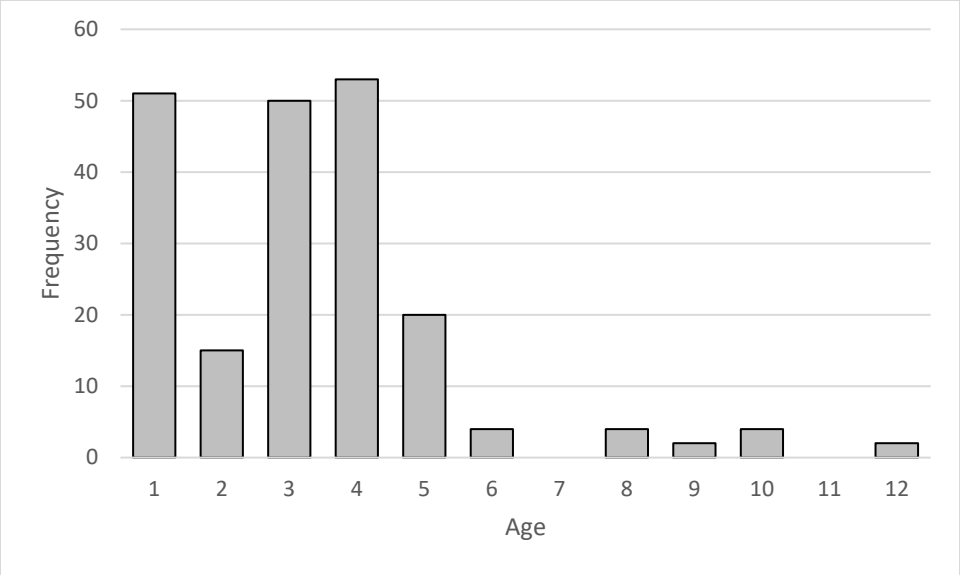

Figure 20. Age frequency distribution of black crappie collected from Lake Menomin during spring 2024.

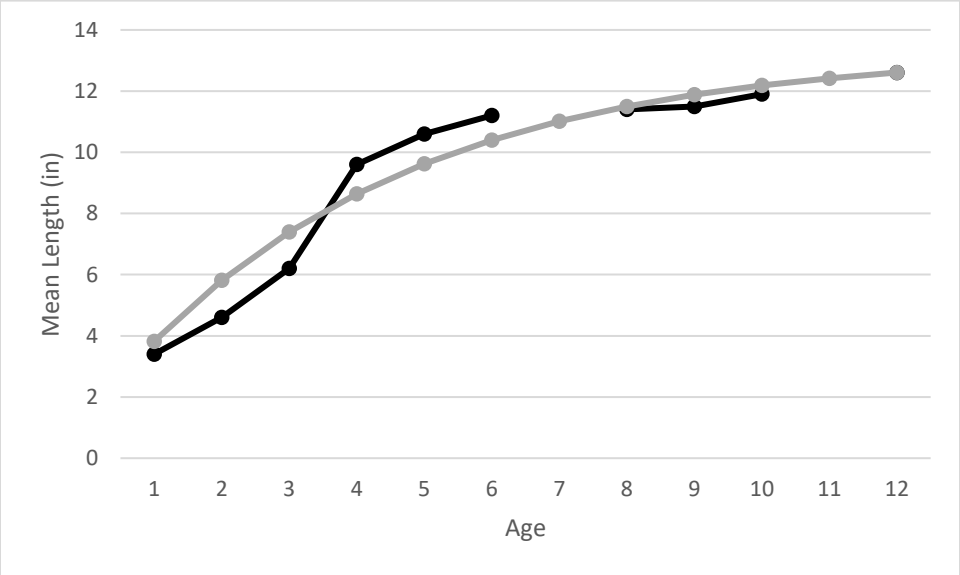

Figure 21. Mean length at age of black crappie collected from Lake Menomin in Dunn County in 2024 and median mean length at age of black crappie in Complex Riverine lakes across Wisconsin.

YELLOW PERCH

Yellow perch were present in low abundance during the 2024 surveys. Fyke net catch rates resulted in 0.7 fish per net night (10th percentile) while electrofishing CPUE was 20.8 fish per mile. Both fyke net and electrofishing catch rates have declined from previous surveys; fyke net CPUE in 2011 was 9.2 fish per net night and electrofishing CPUE was 42.4 fish per mile. A total of 136 were captured throughout surveys ranging in length from 3 to 10.7 inches (Figure 22). Mean length of perch was 5.3 inches. Approximately 10% of perch were larger than 8 inches. PSD of perch was 20 and RSD-P was 3. Yellow perch were in great condition with a mean relative weight of 106.

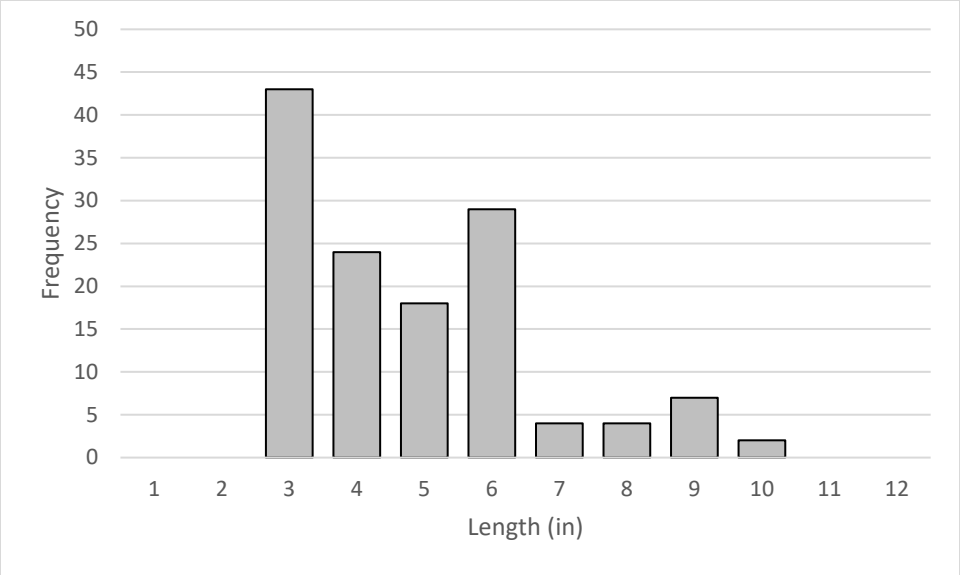

Figure 22. Length frequency distribution of yellow perch collected from Lake Menomin, Dunn County in 2024.

Recruitment of yellow perch was also variable with a weak year class in 2021 (age-3) and strong year classes in 2022, 2020 and 2019 (age-2, age-4 and age-5; Figure 23). Growth of perch was average to above average for most ages when compared to statewide averages in similar lakes (Figure 24). Yellow perch reached 9 inches in 5 years. Growth coefficients estimated by the von Bertalanffy growth model described mean length at age (L_{inf}= 252, K= 0.45, t_0=-0.007, n=131, P < 0.0001, r^2= 0.99*).* Maximum age of yellow perch documented during the survey was seven years of age. Total annual mortality of yellow perch was 36.1% for ages 2-7 (r^2=0.25, n=80, P=0.0001) and 67.8% for ages 2-5 (r^2=0.44, n=72, P=0.0001).

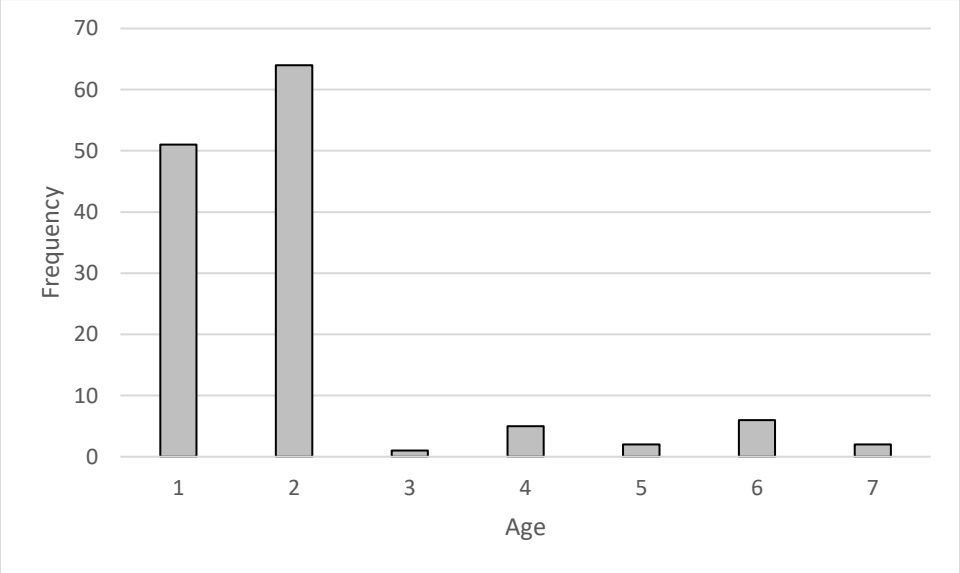

Figure 23. Age frequency distribution of yellow perch collected from Lake Menomin during spring 2024.

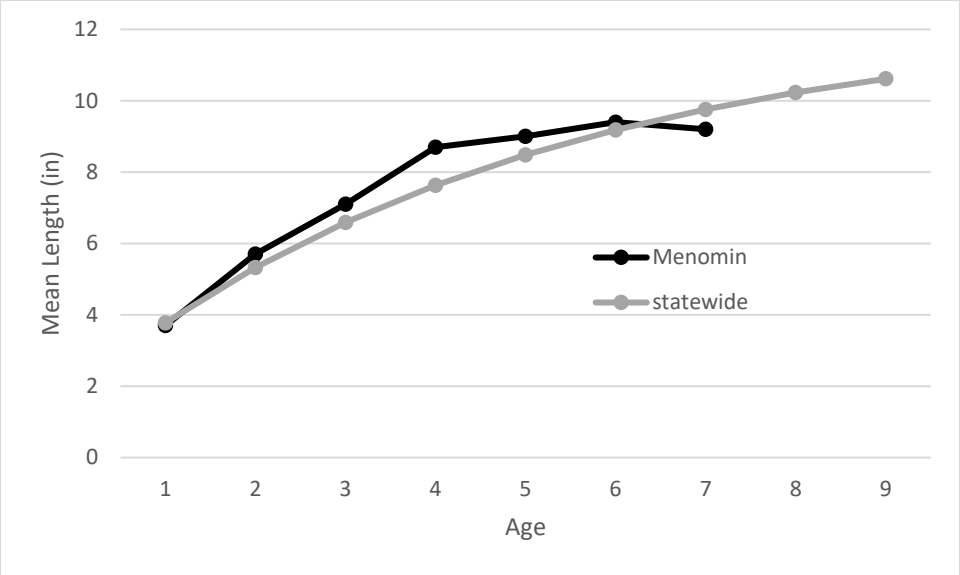

Figure 24. Mean length at age of yellow perch collected from Lake Menomin in Dunn County in 2024 and median mean length at age of yellow perch in Complex Riverine lakes across Wisconsin.

OTHER SPECIES

A single adult muskellunge was captured during surveys which is consistent with previous surveys; a single fish was sampled in 2011 while three were captured during the 1999 survey. Lake Menomin contains a diverse fish community with many native non-game species (Table 1). Other species encountered but not targeted during the SEI surveys include shorthead redhorse, silver redhorse, golden redhorse and greater redhorse. Common carp are present in low densities based on the current survey. White bass catch rates appear stable and most were concentrated within the riverine portion of the lake during sampling. Bowfin catch rates were higher during previous surveys; CPUE in 1999 was 1.8 fish per net night and CPUE in 2011 was 1.9 fish per net night.

Table 1. Species summaries of the 2024 comprehensive lake survey on Lake Menomin in 2024.

SPECIES	NUMBER CAPTURED	2024 CPUE	SIZE RANGE (IN)	MEAN SIZE (IN)
Black bullhead	21	0.28 per net night	.	.
Black crappie	693	8.32 per net night	2.8-12.7	7.1
Bluegill	1322	74.31 per mile	1-9.9	6.8
Bowfin	14	0.20	.	.
Central mudminnow	1	0.01	.	.
Common carp	2	0.01	.	.
Golden shiner	33	0.35	.	.
Largemouth bass	111	10.2 per mile	4-19.5	13.3
Mudpuppy	4	0.05 per net night	.	.
Muskellunge	1	0.1 per mile	42.2	42.2
Northern pike	200	2.2 per net night	9-35.9	17.9
Pumpkinseed	18	2.33 per mile	5.8-7.3	6.9
Rock bass	1	0.01 per net night	.	.

Smallmouth bass	75	7.5 per mile	8-18.5	12.6
Tadpole madtom	6	0.08 per net night	.	.
Trout perch	10	0.14 per net night	.	.
Walleye	1377	65 per hour	4.5-26	16.3
White bass	20	2 per mile	6.4-17	10.4
White sucker	18	0.09 per net night	.	.
Yellow bullhead	19	0.24 per net night	.	.
Yellow perch	136	0.7 per net night	3-10.7	5.3

Discussion

The walleye population in Lake Menomin has increased substantially since the 2011 survey and is at its largest size when compared to all surveys since 1999. Electrofishing catch rates within the refuge were high during early spring despite the exceptionally early ice-out date that occurred in late February and early March on area lakes. Walleye population density has been linked to several factors including lake productivity (Baccante and Colby 1996) and water clarity and depth (Johnson et al. 1977) and angler exploitation rates (Baccante and Colby 1996; Kocovsky and Carline 2001). The high productivity of Lake Menomin is likely a contributing factor in the density and recruitment of walleye. Walleye are light sensitive and rely on adequate thermal optical habitat to complete their life history (Hansen et al 2019). Lake Menomin likely provides optimal habitat throughout the year which may be positively influenced by lake productivity. Adult walleye exhibited excellent size structure and growth rates which was similar to previous surveys. Adult walleye exhibited a similar size structure to walleye in Tainter Lake which resulted in a mean length of 16.5 inches and a PSD value of 63 in 2022 (Yallaly 2023). Growth rates were also similar to those of walleye in Tainter Lake. Recruitment of walleye based on residual analysis, was fairly consistent except for the 2019 and 2020 year classes that were weak. The fall juvenile survey resulted in low catch rates of YOY fish indicating a poor year class for 2024. This is consistent with previous studies that have documented lower recruitment for age-0 walleye is associated with shorter, less severe winters, higher annual growing degree days and more variable late spring temperatures (Hansen et al. 2015, 2017, 2018). The ice-out date on Lake Menomin in 2024 was abnormally early and likely had a similar influence on walleye reproduction and recruitment.

Total annual mortality of walleye was high in 2024 in Lake Menomin at 59%. This estimate was similar to mortality estimates in 1999 of 42-58% (Engel et al. 2001). Tainter Lake walleye also had high mortality in 2022 at 53% (Yallaly 2023). While angler exploitation was not estimated in the current study, angler exploitation may be similar to the previous estimate in 1999 of 18.4% (Engel et al. 2001) based on the percent of catch harvested during the recent creel survey in 2021 (Yallaly and Schurrer 2023). While the amount of directed walleye effort declined from 17 hours per acre in 1999 to 10.5 hours per acre in 2021 and the total walleye catch declined from 13,762 to 4,359, the percentage of fish caught that were harvested increased from 12% in 1999 to 22% in 2021 (Miller 2001; Yallaly and Schurrer 2023). With Menomin's high productivity, fish populations may be able to sustain higher angler exploitation rates (Baccante and Colby 1996). A reduction in the daily bag limit from five to three and an implementation of a protected slot limit from 20-24

inches was imposed in 2022. This survey is likely too early to detect any potential effects of this regulation. Future surveys should focus on obtaining a current exploitation estimate and evaluation of the regulation.

While walleye are currently the dominant gamefish species in Lake Menomin, northern pike abundance has declined since the previous netting survey in 2011. At that time, northern pike were the dominant gamefish species and catch rates were considerably higher than they are currently. Currently, pike are present in low densities, but while density has declined, size structure has improved. PSD of northern pike in 2011 was 22 while the current survey estimate was 49. Northern pike also exhibit average growth rates. The decline in northern pike abundance may be due to natural variability in the population but more frequent sampling is needed to understand this potential trend. A Minnesota and Wisconsin study of northern pike population demographics revealed that a density dependent may explain size structure and growth rates of northern pike (Pierce et al. 2003). Density was negatively related to size structure and growth rates were negatively related to Secchi visibility (Pierce et al. 2003). Densities of northern pike are slightly lower in Tainter Lake. Both lakes contain excellent spawning habitat and stable water levels throughout the spring during spawning which aids in maintaining stable northern pike recruitment. Northern pike have remained a popular part of the fishery for anglers and accounted for approximately 10% of the total angler effort expended on Lake Menomin in both the 1999 and 2021 creel surveys. However, the total number of angler hours per acre spent targeting pike has increased from 8.8 hours per acre in 1999 to 11.7 hours per acre in 2021 but the harvest rate (% of fish caught by anglers that were harvested) has declined from 14% harvested to 11% of the catch that was harvested (Miller 2001; Yallaly and Schurrer 2023). Exploitation was very low (1.3%) during the 1999 survey and is likely currently low based on population demographics and the recent creel survey.

Smallmouth bass were present in moderate densities which was similar to all previous survey estimates. Tainter Lake contains a much higher density smallmouth population with high catch rates in 2022 of 42.4 per mile (95th percentile; Yallaly 2023). Smallmouth bass are concentrated within the riverine portion of the lake and few are found within the lake proper; habitat within the riverine section is excellent for smallmouth bass. Smallmouth bass exhibited good size structure and average growth rates. PSD was higher in Menomin than in Tainter Lake but the proportion of preferred size fish was similar. The PSD value was high which was similar to the PSD value during the 1999 survey indicating a population skewed towards large individuals. Fishing pressure directed towards smallmouth bass has declined substantially since the previous creel survey in 1999 in which they were the 4th most targeted fish in the lake (Miller 2001), which has dropped to 7th most targeted fish in 2021 (Miller 2001; Yallaly and Schurrer 2023), despite higher densities in 2024. In 2021, approximately 3.9 hours per acre were allocated towards smallmouth bass fishing while 10.1 hours per acre were allocated in 1999. Very few bass were harvested during the 2021 creel survey (< 1% of catch); harvest rates have declined since 1999 in which 2% of the catch was harvested.

Similar to smallmouth bass, largemouth bass were also present in moderate densities during the survey. Catch rates in 2024 were slightly lower than estimates from 2019, 2011 and 2004 but were higher than in 1999. Largemouth exhibited inconsistent recruitment

with several weak year classes. Factors negatively impacting recruitment are unknown. A study in the southern Midwest found that environmental variables including reservoir retention during early summer months was positively related to largemouth bass recruitment and that dryer early summers with longer retention rates likely increased largemouth bass production (Maceina and Bettoli 1998). Additionally, catch and release mortality may play a large role in mortality of largemouth bass in Lake Menomin, especially when water temperatures are high. Many studies have documented hooking mortality rates of bass and some studies have documented high mortality (Meals and Miranda 1994; Weathers and Newman 1997; Neal and Lopez-Clayton 2001; Cooke et al 2002). Several bass tournaments occur throughout the summer including weekly tournaments that may increase mortality rates from catch and release angling.

Panfish collectively represent a large part of the Lake Menomin fishery and are also largely popular with anglers. Bluegill and black crappie populations were both present in moderate densities in 2024. Bluegill densities were lower than in 2011 but were average compared to all other previous surveys. Bluegill size structure was impressive with a high mean length and fast growth, well above the upper quartile when compared to other Complex Riverine lakes in Wisconsin. PSD indicated a balanced population. Bluegill abundance was lower in Tainter Lake in 2022 but size structure and growth rates were similar (Yallaly 2023). Some weak or missing year classes were apparent through residual analysis but strong year classes of juvenile fish were present. Bluegill now represent the 2nd most popular species for anglers to target while they were the most popular species during the 1999 creel survey. However, high angler effort is directed towards bluegill currently with anglers targeting them for 42,944 hours in 2021-2022 or 30.6 hours per acre (90th percentile; Yallaly and Schurrer 2023). Specifically, winter angling pressure for bluegill has doubled since 1999. While there is increased angler effort, the percentage of the catch that was harvested has declined from 43.9% harvested in 1999 to 27% of the catch harvested in 2021. The recent creel survey also documented that larger bluegills are harvested during open water than during winter but the month of December contained the highest amount of harvest.

Black crappie are the most popular species to target on Lake Menomin and were present in moderate densities in 2024 which was similar to previous surveys. Catch rates were similar to the previous survey on Tainter Lake. Crappie exhibited good size structure; however, larger fish (> 12 inches) were somewhat scarce which was similar to the 1999 survey. PSD were much higher on Tainter Lake but values on Lake Menomin indicated a more balanced population. There is likely high angling mortality after fish reach 10 inches based on this survey. Growth rates were average except for fast growth between the ages of three and four (6-9 inches) which is generally when forage switches from zooplankton and insects to a higher concentration of minnow forage (Keast 1968). Directed angler fishing effort towards black crappie was high and they are the most targeted species while the species represented the 3rd most targeted species during the 1999 creel survey. Directed fishing effort has more than doubled since then and total angler catch and harvest has increased considerably as well (Miller 2001; Yallaly and Schurrer 2023). However, the percentage of the catch that was harvested has decreased slightly from 45% to 38%.

Yellow perch were the only panfish or gamefish species present in low densities. Surveys have documented a steady decline in yellow perch abundance since 2004. Perch exhibited

average to above average growth rates but size structure was limited and mortality was high which was similar to estimates from previous surveys. Densities during the 1999 survey indicated that yellow perch were common but mortality estimates at that time were very high (83%; Engel et al. 2001). Tainter Lake contains a much more robust perch population. Abundance estimates from 2022 indicated perch catch rates were in the 75th percentile, mean length was excellent and PSD values indicated a balanced population (Yallaly 2023). Angling pressure on yellow perch has increased since the 1999 creel survey from 8 hours per acre to 13.5 hours per acre in 2021 (Miller 2001; Yallaly and Schurrer 2023). Angler catch rates for yellow perch were considerably higher 26 years ago with 11,285 reported caught while only 7,743 were caught by anglers in 2021-2022. This is reflective of the reduced densities of yellow perch within the lake. The percentage of yellow perch caught that were harvested remains similar to the previous survey (30%). It is difficult to determine if fishing mortality is the highest source of yellow perch mortality without an exploitation estimate but creel data suggests that angler harvest of yellow perch is high. Reduced bag limits of yellow perch may be an option to reduce fishing mortality and maintain or sustain the perch population within Lake Menomin. Yellow perch are also a preferred forage source for walleye and increased predation by walleye due to the increase in walleye density may be a driver of perch mortality as well (Chevalier 1973; Forney 1974). As a coolwater species, other studies have documented yellow perch declines but it is difficult to determine which variables directly result in these declines (Hansen et al. 2022).

Muskellunge represent a small part of the fishery in Lake Menomin and are present in very low densities. Previous surveys have captured muskellunge in densities similar to the current survey. Musky that have been captured in past surveys range in length from 27 to 42 inches and are likely the result of upstream stocking in Barron County lakes or natural reproduction that may occur in the Red Cedar River or Hay River above Tainter Lake. Stocking would be needed to maintain a muskellunge fishery in Lake Menomin. Tainter Lake also contains a low density muskellunge population that is also likely influenced by upstream stocking. A total of three juvenile muskellunge were captured in the 2022 survey on Tainter Lake (Yallaly 2023). Anglers continue to target muskellunge in Lake Menomin and spent 420 hours targeting them in 2021-2022 but no fish were reported caught (Yallaly and Schurrer 2023). In 1999, 264 angler hours were spent targeting musky and 35 fish were reported caught with none harvested (Miller 2001). Several other native non-game species were captured in surveys. These populations appear stable except bowfin catch rates have steadily declined throughout the years and are now present in low densities.

Recommendations

Overall, fish populations appear healthy and robust in Lake Menomin based on this survey with a few exceptions. The walleye population is at its highest density recorded by recent surveys. Continued monitoring and obtaining population estimates during future surveys is recommended to evaluate any changes in the population due to the regulation change and to ensure sustainability. Its also recommended to continue annual fall juvenile walleye electrofishing surveys to monitor natural reproduction and recruitment. Lake Menomin was recently upgraded as a High Profile Lake and will now be monitored on a 4 year rotation. Largemouth bass recruitment is highly variable and catch and release mortality may be impacting the population because of the number of tournaments that occur on the waterbody. If publicly supported, coordinate with local tournament organizers to encourage

better catch and release practices or implement catch-photo-release tournaments to reduce any mortality that may be associated with capture. Yellow perch densities have continued to decline and a reduction in bag limits may be warranted to ensure sustainability of the population. Consider public outreach to local conservation organizations and anglers to determine if a regulation change would be supported. Lake Menomin contains a diverse array of fish habitat that supports a robust fish community. However, much of the shoreline around the lake is developed which may impact natural habitats within the littoral zone. Therefore, continue to work with local conservation organizations to implement fish habitat improvements within the littoral zone. Continue to support and encourage Best Management Practices within the watershed to aid in improvement in water quality and fish habitat.

1. Continue monitoring and estimation of the size of the adult walleye population during future surveys on a 4-year rotation to monitor changes in population density and size structure.
2. Continue fall juvenile walleye electrofishing surveys to monitor walleye natural reproduction and recruitment.
3. Encourage better catch and release practices of largemouth bass.
4. Consider a reduction in bag limits of yellow perch and conduct public outreach with local conservation organizations and anglers to obtain input and support.
5. Continue to encourage nearshore habitat improvements in the form of fish sticks and tree drops to maintain and improve littoral habitats.
6. Continue to support and encourage Best Management Practices within the watershed to aid in improvements in water quality.

References

Baccante, D.A. and P.J. Colby. 1996. Harvest, density and reproductive characteristics of North American walleye populations. Annales Zoologici Fennici 33:601-615.

Chevalier, J.R. 1973. Cannibalism as a factor in first year survival of walleye in Oneida Lake. Transactions of the American Fisheries Society 102:739-744.

Cooke, S.J., J.F. Schreer, D.H. Wahl and D.P. Phillipp. 2002. Physiological impacts of catch-and-release angling practices on largemouth bass and smallmouth bass. American Fisheries Society Symposium. American Fisheries Society, 2002.

Engel, M.P., W.J. Michalek Jr., and S. Peavey. 2001. Lake Menomin Comprehensive Lake Survey Report Dunn County, Wisconsin. Wisconsin Department of Natural Resources Survey Report, Madison.

Forney J.L. 1974. Interactions between yellow perch abundance, walleye predation, and survival of alternate prey in Oneida Lake, New York. Transactions of the American Fisheries Society 103:15-24.

Hansen, G.J.A., S.R. Carpenter, J.W. Graeta, J.M. Hennessy and M.J. Vander Zanden. 2015. Predicted walleye recruitment as a tool for prioritizing management actions. Canadian Journal of Fisheries and Aquatic Sciences 72:661-672.

Hansen, G.J.A., J.S. Read, J.F. Hansen and L.A. Winslow. 2017. Projected shifts in fish species dominance in Wisconsin lakes under climate change. Global Change Biology 23:1463-1476.

Hansen, G.J.A., S.R. Midway and T. Wagner. 2018. Walleye recruitment success is less resilient to warming water temperatures in lakes with abundant largemouth bass populations. Canadian Journal of Fisheries and Aquatic Sciences 75:106-115.

Hansen, G.J.A., L.A. Winslow, J.S. Read, M. Treml, P.J. Schmalz and S.R. Carpenter. 2019. Water clarity and temperature effects on walleye safe harvest: an empirical test of the safe operating space concept. Ecosphere 10(5): e02737. 10.1002/ecs2.2737.

Hansen, G.J.A., J.K Ruzich, C.A. Krabbenhoft, H. Kundel, S. Mahlum, C.I. Rounds and A.O. Van Pelt. 2022. It's complicated and it depends: A review of the effects of ecosystem changes on walleye and yellow perch populations in North America. North American Journal of Fisheries Management 42:484-506.

Keast A. 1968. Feeding biology of the black crappie, *Pomoxis nigromaculatus*. Journal of the Fisheries Board of Canada, 25(2), 285-297.

Kocovsky, P.M. and R.F. Carline. 2001. Influence of extreme temperatures on consumption and condition of walleyes in Pymatuning Sanctuary, Pennsylvania. North American Journal of Fisheries Management 21:198-207.

Maceina, M.J. and P.W. Bettoli. 1998. Variation in largemouth bass recruitment in four mainstem impoundments in the Tennessee River. North American Journal of Fisheries Management 18:998-1003.

Meals, K.O. and L.E. Miranda. 1994. Size-related mortality of tournament-caught largemouth bass. North American Journal of Fisheries Management 14:460-463.

Miller, M.J. 2001. A fish creel survey of Lake Menomin Dunn County, Wisconsin. Northern States Power Company, Eau Claire, Wisconsin.

Neal, J.W. and D. Lopez-Clayton. 2001. Impacts of catch-and-release tournament fishing on a tropical largemouth bass population. American Fisheries Society Annual Meeting Abstracts, Phoenix, Arizona, August 2001. Bethesda, Maryland.

Pierce, R.B., C.M. Tomcko and T.L. Margenau. 2003. Density dependence in growth and size structure of northern pike populations. North American Journal of Fisheries Management 23:331-339.

Slipke and Maceina 2010. Fishery analyses and modeling simulator (FAMS). Auburn University, Department of Fisheries and Applied Aquacultures, Agricultural Experiment Station, Auburn, Alabama, USA.

Weathers, K.C and M.J. Newman. 1997. Effects of organizational procedures on mortality of largemouth bass during summer tournaments. North American Journal of Fisheries Management 17:131-135.

Yallaly, K.L. 2023. Tainter Lake 2022 Fisheries Survey Report. Wisconsin Department of Natural Resources Survey Report, Madison.

Yallaly, K.L. and D. Schurrer. 2023. Lake Menomin 2021-2022 Creel Survey Report, Dunn County. Wisconsin Department of Natural Resources Survey Report, Madison.