WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Fisheries Survey Report for the Big Eau Pleine Reservoir, Marathon County, Wisconsin 2024

WATERBODY IDENTIFICATION CODE 1427400

February 2025

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Executive Summary

The Big Eau Pleine (BEP) Reservoir supports a locally important diverse fishery, focused on shared recreational and tribal fisheries. The BEP is notorious for its highly productive sport fish populations, such as walleye, which are currently sustained entirely through naturally reproduction. The most frequently encountered and most-desired species include walleye, northern pike, muskellunge, black crappie and yellow perch. The BEP has regularly experienced high levels of angling, especially during the winter and spring months. Angling effort and harvest are important descriptors of the fishery and can help determine the potential impacts on fish populations. An updated creel survey would be beneficial since the last creel surveys were conducted in 1993 and 2003.

Walleye are the most abundant predatory gamefish species in the BEP and have been the main target for anglers for decades. Walleye reached an estimated population size of 43,695 (6.4/acre) in 2003, all while enduring several notable winter fish kills. The population estimate calculated in 2017 was 22,438 (3.3/acre), which occurred 5-8 years after the two most recent severe winter kills in 2009 and 2012. Since 2017, the population has remained relatively unchanged with an estimated population of 19,927 (2.9/acre) in 2024. Walleye abundance may have decreased since 2003, yet the population biomass and size structure remain high. Population biomass and size structure may reflect patterns of strong natural recruitment. Although naturally recruited strong year classes typically occur every three years, the BEP frequently produces higher catch rates of age-0 walleye than many waterbodies in Wisconsin.

Historical muskellunge stockings have provided another large predator species to the BEP. Although these stockings may have provided an additional opportunity for anglers, returns to the fishery have been minimal and habitat conditions are less than suitable. Conversely, the size structure and growth exhibited by the northern pike population provides a trophy fishery that is rarely seen across the state. In 1995, a more restrictive harvest regulation (32-inch MLL and 1/day) was implemented, which likely played a role in maintaining the trophy northern pike fishery. Although the estimated abundance of northern pike has decreased since 2003, the size structure and growth rates are well above average compared to waterbodies around the state. Northern pike recruitment appeared to be limited in 2017. However, an 85% increase in the number of northern pike ages 1-2 since 2017 indicates that natural recruitment was occurring in 2024 at a much higher level.

The panfish community in the BEP is dominated by black crappie, comprising 99% of the total panfish catch. Panfish populations in the BEP have experienced significant changes since 2003, with black crappie catch rates increasing 89% from 2003-2024. In contrast, yellow perch relative abundance has decreased by 94% during the same timeframe. Age-4 black crappies from the 2020-year class represented 65% of their population in 2024. It appears that a strong year class occurs every 3-4 years on the BEP. Black crappies exhibit fast growth and achieve large sizes at a young age (9 inches by age 3-4). However, their average growth potential tops out around 12 inches, which is much lower than the growth potential in other central Wisconsin River impoundments. Total annual mortality was calculated to be 55% in 2024, which was comparable to 2017 (49%), but much higher than other local central Wisconsin River impoundments (2022 Lake DuBay annual mortality = 20-30%). The higher annual mortality rates in the BEP may be due to 65% of their population being age-4 fish between 9-10 inches, in addition to 99.8% of the population being ≥8 inches.

Introduction

The Big Eau Pleine (BEP) Reservoir is a 6,830-acre hypereutrophic impoundment located near Mosinee, Wisconsin in south central Marathon County and is situated within the Ceded Territory. The reservoir impounds the Big Eau Pleine River which originates in eastern Taylor County and flows east before forming a confluence with the Wisconsin River at Lake DuBay. Two main tributaries feed into the reservoir, Fenwood Creek and Freeman Creek, which flow in from the north. The BEP has 66 miles of shoreline and a maximum depth of 46 feet, with bottom substrate primarily composed of sand (60%), muck (25%) and rock (15%).

The BEP is a water storage reservoir that was created in 1937 with its primary purpose to regulate and maintain uniform flows to the Wisconsin River. Currently, the Wisconsin Valley Improvement Company (WVIC) maintains the dam (Moon Dam) and regulates the flows. Specifically, the reservoir and dam are operated to store water during spring and fall which is then released during summer and winter for augmenting natural low flows in the Wisconsin River. Winter discharge is gradually increased, within a licensed range, until drawdown is complete, and the reservoir is refilled again in the Spring.

Historically, the BEP has experienced anoxic conditions and periodic winter fish kills due to high biological oxygen demand (BOD) resulting from nonpoint source runoff which adds excessive amounts of sediment, organic matter, and nutrients (particularly animal waste). Unfortunately, high nutrient loads from nonpoint sources upstream have contributed to unfavorable water quality and habitat conditions throughout the reservoir. Additionally, because of high nutrient inputs and other contributing factors (i.e., residence time, seasonal turnover, climate, reservoir stage), the BEP periodically experiences significant algal blooms throughout the year. These water quality issues are a high priority for fisheries management and require considerable attention due to implications regarding habitat degradation and the threat of fish kills. To help protect the fishery, a diffuser aeration system was installed in 1981. The aeration system is located at a narrow area in the reservoir across from the county park and is still operates during winters when dissolved oxygen (D.O.) becomes severely depleted. This system was upgraded in 2011 and will be upgraded again with new blowers and motors in the next few years.

Although the BEP is riverine in origin, the median hydrologic residence time is considerably longer (310 days) than most riverine impoundments (≤15 days). Due to the BEP's long residence time, eutrophic status, local climate (based on degree days) and fish assemblage dynamics, the Wisconsin Department of Natural Resources (DNR) Fisheries Management has classified the BEP as a complex-warm-dark Lake for fisheries management purposes. Lake class is helpful for comparing fish populations with other lakes that have similar productivity characteristics and fish communities. Regardless of this classification, the BEP is very similar to other riverine systems being that these waters are extremely fertile and have the capacity to support highly productive fish populations.

The BEP supports a locally important and diverse fishery. Being that the BEP is within the Ceded Territory, fish management is focused on shared recreational and tribal fisheries. Regardless of the BEP being a treaty fishery, it still receives substantial management attention because of its size and incredibly productive fish populations. The BEP is notorious for its highly productive sport fish populations, such as walleye and black crappie, which are currently sustained entirely through naturally reproduction. Maintaining the stability of these

naturally self-sustaining fish populations is important for areas surrounding the BEP, since revenues associated with recreational fisheries have a tremendous economic impact on the local communities. The diverse fish assemblage within the BEP contains a cosmopolitan group of sport fish species, offering numerous angling opportunities. The most frequently encountered and most-desired species include walleye, northern pike, muskellunge, black crappie and yellow perch. The fish community also contains many nongame fish species which contribute to the massive forage base in the system. Of these species, most encountered are native bullhead, sucker, redhorse, and minnow species, as well as the non-native common carp. Although management is often geared towards sports fish species, populations of nongame fish species are monitored to better manage food web dynamics and ecosystem function.

Fisheries surveys and fish stocking have been important fisheries management tools used to achieve desired long-term management goals. Comprehensive fisheries surveys were conducted in 1993, 1999, 2003, 2017 and 2024 (Table 1). Additionally, a special 4.2-mile spring electrofishing trend station used to monitor walleye status was surveyed in 2006, 2009, 2011-2017 and 2024. Also, fall electrofishing surveys to monitor walleye recruitment have been completed in 2001, 2003 and 2016-2024 (Table 1). Since 1972, several different species have been stocked (Table 2). Stocking has largely focused on maintaining walleye and muskellunge abundance. Muskellunge stocking began in 1972 and continued through 2016 to provide more recreational angling opportunities. Walleye fry were stocked eight times from 1974-1983, but was discontinued since the population was determined to be self-sustained through natural reproduction. Following the 2009 and 2012 winter fish kill events, Walleyes for Tomorrow reestablished walleye fry stockings from 2013-2019 to supplement natural reproduction with the use of their portable lakeside hatchery. However, genetic analysis has proven these stockings show minimal return to the fishery. The highly productive fish populations in the BEP are resilient and have proven to have self-sustaining capability through historically severe environmental crisis. Therefore, stocking for all species in the BEP has been discontinued since 2019 and all populations are currently self-sustaining (Table 2).

Fisheries management has applied various harvest regulations designed to enhance populations of angler-targeted fish in the BEP. The use of special harvest regulations has been only applied to walleye, northern pike and panfish because of their importance in the BEP. The northern pike harvest regulations changed in 1995 from a no minimum length limit (MLL) and 5/day to a 32-inch MLL and 1/day (Table 3). Walleye harvest regulations in the BEP are based on potential safe tribal spearing harvest. Since 1990, the walleye harvest regulation was a 15-inch MLL and 5/day. In 2015, this regulation changed to a 15-inch MLL with a 20–24-inch protected and 3/day (only 1/day can be over 24 inches). The most recent harvest regulation change occurred on April 1, 2022, when the panfish bag limit changed from a 25/day limit to a 10 panfish total daily bag limit (Table 3). Changes in harvest regulations for other sought-after species in the BEP have corresponded with statewide general MLLs and daily bag limits for inland waters.

The objective of the 2024 comprehensive survey was to determine the status of the fish community in the BEP. Specifically, to gain more insight on the status and current population characteristics of various gamefish and panfish species. This status update will allow us to assess the effectiveness of fish management practices and to determine the health of the fishery.

Methods

A comprehensive fishery survey was conducted on the BEP during 2024, including early spring fyke netting (SN1), muskellunge fyke netting (SN2), early spring electrofishing (SE1), late spring electrofishing (SE2) and fall electrofishing (FE; Table 1).

DATA COLLECTION

Early Spring Fyke Netting (SN1) – A DNR standard early spring fyke netting survey was conducted targeting spawning northern pike and walleye. Following ice-out, nine standard 2-, 3-, and 4-foot frame fyke nets were set on March 11, 2024, and pulled on March 15, 2024, due to cold weather and ice reforming on the reservoir. Following the cold weather, 21 nets were reset on April 1, 2024, and fished until April 11, 2024. Nets were set in 32 different locations and effort was focused on the middle portion of the BEP from Balsam Road (i.e., Spindler's bridge) downstream to County Highway O (Figures 1-3). Nets were set in varying habitats (i.e., substrate and vegetation) and water depths targeting gamefish species. Nets were checked daily by two separate crews and all fish removed. Nets that showed decreases in catch rates, did not fish well (e.g., nets rolled, changes in water level or flows) were periodically moved to new locations. Total netting effort was 229 net-nights. Water temperature ranged from 34 to 55° F during the netting survey.

All gamefish captured were measured to the nearest 0.1 inch, and sex was recorded when evident based on expression of gametes. Counts were recorded for non-gamefish species. All northern pike, walleye, smallmouth bass and largemouth bass were marked with a top caudal (TC) fin clip. Muskellunge were checked for a PIT (passive integrated transponder) tag and if one was not found, a PIT tag was internally placed adjacent to the dorsal fin. Otoliths were collected from a subsample of walleye (<20 inches) and black crappie for age estimation. Additionally, dorsal spines were collected for age estimation from a subsample of walleye (>20 inches). The first anal fin ray was removed from a subsample of northern pike and from all newly captured adult muskellunge for age estimation.

Early Spring Electrofishing (SE1) – One nonstandard early spring electrofishing survey took place on the night of April 10, 2024, using pulsed direct current (DC) on a maxiboom electrofishing boat. Total electrofishing effort was 3.1 miles (1.7 hours) focused near a historical 4.2-mile trend station across from the county park and by County Highway S (Figures 1-3). Water temperature was 45° F. An additional nonstandard electrofishing survey took place during the day of April 10, 2024, using a miniboom electrofishing boat. Total electrofishing effort was 3.35 miles (2.08 hours) focused upriver above Spindler's bridge (Figures 1-3). The purpose of these nonstandard surveys was to mark additional spawning adult walleye, identify unknown walleye spawning habitat upriver and tag additional muskellunge. Only walleye, muskellunge and bass were collected, marked and measured to the nearest 0.1 inch.

One standard electrofishing survey was conducted on the night of April 12, 2024, using five Wisconsin DNR maxiboom electrofishing boats. All shorelines with potential walleye spawning habitat were sampled (Figures 1-3). Following Treaty protocols for SE1 walleye recapture surveys, the survey was conducted near peak walleye spawning. All walleye and muskellunge were collected, measured and examined for a TC fin clip. The total

electrofishing effort for this survey was 23.64 miles and 13.47 hours. Water temperature ranged from 45 to 49° F throughout the reservoir.

Muskellunge Fyke Netting (SN2) – A DNR standard spring fyke netting survey was conducted targeting spawning muskellunge in backwater habitats. Ten standard 4-foot frame fyke nets were set on April 22, 2024, and fished until April 25, 2024. Nets were set in ten different locations focused on the upper portion of the BEP from just downstream of Maryel Boat Landing to just upstream of County Highway M (Figures 1-3). Nets were checked daily, and all fish were removed. Total netting effort was 28 net-nights. Water temperature remained at 50° F during the netting survey.

Late Spring Electrofishing (SE2) – A DNR standard late spring electrofishing survey took place on the nights of May 28 and 30, 2024 targeting spawning bass and panfish. Total effort was 6.8 miles and 3.62 hours of electrofishing. Water temperature ranged from 60 to 63° F. Three shoreline stations within the reservoir, three shoreline stations in the Big Eau Pleine River and one station in Fenwood Creek were surveyed (Figures 1-3). All gamefish and panfish were collected and measured to the nearest 0.1 inch. If possible, non-gamefish and other fish observed during the survey were counted or recorded as being present. In addition, all muskellunge collected were checked for a PIT tag or given a PIT tag if one was not found.

Fall Electrofishing (FE) – A DNR standard fall electrofishing survey took place on the night of Oct. 23, 2024, targeting juvenile walleye and muskellunge. Total effort was 7 miles and 3.27 hours of electrofishing. Water temperature ranged from 54 to 56° F. In total, four 1-mile shoreline trend stations and three random 1-mile shoreline stations were surveyed (Figures 1-3). All walleye and muskellunge were collected and measured to the nearest 0.1 inch. The purpose of this survey was to capture juvenile walleye and muskellunge to monitor recruitment and survival of young-of-year (YOY) and age-1 fish.

DATA ANALYSIS

Data from each survey were compiled and analyzed to estimate relative abundance and size-structure for all targeted species. When data were available, additional population metrics were calculated, including growth, mortality, and recruitment. Population estimates were calculated for walleye and northern pike following Treaty mark-recapture protocols. Population characteristics from the 2024 comprehensive survey were compared to results from past comprehensive surveys and other Wisconsin River impoundments within Central Wisconsin.

Length frequency distributions were generated for gamefish and panfish species, including walleye, muskellunge, northern pike, smallmouth bass, largemouth bass, black crappie and yellow perch. Relative abundance was indexed using catch per unit of effort (CPE) calculated by gear type for gamefish and panfish species. CPE was calculated as the number of fish captured per net-night for netting surveys and as the number of fish captured per shoreline mile or per hour for electrofishing surveys. The CPE values and overall average and maximum lengths of each fish species were compared to the 25^{th}-75^{th} percentile lake class standard for Wisconsin's warm-dark lakes with complex fish assemblages that fall within the same lake class as the BEP. Proportional size distribution (PSD) and relative stock density (RSD) are indexes used to describe size structure of fish, calculated as the percentage of various size fish observed within the total catch of stock or greater size fish for a given species. Length

designations for stock, quality, preferred, and memorable sizes of fish species collected from the BEP can be found in Table 8 (Anderson and Neumann 1996).

Population characteristics were calculated using standard statistical analyses employed by DNR Fisheries Management. Abundance and density were estimated using the Chapmans modification of the Peterson formula (Ricker 1975) for walleye and using the Schnabel method (Schnabel 1938; Seber 1982) for northern pike. Growth was evaluated for walleye, northern pike and black crappie by estimating fish age and calculating mean length-at-age and growth parameters (von Bertalanffy 1938) to estimate predicted length-at-age. Growth parameters were compared to the lake class standard for Wisconsin's complex warm-dark lakes in the same class as the BEP. Age-frequency distributions were created for walleye, northern pike and black crappie and mortality/survival rates were calculated from catch curves incorporating all age ranges fully vulnerable to capture.

Results

A total of 26,989 fish representing 19 different species were collected during the 2024 comprehensive survey (Table 4). Non-gamefish species represented 26% of the total number of fish captured, with majority comprised of common carp, shorthead redhorse and white sucker (25% of the total catch). Black crappie and walleye accounted for 71% of the total number of fish captured, with black crappie dominating the gamefish catch (40% of the total catch; Table 4). When looking at only the gamefish catch during spring fyke netting, black crappie accounted for 69% and walleye accounted for 26% of total gamefish captured. The proportions of gamefish species captured in 2017 and 2024 were very similar (Figure 4). However, proportions of gamefish species captured in 2017 and 2024 were far different than observed in 2003.

WALLEYE

During the 2024 early spring surveys, 4,164 walleyes were captured during SN1 and SN2, 3,524 during SE1, 253 during SE2 and 362 during FE (Table 4; Figure 5). Walleye ranged in length from 5.5-31.5 inches with an average length of 15.2 inches (Table 5). The maximum length for walleye in the BEP was above the 100th percentile and mean length was above the 75th percentile lake class standards for similar lakes in Wisconsin (Table 5). The sex ratio of walleye (female: male) captured during early spring surveys was 1:12 which was greatly skewed toward male (Figure 5). Normal sex ratios during early spring surveys on impoundments in Central Wisconsin are typically skewed toward male walleyes. The sex ratio during early spring surveys in 2003 and 2017 were 1:17 and 1:7, respectively. For comparison, the average sex ratio for Lake DuBay is 1:2 in 2022.

The relative abundance of walleye captured was CPE = 17.7/net-night which was the lowest catch rate for spring fyke netting surveys (Average CPE = 45.6/net-night) but was well above the 90th percentile lake class standard for similar lakes in Wisconsin (Table 6). When compared to the relative abundance during the 1993, 1999, 2003 and 2017 spring netting surveys, CPE of walleye ≥15 inches (CPE = 9.6/net-night), ≥20 inches (CPE = 0.7/net-night) and ≥25 inches (CPE = 0.15/net-night) captured in 2024 were the lowest catch rates for all comprehensive surveys (Figure 6). Although walleye relative abundance at these size categories has decreased since 2017, it is still higher than other nearby waterbodies like the Stevens Point Flowage and Lake DuBay. However, relative abundance was well above average

at an electrofishing trend site during peak walleye spawning (Figure 7). This site, located across from the Marathon County Park, had been surveyed annually from 2009-2017 and the catch rate of walleye ≥15 inches in 2024 was CPE = 46.0/mile (2006-2024 average CPE = 34.2/mile).

The current protected no harvest slot regulation from 20-24 inches was implemented in 2015 to protect spawning adult walleye and increase size structure. Although CPE of walleye ≥20 inches has decreased since 2017, population size structure has substantially improved (Figures 6 and 8). In 2017, the size structure of walleye ≥20 inches was the best on record, with 19% of stock sized walleye being ≥20 inches and 5.2% being ≥25 inches (Figure 8). However, size structure of the entire stock population (Table 8) in 2024 was the highest since 1993, with 52% of walleye captured ≥15 inches (Figure 8; Table 9). The increase in walleye population size structure since 2003 gives anglers good odds of catching a harvestable size walleye when fishing the BEP. For comparison, walleye size structure (≥15 inches) in the BEP during 2024 was nearly twice as high as what was observed for walleye captured on Lake DuBay during the comprehensive survey completed in 2022.

Growth rate of walleye was above the 90th percentile lake class standard for similar lakes in Wisconsin. Mean length-at-age of female walleye was above the 75th percentile and male walleye was below the 50th percentile lake class standard for similar lakes in Wisconsin (Figure 9). Growth and length-at-age were variable, with individual fish exhibiting a wide range of growth rates. Walleye exhibited similar growth compared to previous comprehensive surveys. However, growth rates were faster compared to nearby impoundments like Lake DuBay and the Stevens Point Flowage. On average, female walleye reach legal size (15 inches) at four years old and males at 5 years old (Figure 9).

The estimated population size (abundance) for adult walleye was 19,927 (2.9 fish/acre), with a 95% confidence interval from 18,348 to 21,506. Walleye abundance had decreased 49% from the 2003 to 2017 comprehensive surveys but has only decreased 11% since 2017 (Figure 10). Although abundance has exhibited a total decrease of 55% from 2003 to 2024, biomass of the population has only decreased 27% since 2003 (Figure 10). The estimated abundance of walleyes ≥15 inches was 5,735 in 2003 and 7,395 in 2017, which has increased to an estimate of 8,350 in 2024 (31% increase since 2003).

The age-frequency distribution of the walleye population peaked at age-5 when majority of fish reached 15 inches (Figure 11). Estimated annual mortality rate was 66% from ages 5-8, which is indicated by the steep decline in number of age-5 to age-8 walleyes (Figure 11). Susceptible to both natural and fishing mortality, these age classes are mainly comprised of walleyes from 15-20 inches, which are likely impacted by the highest levels of angler harvest. Annual mortality rate from ages 8-16 was estimated to be much lower (34%), likely due to more restrictive angler harvest at these age classes. The average male in these age classes spends the rest of its life within the protected no harvest slot from 20-24 inches and is only susceptible to natural mortality. However, the average female walleye remains in the protected slot until around age-10.

During the 2024 fall electrofishing survey targeting juvenile walleye, 147 young-of-year (YOY), 147 age-1 and 68 age-2+ walleyes were captured. Young-of-year walleye ranged in length from 5.5-7.8 inches with an average length of 6.4 inches. The relative abundance of YOY walleye was CPE = 21/mile and was CPE = 21/mile for age-1 walleye (Figure 12). The catch rate

for YOY walleye in 2024 was below the average and the lowest since 2017 (Average CPE = 56.6/mile; Figure 12). The higher catch rate of age-1 walleye in 2024 was a result of the higher catch rate of YOY walleye in 2023. Despite the low relative abundance of YOY walleye observed in 2024, the population appears to be showing a trend where a successful cohort of walleye occurs every three years (Figure 12).

MUSKELLUNGE

During the 2024 comprehensive survey, 11 muskellunge were captured during SN1, SE1, SN2 and SE2 (Table 4; Figure 13). Muskellunge ranged in length from 12.8-47.7 inches with an average length of 26.7 inches (Table 5; Figure 13). The average length for muskellunge in the BEP was between the 90th and 95th percentile and maximum length was above the 100th percentile lake class standards for similar lakes in Wisconsin (Table 5).

The relative abundance of muskellunge was CPE = 0.02/net-night which was the lowest catch rate since the 1993 spring fyke netting survey (Table 6; Figure 14). This catch rate was in the 10th percentile lake class standard for similar lakes in Wisconsin and well below the average for spring netting surveys on the BEP. The catch rate during the 2024 late spring bass-panfish electrofishing survey was 0.3/mile which is three times higher than the catch rate observed in 2017 (Table 7). Not enough muskellunge were captured to determine the size structure of the population in 2024. However, the number of yearling muskellunge captured (n = 5) throughout 2024 verifies that there was a successful spawn in 2023, and that natural reproduction is occurring in the absence of stocking (Figure 13).

NORTHERN PIKE

During the 2024 spring surveys, 473 northern pike were captured during SN1 and SN2 and an additional five were captured during SE1 and SE2 (Table 4; Figure 15). Northern pike ranged in length from 12.2-41.5 inches with an average length of 24.6 inches (Table 5). The average length for northern pike in the BEP was above the 95th percentile and maximum length was above the 100th percentile lake class standard for similar lakes in Wisconsin (Table 5). On average, males were smaller (22.3 inches) and comprised 62% of the total catch, while females were larger (29.1 inches) and represented 38% of the total catch.

The relative abundance of northern pike was CPE = 1.9/net-night which was below the average catch rate for spring fyke netting surveys (Average CPE = 6.6/net-night; Table 6). This catch rate was normal for similar lakes in Wisconsin, falling just above the 50th percentile lake class standard (Table 6). Relative abundance for 27, 32 and 40-inch northern pike were second lowest since 1993 (Figure 16). The size structure of northern pike in 2024 was very good and above average since 1993 (Figure 17), with 74% of stock sized northern pike being ≥21 inches, 29% being ≥28 inches and 10% being ≥34 inches (Table 9). Size structure has decreased since 2017, and northern pike captured in 2024 were smaller overall. However, size structure of their population within the BEP remains very good and much better than the nearby northern pike populations in Lake DuBay and the Stevens Point Flowage.

Northern pike exhibited fast growth rate, which was above the 95th percentile lake class standard for similar lakes in Wisconsin. Mean length-at-age of female northern pike was above the 75th percentile and male northern pike was above the 50th percentile lake class standard for similar lakes in Wisconsin (Figure 18). Growth and length-at-age were stable for both males and females, allowing length to be a relatively good indicator of age. Growth in

2024 was slightly slower compared to the 2017 comprehensive survey. However, growth rates were much faster compared to nearby impoundments like Lake DuBay and the Stevens Point Flowage. On average, female northern pike reach legal size (32 inches) at six years old and males at 10 years old (Figure 18).

The estimated population size (abundance) for adult northern pike was 1,519 (0.22 fish/acre), with a 95% confidence interval from 1,177 to 2,144. Abundance estimates have declined since 2003, decreasing 37% from 2003-2017 and 44% from 2017-2024 (Figure 19). Although abundance has had a total decrease of 65% since 2003, the number of northern pike ages 1-2 captured had increased 85% since 2017. These strong year classes will be an important contribution to the adult fishery in the future.

The age-frequency distribution of the northern pike population peaked at age-3 when majority of fish reached 20 inches (Figure 20). Estimated annual mortality rate was 37% from age-3 to age-13 (Figure 20). Fishing mortality doesn't become a factor until about age-10 for males, and age-6 for females due to the minimum size limit of 32 inches. However, with a daily bag limit of only one fish, fishing mortality is likely not a major factor in the total annual mortality for the northern pike population in the BEP.

SMALLMOUTH BASS

During the 2024 spring surveys, 114 smallmouth bass were captured during SN1 and SN2, with an additional 31 smallmouth bass captured during SE1 and 15 captured during SE2 (Table 4; Figure 21). Smallmouth bass ranged in length from 3.8-18.7 inches with an average length of 14.3 inches (Table 5). The average and maximum lengths for smallmouth bass in the BEP were well above the 100th percentile lake class standard for similar lakes in Wisconsin (Table 5).

The spring fyke netting relative abundance of smallmouth bass was low (CPE = 0.5/net-night) but has increased since 1993 (Table 6; Figure 23). Catch rate for smallmouth bass during fyke netting surveys is traditionally low in central Wisconsin impoundments. However, the relative abundance of smallmouth bass captured during SE2 was CPE = 2.2/mile, which is much higher than observed in 2017 and just below the 75th percentile lake class standard for similar lakes in Wisconsin (Table 7). The size structure of smallmouth bass in 2024 was good and stable, with 98% of stock sized smallmouth bass being ≥11 inches, 62% being ≥14 inches and 7% being ≥17 inches (Table 9).

LARGEMOUTH BASS

During the 2024 spring surveys, 25 largemouth bass were captured during SN1, with an additional 3 captured during SE2 (Table 4; Figure 22). Largemouth bass ranged in length from 6.0-17.7 inches with an average length of 13.8 inches (Table 5). The average length for largemouth bass was just below the 100th percentile and the maximum length was just below the 90th percentile lake class standard for similar lakes in Wisconsin (Table 5).

The relative abundance of largemouth bass was very low (CPE = 0.1/net-night) but comparable to the catch rate in 2003 (Table 6; Figure 23). Catch rate for largemouth bass during fyke netting surveys is traditionally low in Central Wisconsin River impoundments. The relative abundance of largemouth bass captured during SE2 was also very low (CPE = 0.4/mile) and didn't even rank within the percentiles for ranking populations based on lake classification standards in Wisconsin (Table 7). Despite extremely low capture success of

largemouth bass in the BEP, catch rates have increased since 2013 during SE1 (CPE = 0.4/mile in 2024), ranking just above the 1st percentile lake class standard for similar lakes in Wisconsin (Figure 24). Size structure was poor in 2024, with 92% of stock sized largemouth bass being ≥12 inches, 31% being ≥15 inches and 0% captured ≥20 inches (Table 9).

BLUEGILL

During the 2023 spring surveys, 16 bluegills were captured during SN1, with an additional six bluegill captured during SE2 (Table 4; Figure 25). Bluegill ranged in length from 4.7-9.3 inches with an average length of 7.1 inches (Table 5; Figure 25). The average and maximum lengths for bluegill captured in the BEP were above the 100th percentile lake class standard for similar lakes in Wisconsin (Table 5).

The relative abundance of bluegill was very low (CPE < 0.1/net-night), which is typical for the bluegill population in the BEP (Table 6; Figure 28). During late spring electrofishing, relative abundance was also very low (CPE = 0.9/mile) and didn't even rank within the percentiles for ranking populations based on lake class standards in Wisconsin (Table 7). However, size structure was moderate, with 73% of stock sized bluegill being ≥6 inches and 36% being ≥8 inches (Table 9).

BLACK CRAPPIE

During the 2024 spring surveys, 10,774 black crappies were captured during SN1 and SN2, with an additional 68 captured during SE2 (Table 4; Figure 26). Black crappie ranged in length from 3.2-13.9 inches with an average length of 9.6 inches (Table 5; Figure 26). The average length for black crappie in the BEP was above the 100th percentile and maximum length was above the 99th percentile lake class standard for similar lakes in Wisconsin (Table 5).

The relative abundance of black crappie was CPE = 43.1/net-night which was the highest catch rate for all comprehensive surveys and well above the average catch rate for spring fyke netting surveys since 1993 (Average CPE = 15.1/net-night; Figure 28). This catch rate is a dramatic increase since 2017 and was between the 90th and 95th percentile lake class standards for similar lakes in Wisconsin (Table 6). Size structure was good, with 99% of stock sized black crappies being ≥8 inches, 31% being ≥10 inches and 0.5% being ≥12 inches (Table 9). Size structure in 2024 was very similar to size structure in 2017 but slightly lower than earlier surveys.

Growth rate and mean length-at-age of black crappie was around the 50th percentile lake class standard for similar lakes in Wisconsin (Figure 29). On average, black crappie were very fast growing early in life, with growth greatly tapering off around ages 5-6 (9-10 inches). Similar growth was observed during the 2017 comprehensive surveys which had also shown growth greatly tapering off at ages 5-6. On average, black crappie reached 10 inches by age-6 and very rarely exceeded 12 inches (Figure 26 and 29). Specifically, one black crappie was aged at 15 years old at 11.9 inches in length (Figure 29).

The age-frequency distribution of the black crappie population peaked at age-4, when majority of fish reached 9 inches (Figure 30). Estimated annual mortality rate was 55% from ages 4-10, which is indicated by the steep decline in number of age-4 to age-10 black crappies (Figure 30). Susceptible to both natural and fishing mortality, these age classes are mainly comprised of quality and preferred sized fish >9 inches, which are likely impacted by

the highest levels of angler harvest. Strong age classes (age-4) and absent age classes (age-6) are common for black crappie populations due to their sporadic recruitment in many waterbodies around the state (Figure 30). Therefore, it is typical to see one or two age-classes supporting a fishery.

YELLOW PERCH

During the 2024 spring surveys, 116 yellow perch were captured during SN1 and SN2, with an additional 4 captured during SE2 (Table 4; Figure 27). Yellow perch ranged in length from 4.0-9.7 inches with an average length of 7.1 inches (Table 5; Figure 27). The average length for yellow perch in the BEP was above the 99th percentile and maximum length was above the 90th percentile lake class standard for similar lakes in Wisconsin (Table 5).

The relative abundance of yellow perch was low (CPE = 0.5/net-night). Relative abundance was below the average catch rate for spring fyke netting surveys since 1993 (Average CPE = 2.9/net-night) and fell within the 10th and 25th percentile lake class standards for similar lakes in Wisconsin (Table 6; Figure 28). Size structure was poor, with only 31% of stock sized yellow perch being ≥8 inches and none being ≥10 inches (Table 9).

OTHER SPECIES

Many other species of fish were captured during the 2024 comprehensive survey on the BEP. One burbot and one rock bass were each encountered on one occasion and were rare to see in the BEP (Table 4). In addition, non-gamefish species captured included common carp, shorthead redhorse, white sucker, yellow bullhead, golden shiner, golden redhorse, silver redhorse, black bullhead and gravel chub (Table 4).

Discussion and Recommendations

The fishery on the BEP appears to be diverse and healthy with good populations of many species of fish, including gamefish and panfish populations that have been exclusively maintained through natural reproduction since 2019. The BEP offers a range of fishing opportunities for anglers and has a complex fish assemblage. The main predatory fish are walleye and northern pike, with smaller populations of muskellunge, smallmouth bass and largemouth bass. The highly abundant black crappie population provides anglers an additional opportunity to enjoy the quality panfish fishery.

WALLEYE

Walleyes dominate the predatory gamefish community in the BEP and provide an abundance of fish over a wide range of size classes. Overall, the BEP walleye population characteristics are consistent with a high-quality walleye fishery. Data from the last creel survey completed in 2003 showed that 57% of the targeted fishing effort on the BEP was for walleye. Since then, the fish community has dramatically shifted (Figure 4) and catch rates during survey efforts indicate black crappie are now most prevalent. An updated creel survey would be beneficial to determine how targeted fishing effort has changed since 2003. Furthermore, previous surveying efforts have focused entirely within the reservoir, which excluded data from walleye that may have migrated upriver to spawn. The electrofishing completed in the Big Eau Pleine River in 2024 was the first verification of walleye spawning upriver (Figure 3). These survey efforts should be expanded in future surveys and included in population estimates.

Walleye stockings began in 1974, with eight walleye fry stocking events occurring between 1974 to 1983. No walleye stocking occurred from 1984 to 2012 and the BEP walleye population thrived, reaching an estimated population size of 43,695 (6.4/acre) in 2003, all while enduring several notable winter fish kills. The population estimate calculated from the 2017 comprehensive survey was 22,438 (3.3/acre), which occurred 5-8 years after the two most recent severe winter kills in 2009 and 2012. The population has remained relatively unchanged, with an estimated population of 19,927 (2.9/acre) in 2024. By only looking at the changes in estimates of abundance over time, it is difficult characterize whether winter kill events had a major influence on walleye population dynamics.

Walleye abundance may have decreased since 2003, yet the population biomass to abundance ratio has improved, indicating increased production and overall population size structure. When compared to abundance estimates, changes in biomass better reflect changes to overall size and age structure within the population. It's likely that walleye biomass is a factor of increased growth (environmentally induced), increased size structure and decreased angler harvest of 20-24-inch fish protected by the slot. Specifically, walleye size structure has changed substantially since 2003, with an increase in the proportion of walleye ≥15 inches from 21% in 2003, to 45% in 2017 and to 55% in 2024. When considering age and size structure information, angler harvest appears to have the greatest influence on annual mortality rate when compared to other factors. For example, obvious declines (major drops in fish abundance) can be seen in the age-structure data from ages 5-8 (Figure 11) when walleyes are legally harvestable (15-20 inches).

In the BEP, it's likely that walleye biomass could also reflect patterns of strong recruitment. Studies have shown that walleye productivity and biomass are significantly higher in waterbodies sustained solely by natural reproduction (Rypel et al. 2018). Naturally recruited strong year classes typically occur every three years in the BEP, yet the BEP frequently produces higher catch rates of age-0 walleye than most waterbodies in Wisconsin. Although adult abundance may be lower than previous surveys, sub-adult fish may be more abundant. However, these fish are difficult to capture and quantify using standard surveying gears. In general, the BEP has fish productivity that resembles riverine classified waterbodies and has much higher productivity than most complex-warm-dark lakes in its lake class. This is largely a factor of high phosphorus inputs, primarily agriculture and other environmental factors within the watershed that make the BEP so unique.

MUSKELLUNGE

Muskellunge stocking began in 1972 and continued through 2016. From 1972 to 2007, 22 stocking events occurred with an average of 486 fish stocked annually. Following the fish kill in 2009, there have been five stocking events at the maximum stocking rate of 2,500 fish based on statewide stocking protocols. The goal of the increased stocking rate was to create a better muskellunge fishery while also improving the predatory fish community. The common carp population became highly abundant following the severe fish kill in 2009, and the idea was that these stocked muskellunge would help suppress their population through predation. However, survival from these stocking events appears to be minimal based on survey efforts and PIT tagging data. It is difficult to determine the true contribution of these stocking events based on limited data, but low catch rates suggest the high stocking rates were not significantly contributing to the adult population. Since the last stocking event in

2016, the population remains low. However, capture and observation of numerous yearling muskellunge in 2024 provides verification of natural reproduction at a level not observed in other local waterbodies, including the Wisconsin River system in central Wisconsin.

Since the BEP is a large reservoir with an extremely productive forage base, the low catch rates of higher quality sized muskellunge (fish >45 inches) suggest they are not reaching their growth potential in the BEP. Research has found that lake area has a significant influence on the growth potential of muskellunge (Parks et al. 2017; Simonson 2019). Specifically, Simonson (2016) found that lakes ≥2000 acres can produce fish 50 inches and greater. Compared to the well-established northern pike population in BEP, the muskellunge population appears to have a limited productive capacity. Competition between the northern pike and muskellunge populations may be a factor impacting their potential to establish a productive population. However, seasonally low dissolved oxygen concentrations and high turbidity are likely major factors limiting the muskellunge population. These conditions are more favorable for northern pike (Casselman and Lewis 1996; Pierce et al. 2013), as muskellunge are considerably less tolerant to these degraded environmental conditions (Casselman and Harvey 1975).

NORTHERN PIKE

The BEP supports a healthy northern pike population that has seen fluctuations in size structure over time. However, the estimated population size has steadily decreased since 2003. The population has been almost exclusively sustained by natural reproduction. Only four northern pike stocking events have occurred since 1978, each following a winter fish kill event. In 1995, a more restrictive harvest regulation (32-inch MLL and 1/day) was implemented, which likely played a role in maintaining the trophy northern pike fishery.

Comprehensive survey data since 1993 shows the population size structure has remained very good, and relatively stable if you exclude data from the 2003 and 2017 comprehensive surveys (total catch ≥32 inches = 12.5% in 1993, 19.9% in 1999, 3.2% in 2003, 27.1% in 2017 and 19.5% in 2024). The lower size structure calculated in 2003 resulted from the high abundance of northern pike <20 inches in the BEP at that time. In the absence of any recent fish kill events before 2003, natural recruitment was very high. In contrast, the high size structure observed in 2017 may have been a result of the 2009 and 2012 fish kill events. Specifically, the surviving population had a high abundance of young fish to prey on during a time when many populations of fish were recovering from these large fish kill events. Overall, the size structure of northern pike in 2024 offers a trophy fishery and remains very good when compared to other waterbodies in central Wisconsin. However, their lower abundance may make them rarer to catch than in previous years.

Northern pike in the BEP exhibit well-above average growth rates compared to other waterbodies in the same lake classification, in addition to many other local populations. For example, mean length at each age class far exceeded those from recent data collected from northern pike in Lake DuBay and the Stevens Point Flowage. Northern pike in the BEP reach harvestable size (32 inches) on average by age 6, while it takes 9-10+ years in Lake DuBay and the Stevens Point Flowage. Total annual mortality was calculated from age-frequency data to be 37%, which was lower than in 2017 (51%) but comparable to the Stevens Point Flowage (45%). Ultimately, northern pike growth rates in the BEP are very fast and resemble growth observed for muskellunge populations in central Wisconsin impoundments.

Recruitment appeared to be limited in 2017 based on the lack of northern pike captured <20 inches (ages 1-2). However, an 85% increase in the number of northern pike ages 1-2 since 2017 indicates that natural recruitment was occurring in 2024 at a much higher level. Northern pike typically require flooded vegetation for spawning activities and successful recruitment (Casselman and Lewis 1996). High turbidity in the BEP may be a limiting factor for plant growth. Casselman and Lewis (1996) also found that northern pike year-class strength has been positively correlated to water levels. It is likely that recruitment may have been much higher in 2024 compared to 2017 due to winter drawdowns and the timing of spring refill in relation to northern pike spawning. However, this would be difficult to determine, as there are likely many factors that impact recruitment in the BEP. Ultimately, the increased number of northern pike ages 1-2 in 2024 provide strong year classes that will be important contributions to the adult fishery in the future.

SMALLMOUTH BASS & LARGEMOUTH BASS

Smallmouth and largemouth bass appear to be low density and small size structure fisheries in the BEP. All comprehensive surveys have indicated low relative abundance and size structure bass populations that have remained stable over time. The early spring fyke netting surveys occur while water temperatures are lower than when bass typically spawn, which is likely why fyke netting catch rates have been consistently low. However, anecdotal evidence from anglers catching increased numbers of largemouth bass as bycatch while fishing for other species suggests the largemouth bass population in the BEP is increasing. Since DNR survey data does not indicate the same increasing trend, it is difficult to verify if the population is increasing or determine why anglers are catching them more frequently if their population is not increasing.

Standard electrofishing surveys targeting spawning bass during late spring are typically a better method to fully evaluate their population. However, finding and capturing bass in areas with their “typical” spawning habitat proved to be unsuccessful and few fish were captured. It is possible that the largemouth bass population in the BEP may use spawning habitat that isn’t typical of other populations around the state. Future surveys should focus on spreading out effort to various habitat types to get an adequate representation of their population and where they may be spawning. Furthermore, previous surveying efforts have focused entirely within the reservoir, which excluded any data collected on bass that may have migrated upriver to spawn. The electrofishing completed in the Big Eau Pleine River in 2024 was the first survey targeting bass upriver (Figure 3). Although no largemouth bass were captured upriver, the habitat was ideal for smallmouth bass and their catch rates were much higher than in the reservoir. These survey efforts should also be expanded in future surveys.

PANFISH

The panfish community in the BEP is dominated by black crappie, comprising 99% of the total panfish catch. Panfish populations in the BEP have experienced significant changes since 2003. For example, black crappie relative abundance has substantially increased from 2003-2017 and 2017-2024, an 89% increase in fyke netting catch rates since 2003 (Figure 28). In contrast, yellow perch relative abundance has decreased by 94% during the same timeframe.

Age-4 black crappies from the 2020-year class represented 65% of their population in 2024. Similarly, the 2013-year class (age-4) represented 78% of the population in 2017, which was a

product of the first spawn following the 2012 winter fish kill. Large year classes could indicate compensatory recruitment in an event such as fish kills or following several years of weak year classes. It appears that a strong year class occurs every 3-4 years on the BEP. The 2018-year class (age-6) of black crappie in 2024 was absent in our catch, with a weak year class also occurring in 2019 (age-5) followed by the strong year class in 2020 (age-4). Similar trends are seen in other central Wisconsin impoundments, like Lake DuBay where strong year classes have typically occurred every 3-4 years. Research has shown that it is common for black crappie populations to have erratic recruitment (Hooe 1991) that is often cyclical, with a strong year-class often forming only once every 3-5 years in many large reservoir systems (Swingle and Swingle 1967).

Compared to lake class standards, the average total lengths for black crappie in 2017 and 2024 (9.8 and 9.6 inches, respectively) were well above the 95th percentile compared to other complex-warm-dark lakes (7.7 inches) and complex-riverine systems (8.5 inches). Black crappie size structure in 2024 was comparable to the normal range identified from recent surveys on other local Wisconsin River impoundments. Black crappies in the BEP grow fast and achieve large sizes at a young age (9 inches by age 3-4). However, their average growth potential tops out around 12 inches, which is much lower than the growth potential in other central Wisconsin River impoundments that can exceed 14 inches. The differences in these growth potentials may be a factor of density dependent growth, as relative abundance of black crappie in the BEP was nearly four times higher than other central Wisconsin River impoundments.

Total annual mortality was calculated to be 55% in 2024, which was comparable to 2017 (49%) but much higher than other local central Wisconsin River impoundments (2022 Lake DuBay annual mortality = 20-30%). The higher annual mortality rates in the BEP may be due to 65% of their population being age-4 fish between 9-10 inches, in addition to 99.8% of the population being ≥8 inches. Therefore, majority of the adult black crappie population in the BEP were above the minimum size harvested by many anglers. In contrast, only 53% of the black crappie population in Lake DuBay are fish ≥8 inches, which reduces mortality rate estimates since anglers typically don't harvest black crappies <8 inches. Ultimately, harvest is likely a large contributor to the total annual mortality within the BEP, and the recently reduced daily bag limit implemented in 2022 should allow more fish to grow and survive to multiple strong year classes in the future.

The other notable panfish species that has been historically important to the BEP fishery is yellow perch. However, yellow perch comprised <1% of the total panfish catch in 2024. Their relative abundance has steadily declined since 2003, which was three times lower in 2024 than in 2017, and 18 times lower than in 2003 (9.0/net-night in 2003 and 0.5/net-night in 2024). It should be noted that Wisconsin DNR spring netting protocols and sampling gear may not adequately sample yellow perch populations in large impoundments, underrepresenting their populations. Regardless, the yellow perch population has an important predator-prey relationship with walleye and other gamefish species. This relationship likely plays a role in regulating yellow perch abundance and size structure, in addition to many other factors which play a role in shaping all fish populations in the BEP.

Acknowledgements

The data collected for this report would not have been possible without the work of many DNR and WVIC staff, as well as former staff who were present during the 1993, 1999, 2003 and 2017 comprehensive surveys. Jake Thompson, Wausau advanced fisheries technician, prepared all survey gear, coordinated all volunteer assistance for successful completion of the 2023 comprehensive survey, operated the electrofishing boat, processed and aged all the fish aging structures and entered all data into appropriate databases. Two netting crews wouldn't have been possible without WVIC staff Ben Niffenegger and Scott Blado who completed the fyke netting survey on the upper end of the BEP and assisted with electrofishing surveys. Wisconsin Rapids Fisheries Management staff Jennifer Berman, Jason Spaeth, Dave Osier and DNR area team supervisor Al Niebur filled in to help with completion of various surveying efforts during the 2024 comprehensive survey. A special thanks goes to all Wisconsin DNR fisheries staff from the Antigo, Wisconsin Rapids, Shawano and Wautoma offices for bringing their electrofishing boats and gear to help complete the walleye recapture electrofishing survey. Finally, a huge thank you to all volunteers that filled in and provided help in completing our survey.

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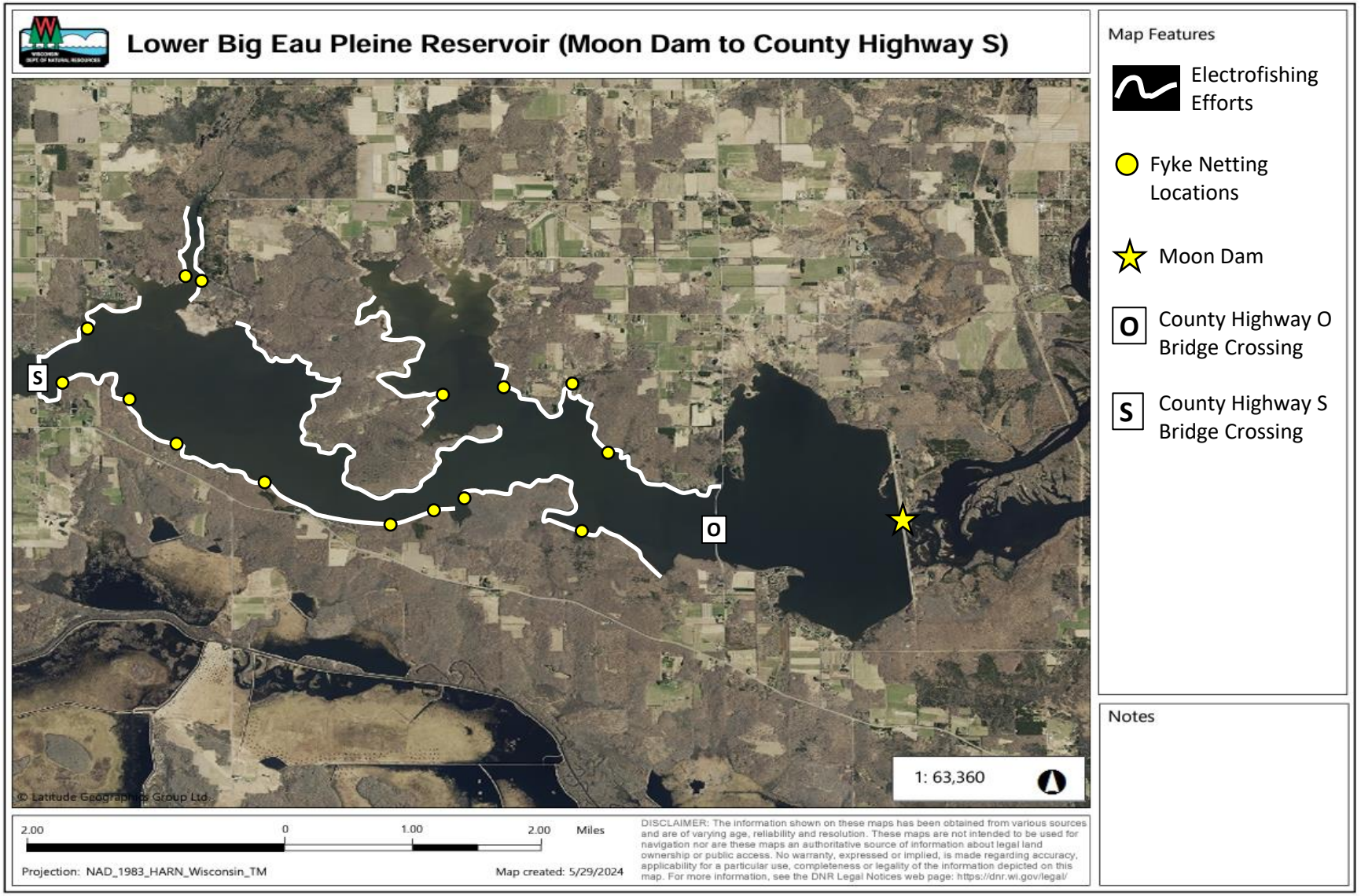

Figure 1. Map of the lower Big Eau Pleine Reservoir (from Moon Dam upstream to County Highway S) including fyke netting locations and electrofishing transects during the 2024 comprehensive survey.

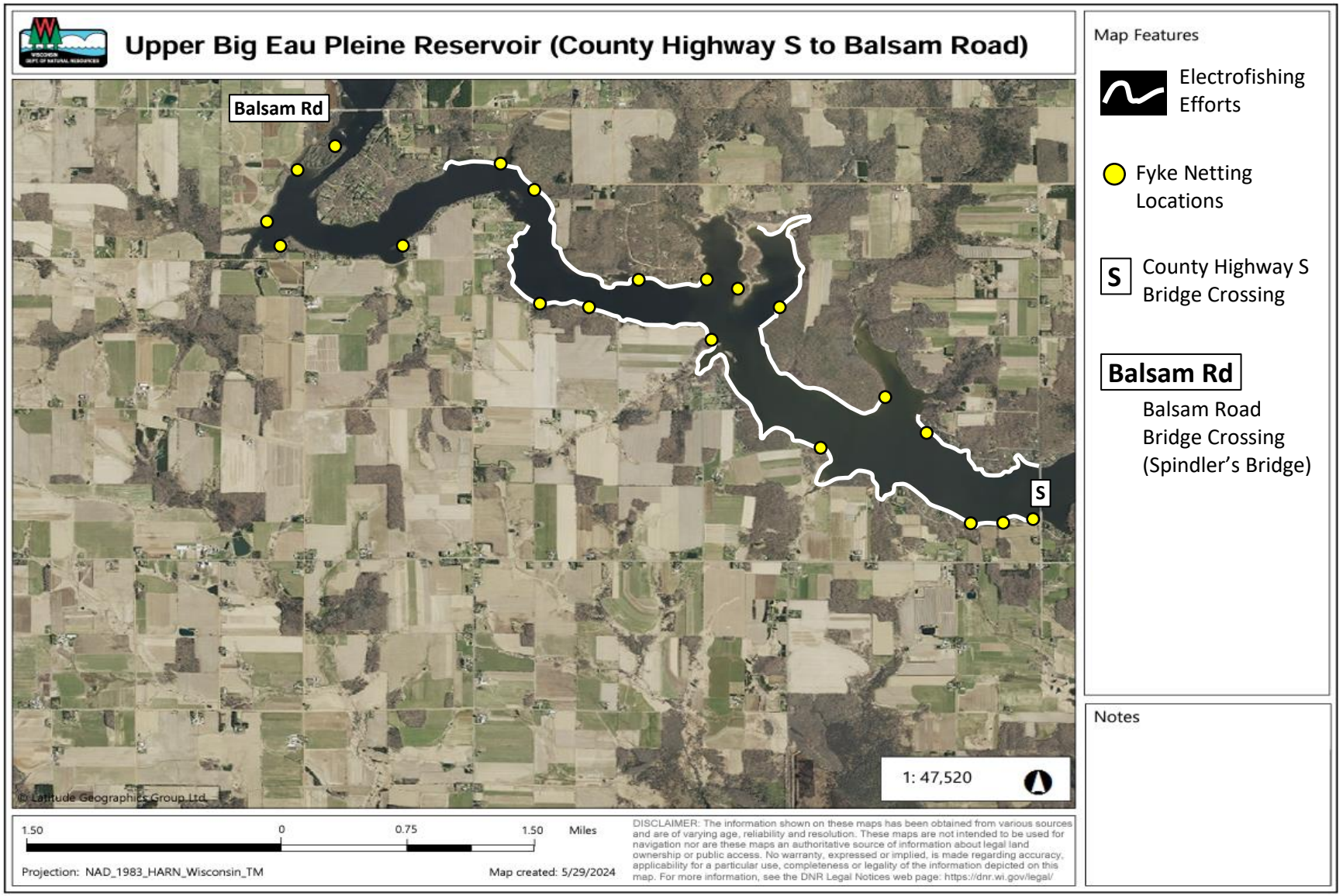

Figure 2. Map of the upper Big Eau Pleine Reservoir (from County Highway S upstream to Balsam Road) including fyke netting locations and electrofishing transects during the 2024 comprehensive survey.

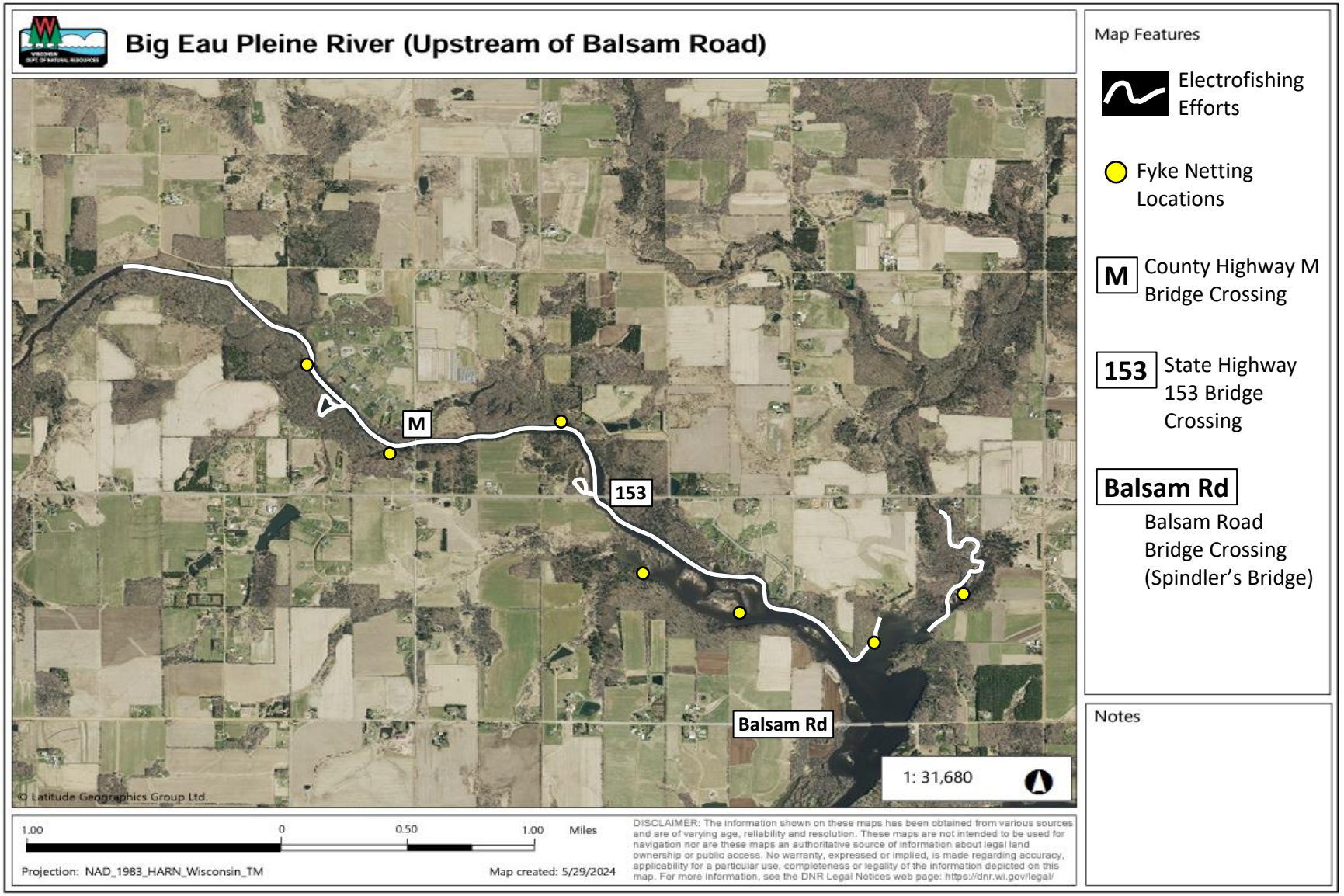

Figure 3. Map of the Big Eau Pleine River (from Balsam Road upstream to Stratford) including fyke netting locations and electrofishing transects during the 2024 comprehensive survey.

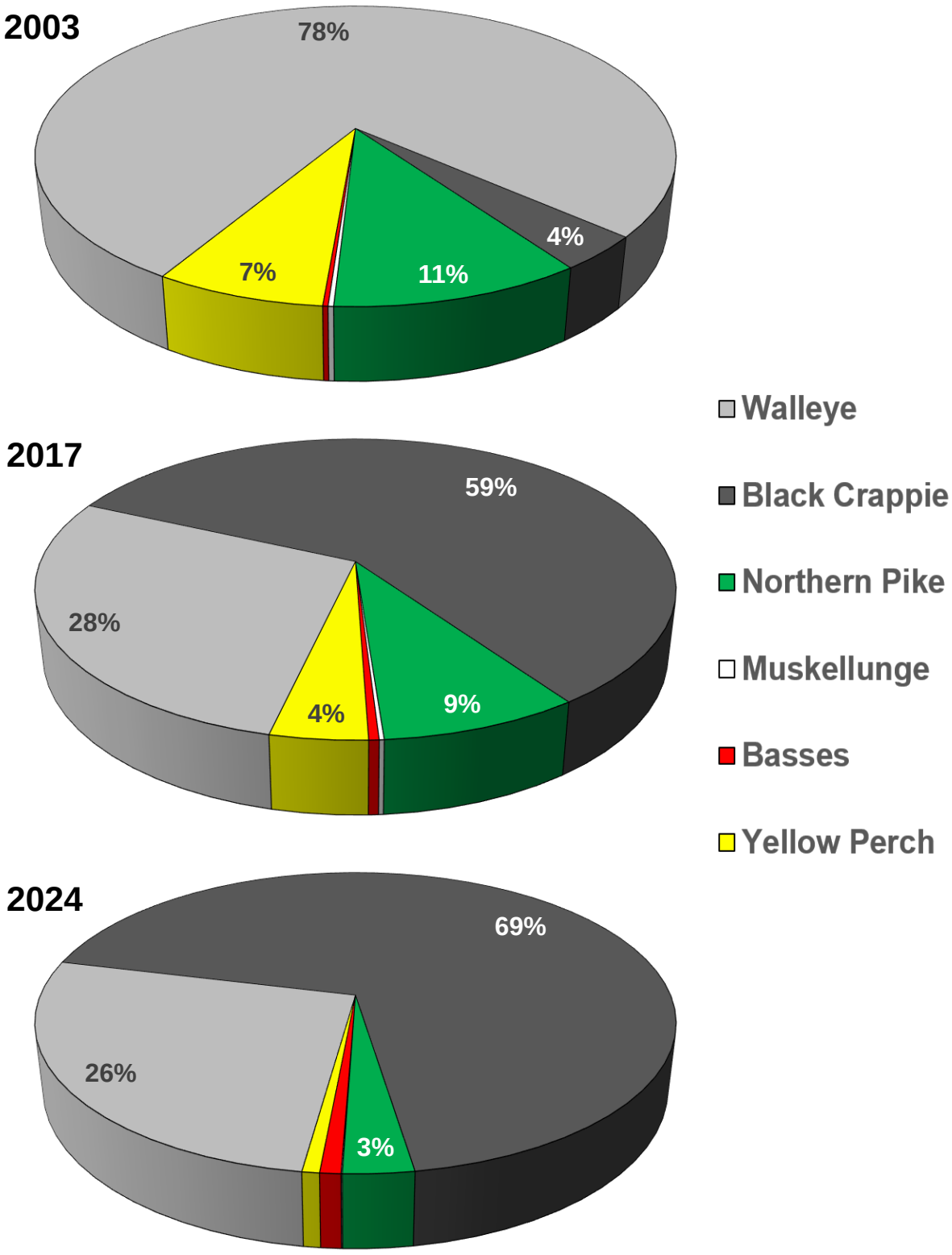

Figure 4. – Proportion of gamefish catch, shown as the percentage of each gamefish species captured (by total number) from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during spring netting surveys in 2003 (top), 2017 (middle) and 2024 (bottom).

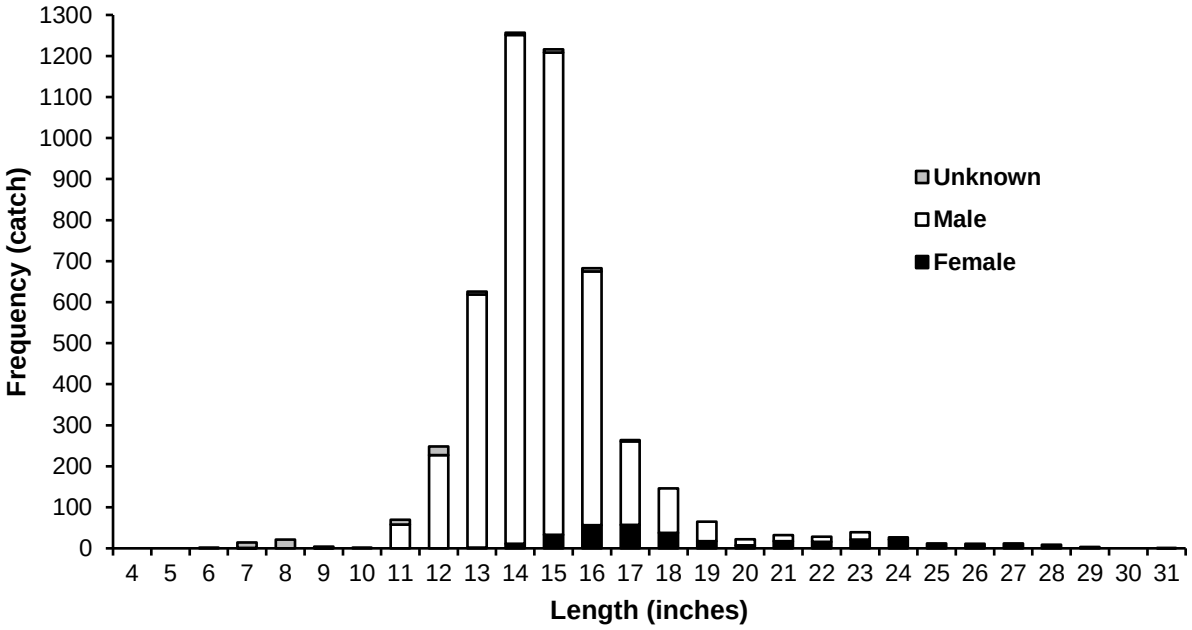

Figure 5. – Length frequency of walleye (n = 4,814) captured from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 spring netting (SN1) and electrofishing (SE1) surveys.

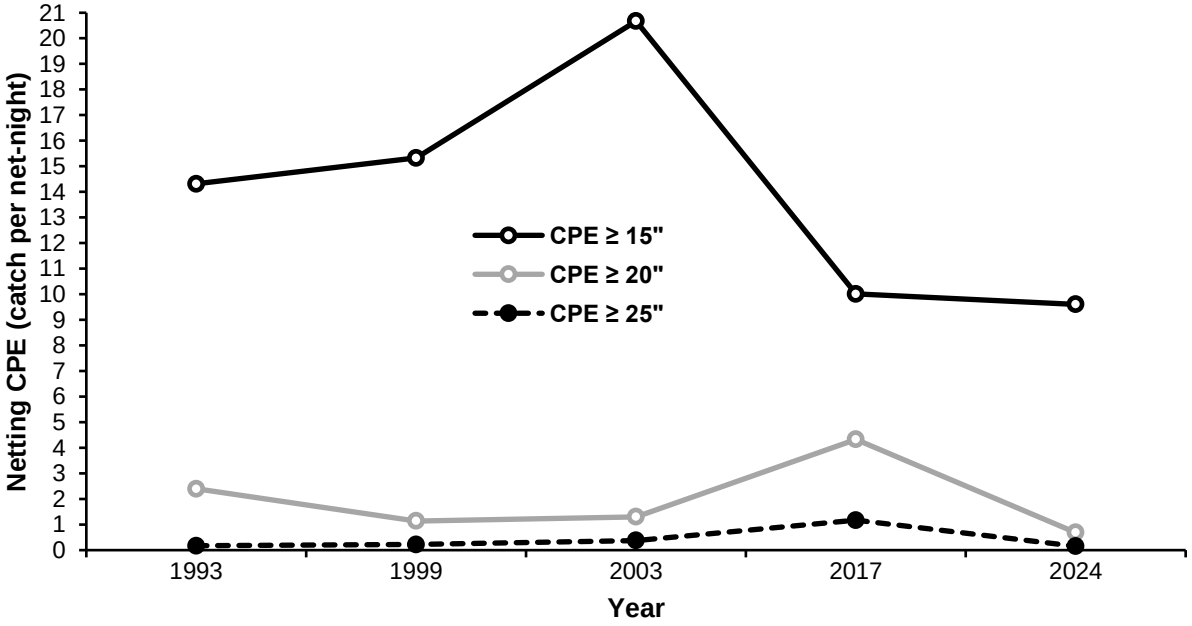

Figure 6. – Relative abundance (catch per effort; CPE) of walleye at various sizes captured during spring fyke netting (SN1) from the Big Eau Pleine Reservoir, Marathon County, Wisconsin in 1993, 1999, 2003, 2017 and 2024.

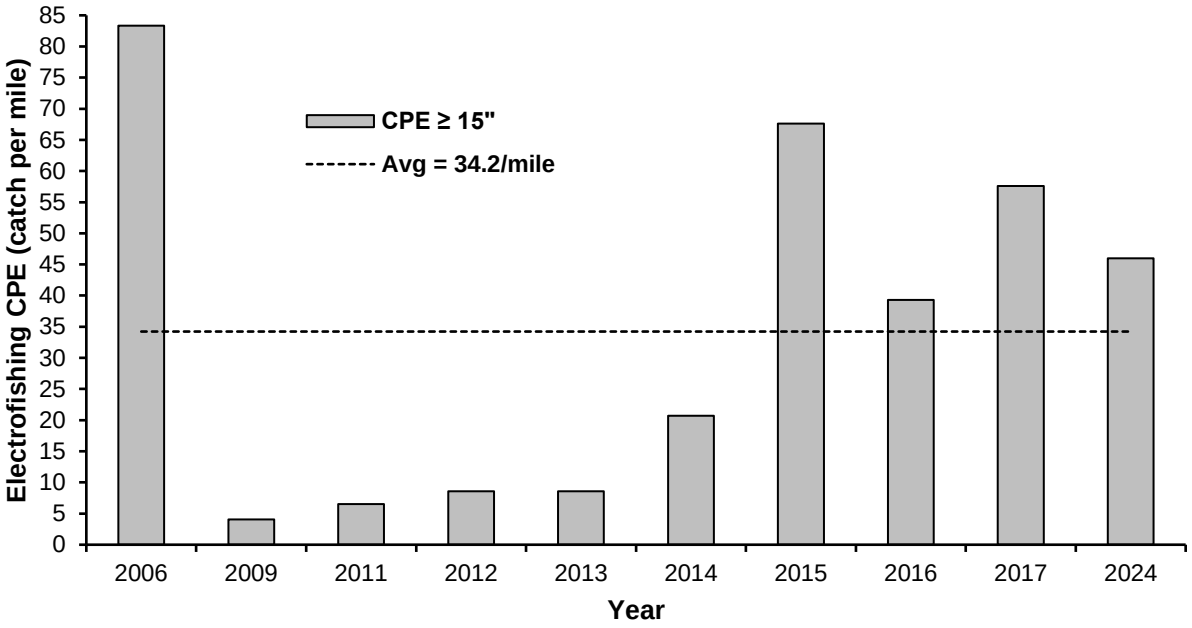

Figure 7. – Relative abundance (catch per effort; CPE) trend of walleye captured from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during 2006-2024 spring electrofishing surveys at the trend site located on the south shoreline across from the Marathon County Park.

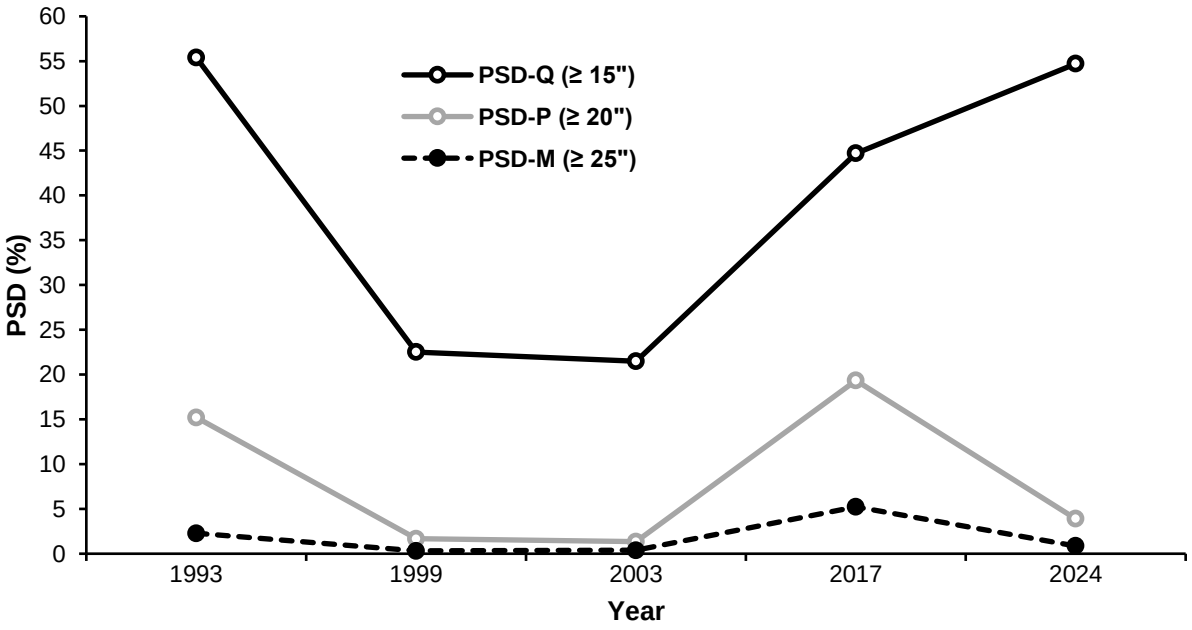

Figure 8. – Proportional stock distribution (PSD; %) of walleye at quality (PSD-Q), preferred (PSD-P) and memorable (PSD-M) sizes captured during spring fyke netting (SN1) from the Big Eau Pleine Reservoir, Marathon County, Wisconsin in 1993, 1999, 2003, 2017 and 2024.

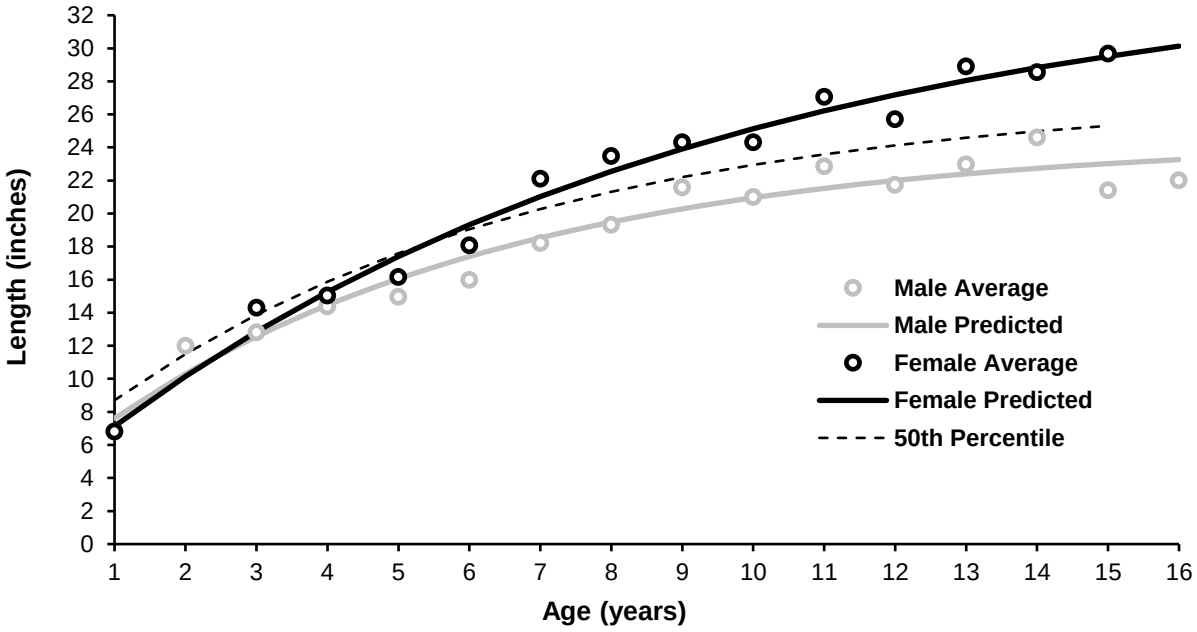

Figure 9. – Mean length-at-age and predicted length-at-age (von Bertalanffy, 1938) of male and female walleye captured in the Big Eau Pleine Reservoir, Marathon County, Wisconsin during 2024 compared to the 50th percentile lake class standards for Wisconsin's complex warm-dark lakes (combined sexes).

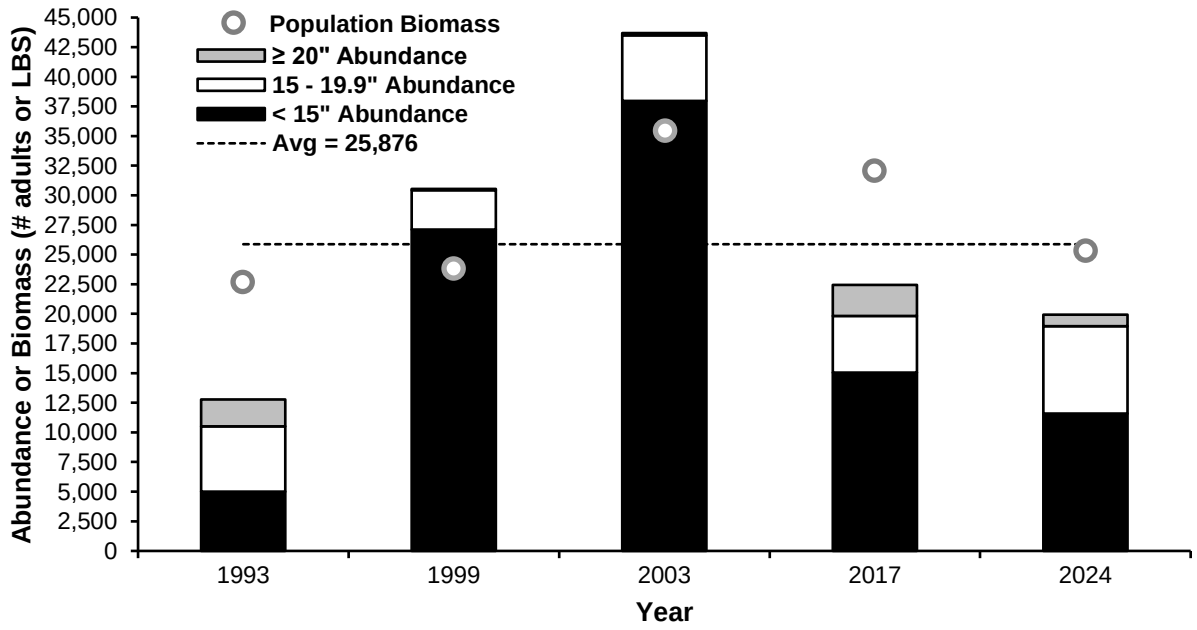

Figure 10. – Mark-recapture population estimates for adult walleye (abundance = number of adults; population biomass = total pounds) on the Big Eau Pleine Reservoir, Marathon County, Wisconsin calculated during the 1993, 1999, 2003, 2017 and 2024 comprehensive surveys.

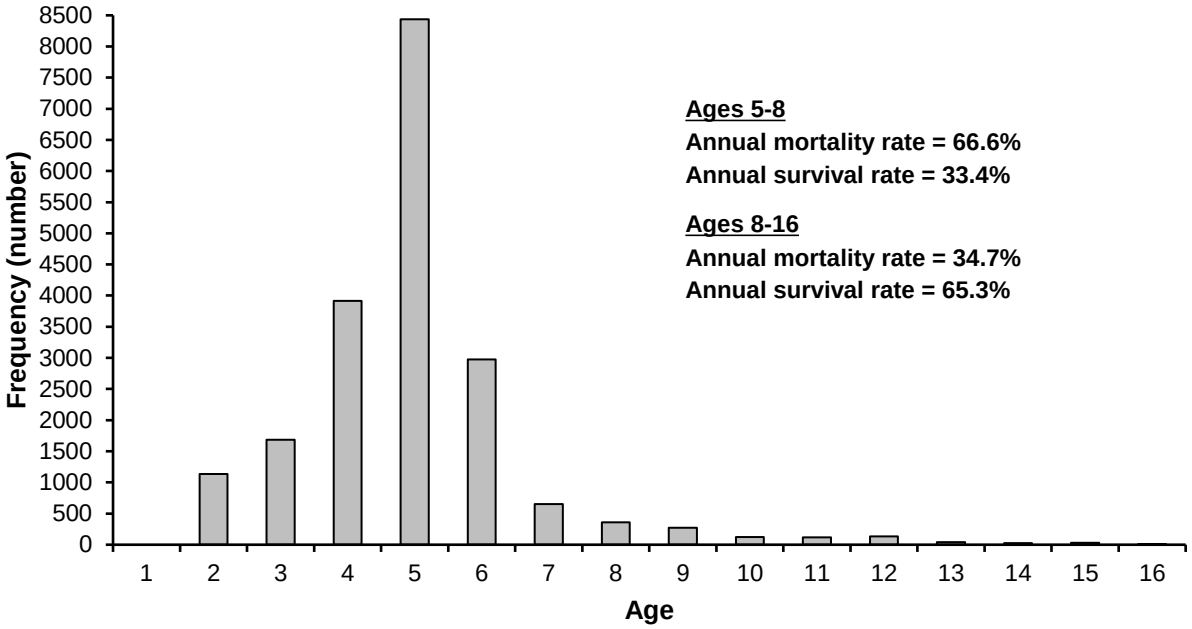

Figure 11. – Age-frequency distribution of walleye including mortality and survival rate estimates calculated from catch curves incorporating all age ranges fully vulnerable to capture from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 comprehensive survey.

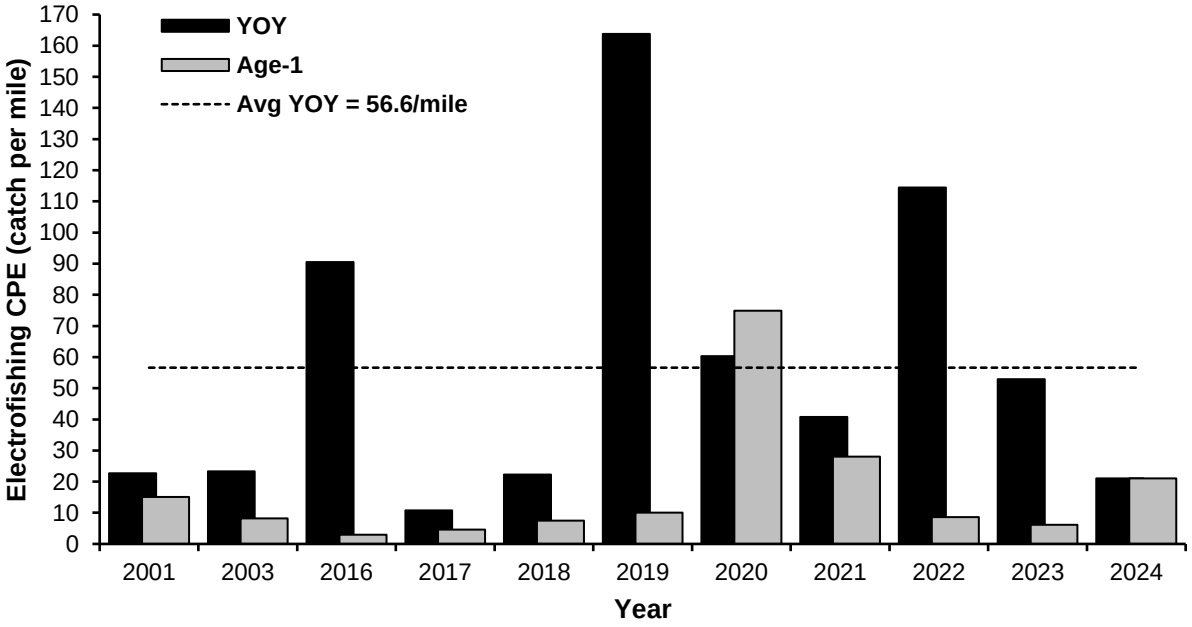

Figure 12. – Relative abundance (catch per effort; CPE) of young-of-year (YOY) and Age-1 walleye captured from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during 2001-2024 fall electrofishing (FE) surveys.

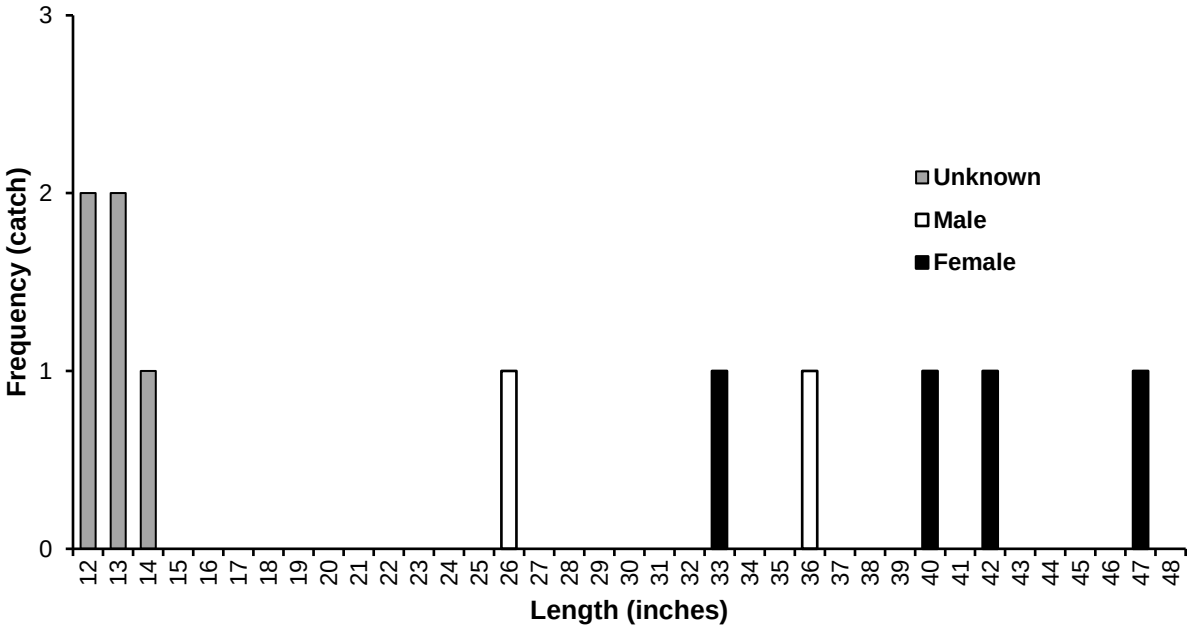

Figure 13. - Length frequency of muskellunge (n = 9) captured from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 comprehensive survey.

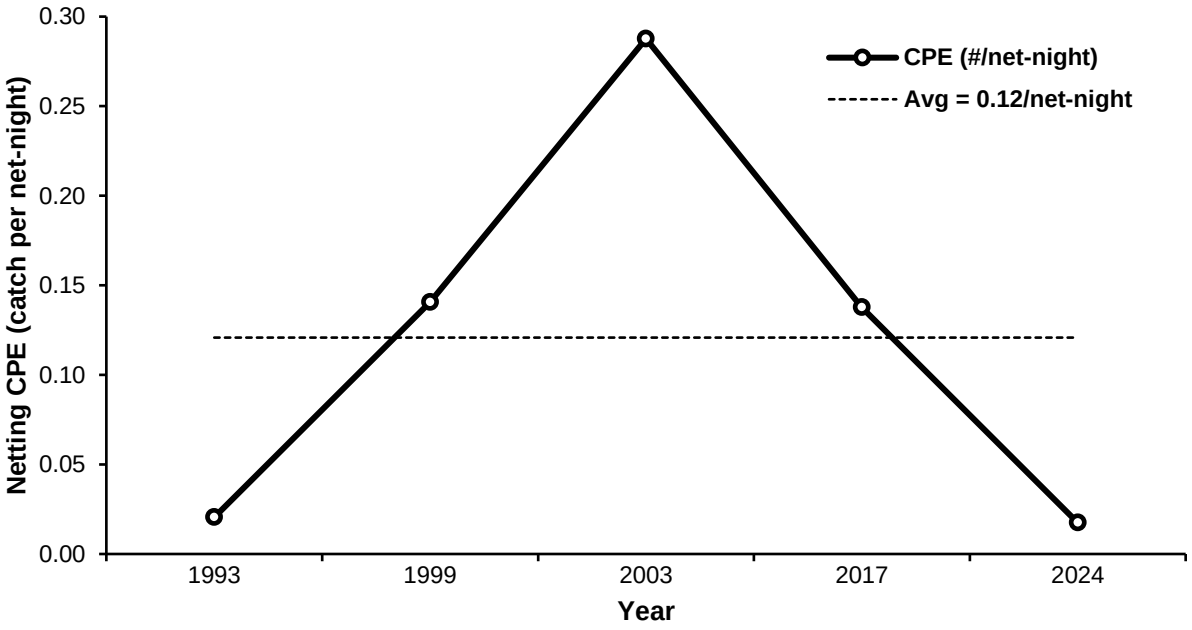

Figure 14. – Relative abundance (catch per effort; CPE) of muskellunge captured during spring fyke netting from the Big Eau Pleine Reservoir, Marathon County, Wisconsin in 1993, 1999, 2003, 2017 and 2024.

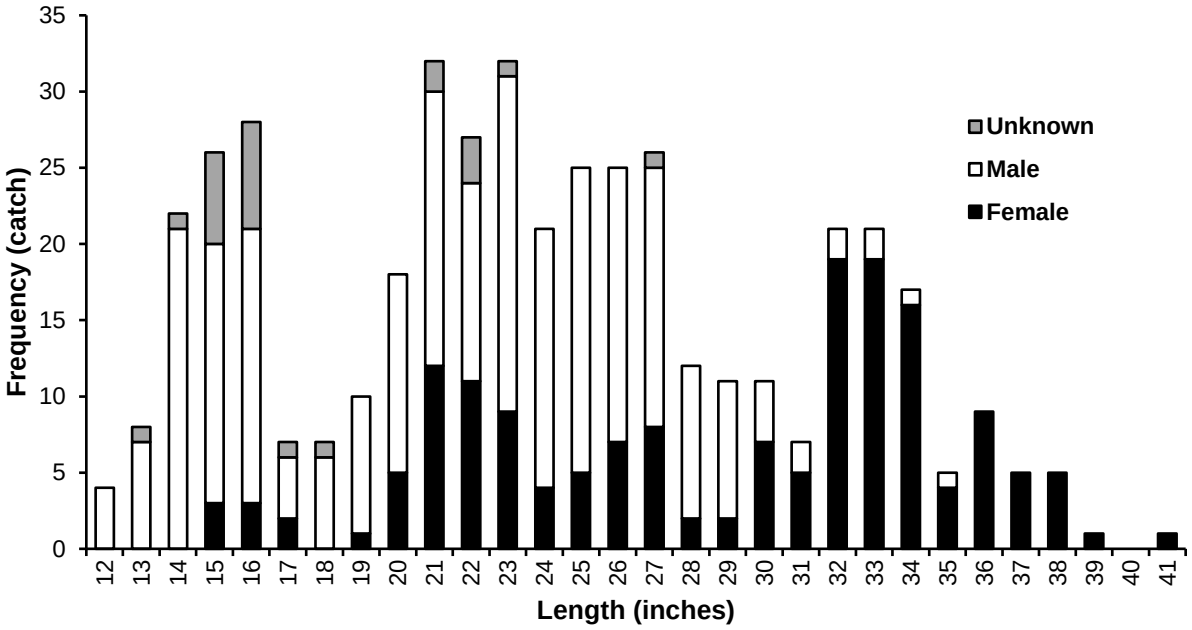

Figure 15. - Length frequency of northern pike (n = 444) captured from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 spring netting (SN1) and electrofishing (SE1) surveys.

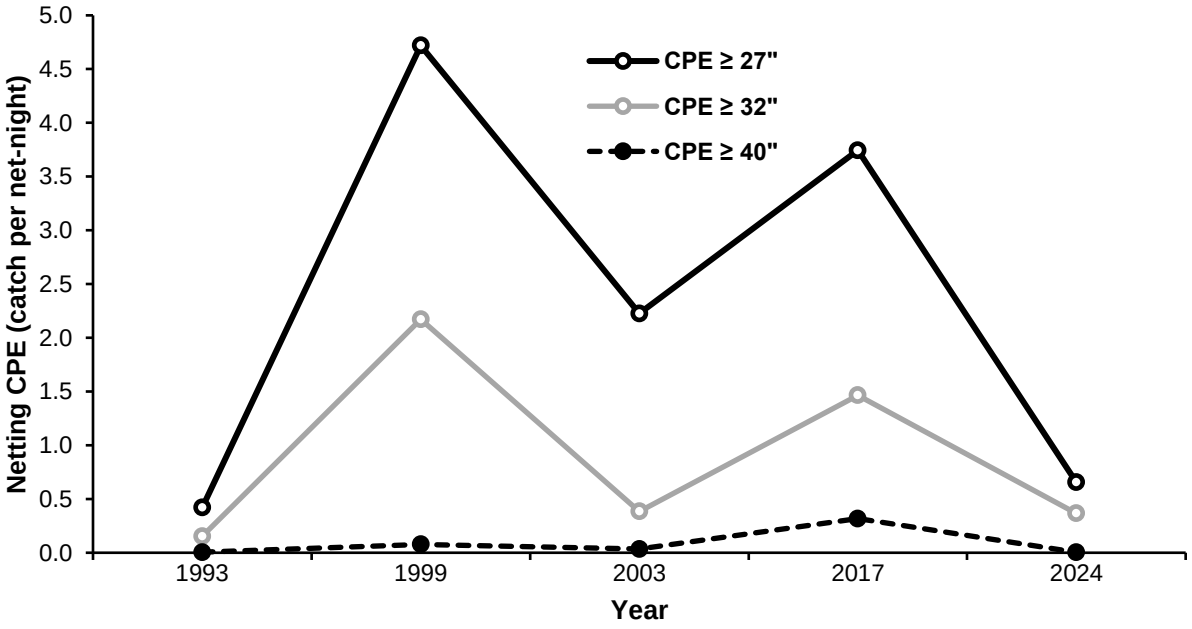

Figure 16. – Relative abundance (catch per effort; CPE) of northern pike at various sizes captured during spring fyke netting (SN1) from the Big Eau Pleine Reservoir, Marathon County, Wisconsin in 1993, 1999, 2003, 2017 and 2024.

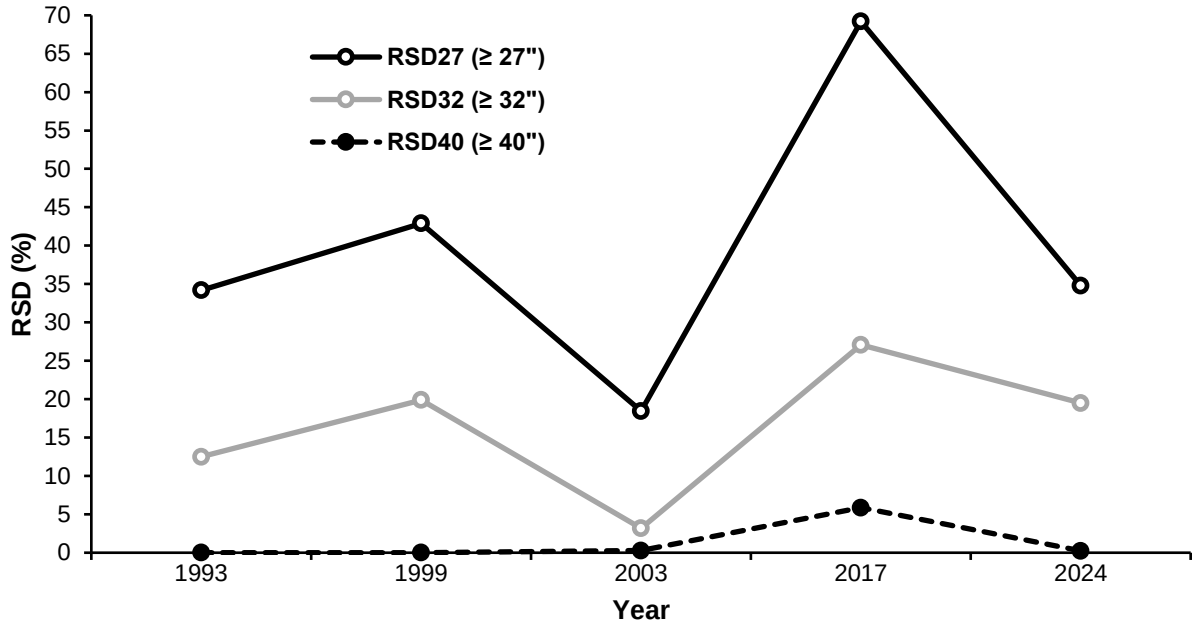

Figure 17. – Relative stock distribution (RSD; %) of northern pike at various sizes captured during spring fyke netting (SN1) from the Big Eau Pleine Reservoir, Marathon County, Wisconsin in 1993, 1999, 2003, 2017 and 2024.

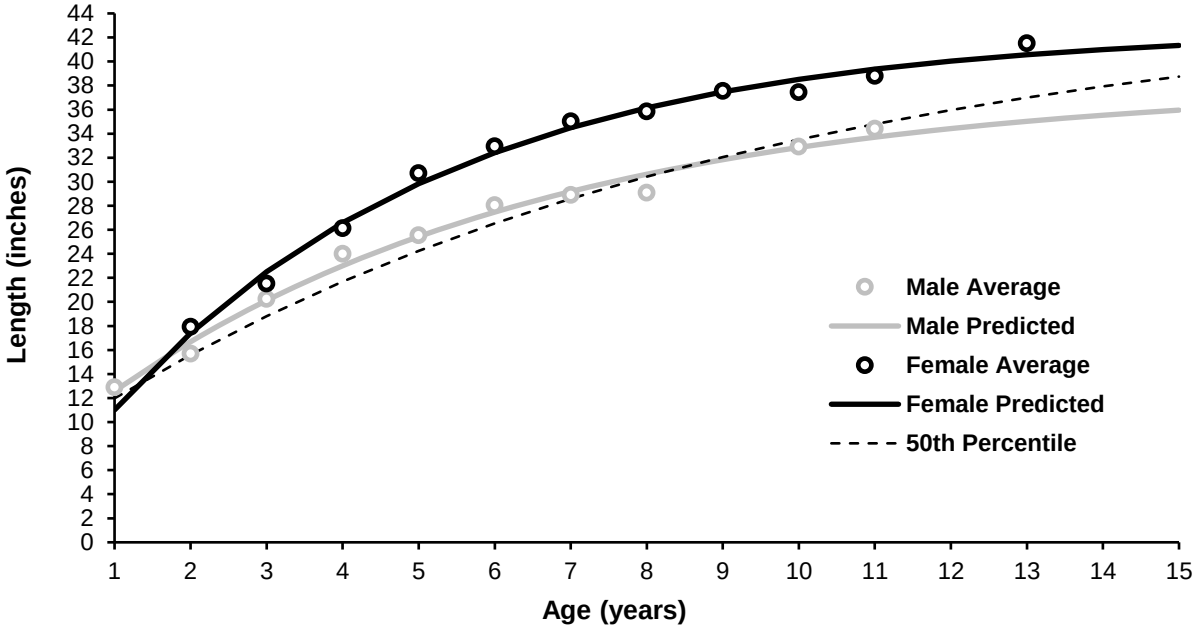

Figure 18. – Mean length-at-age and predicted length-at-age (von Bertalanffy, 1938) of male and female northern pike captured in the Big Eau Pleine Reservoir, Marathon County, Wisconsin during 2024 compared to the 50th percentile lake class standards for Wisconsin's complex warm-dark lakes (combined sexes).

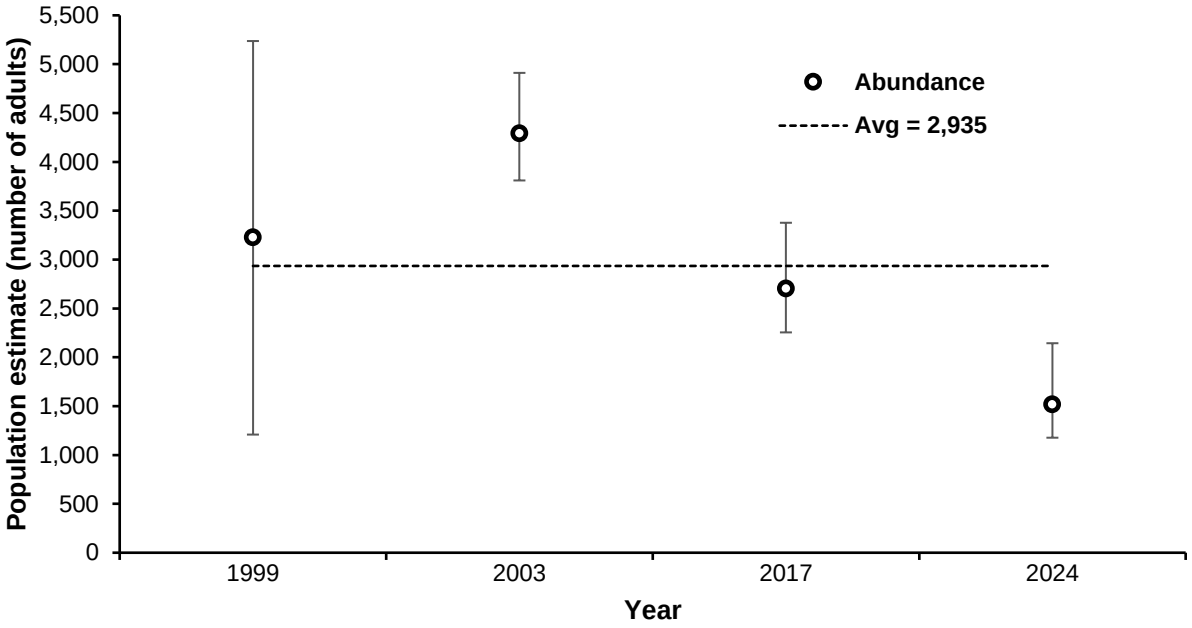

Figure 19. – Mark-recapture population estimates for adult northern pike on the Big Eau Pleine Reservoir, Marathon County, Wisconsin calculated during the 1999, 2003, 2017 and 2024 comprehensive surveys.

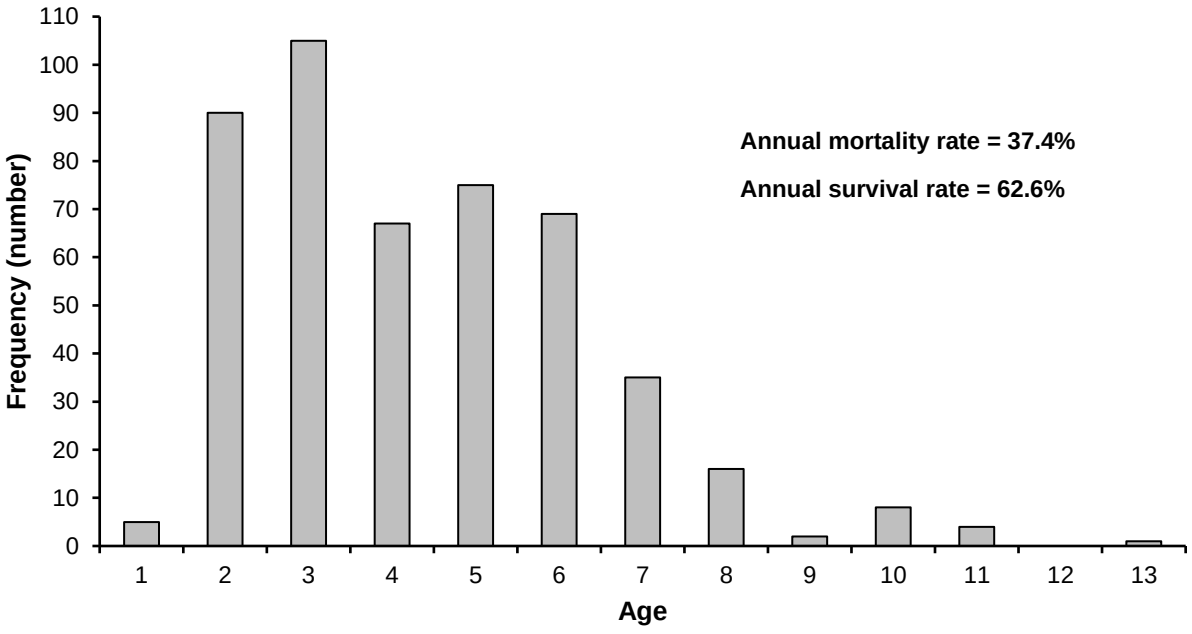

Figure 20. – Age-frequency distribution of northern pike including mortality and survival rate estimates calculated from catch curves incorporating all age ranges fully vulnerable to capture from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 comprehensive survey.

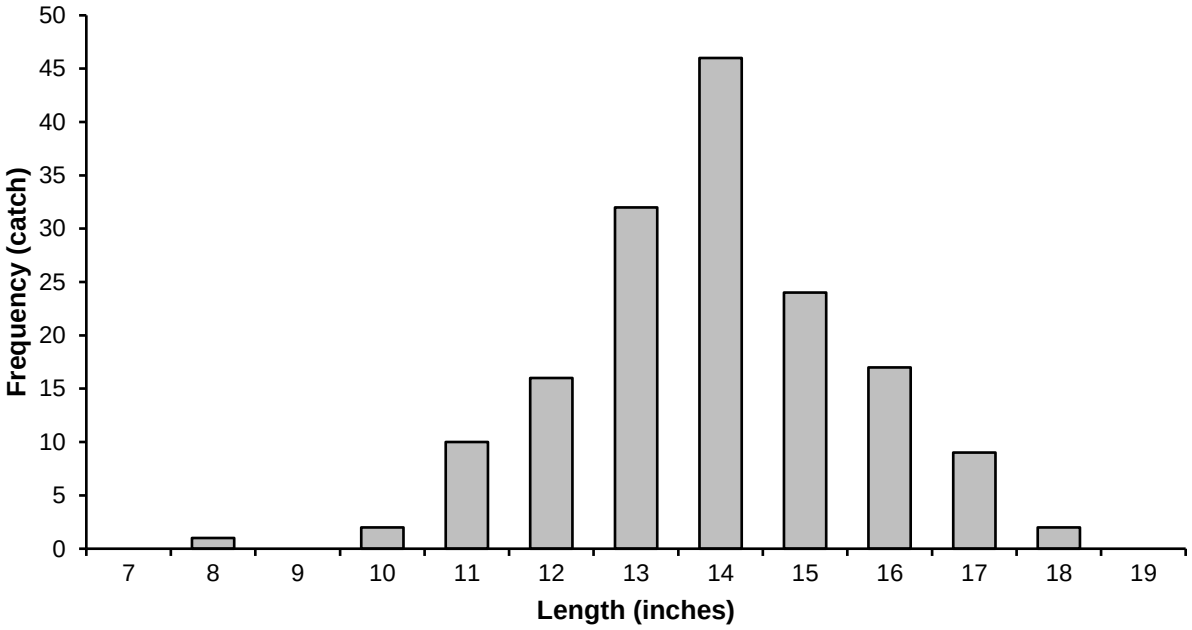

Figure 21. – Length frequency of smallmouth bass (n = 159) captured from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 comprehensive survey.

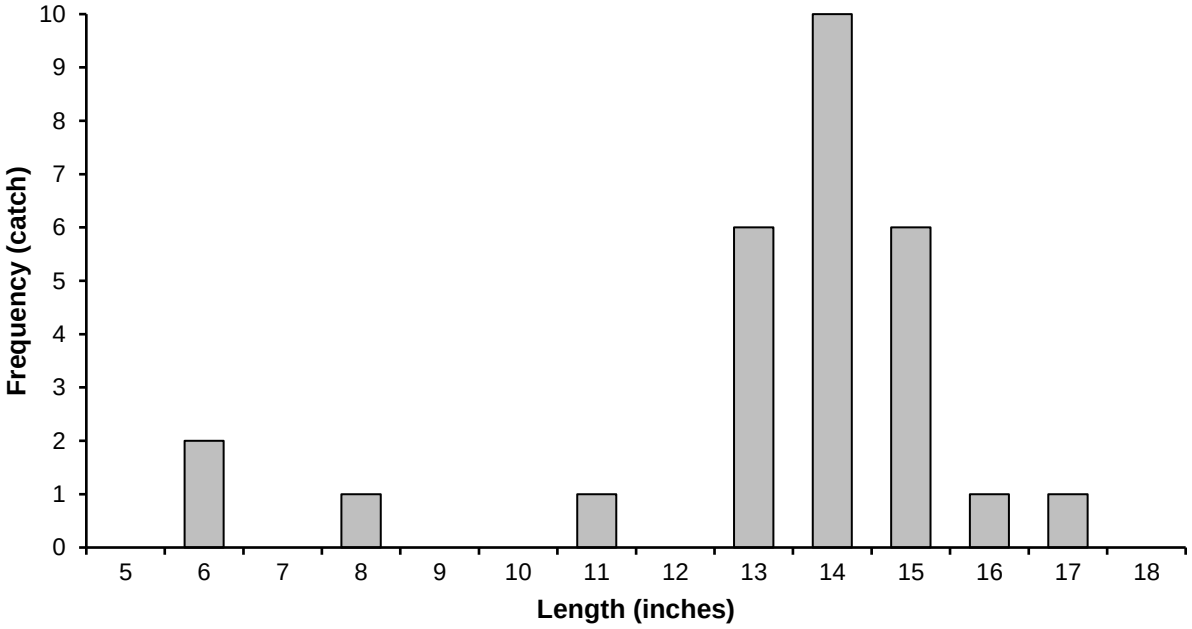

Figure 22. – Length frequency of largemouth bass (n = 28) captured from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 comprehensive survey.

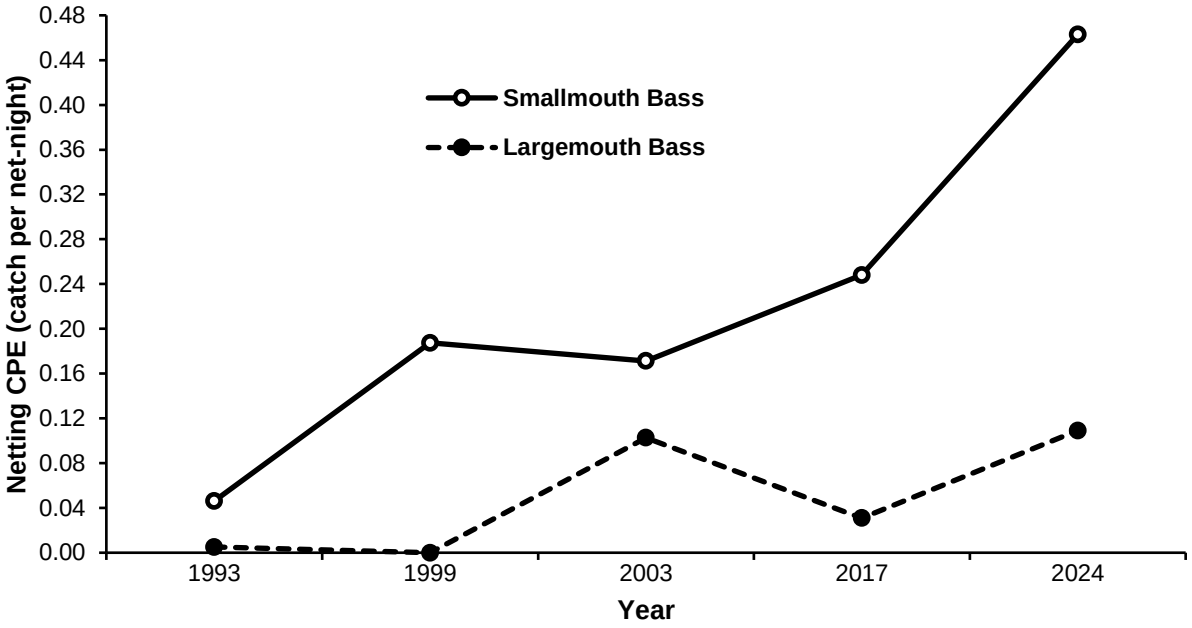

Figure 23. – Relative abundance (catch per effort; CPE) of smallmouth and largemouth bass captured during spring fyke netting from the Big Eau Pleine Reservoir, Marathon County, Wisconsin in 1993, 1999, 2003, 2017 and 2024.

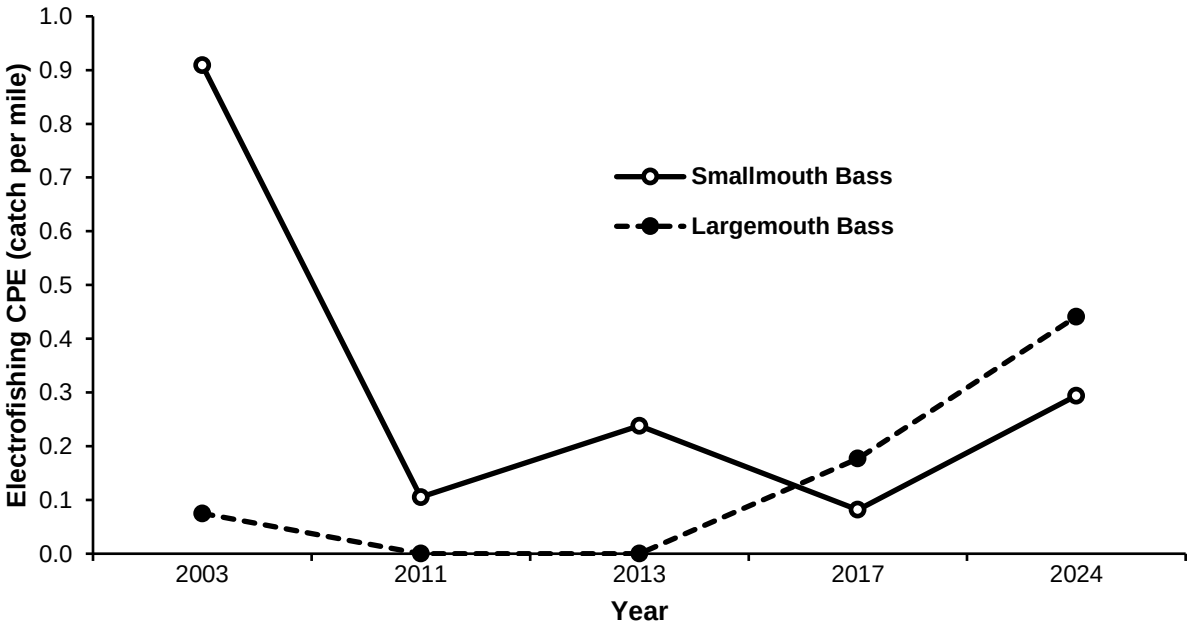

Figure 24. – Relative abundance (catch per effort; CPE) of smallmouth and largemouth bass captured during spring electrofishing (SE1) from the Big Eau Pleine Reservoir, Marathon County, Wisconsin in 2003, 2011, 2013, 2017 and 2024.

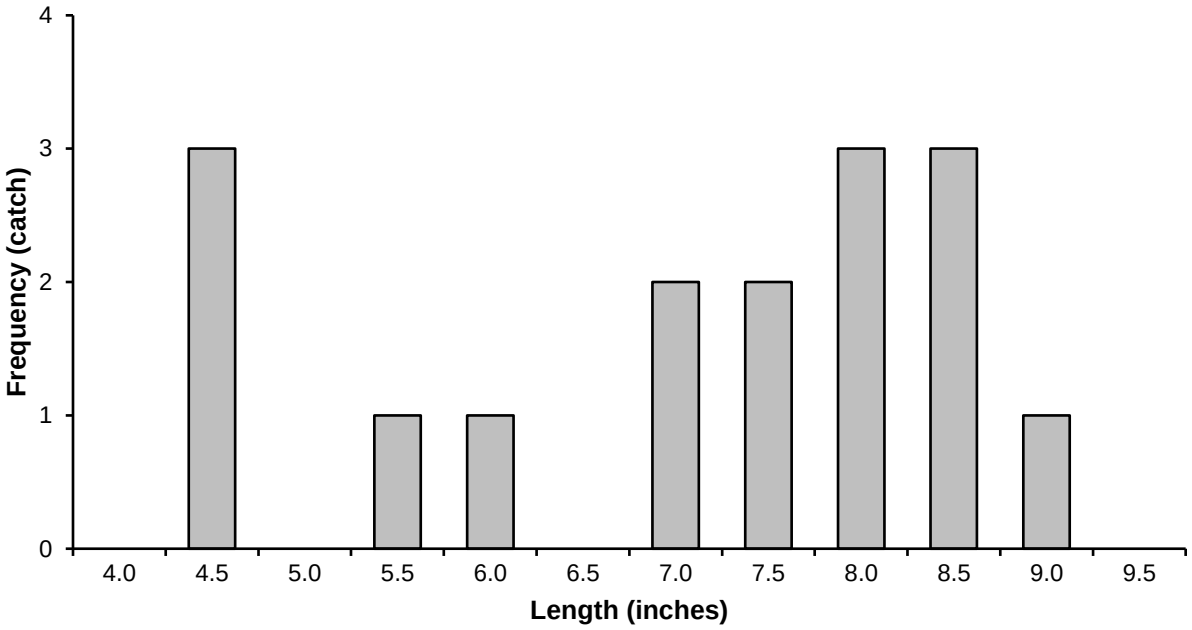

Figure 25. – Length frequency of bluegill (n = 16) captured from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 comprehensive survey.

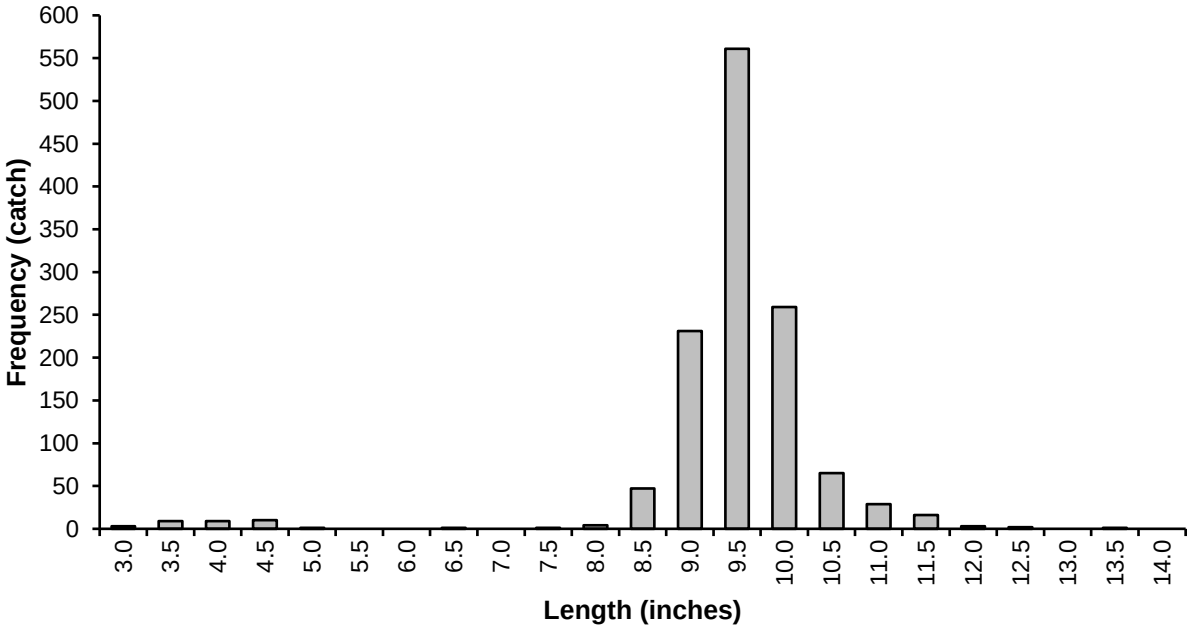

Figure 26. – Length frequency of black crappie (n = 1,252) from a subsample measured from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 comprehensive survey.

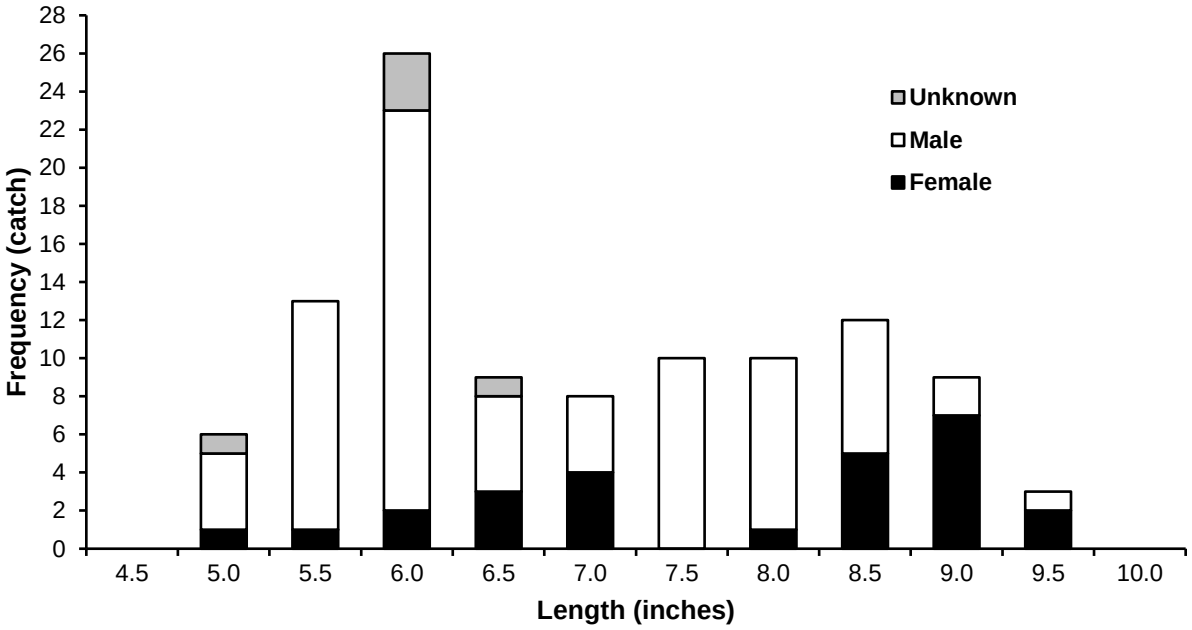

Figure 27. – Length frequency of yellow perch (n = 106) captured from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 comprehensive survey.

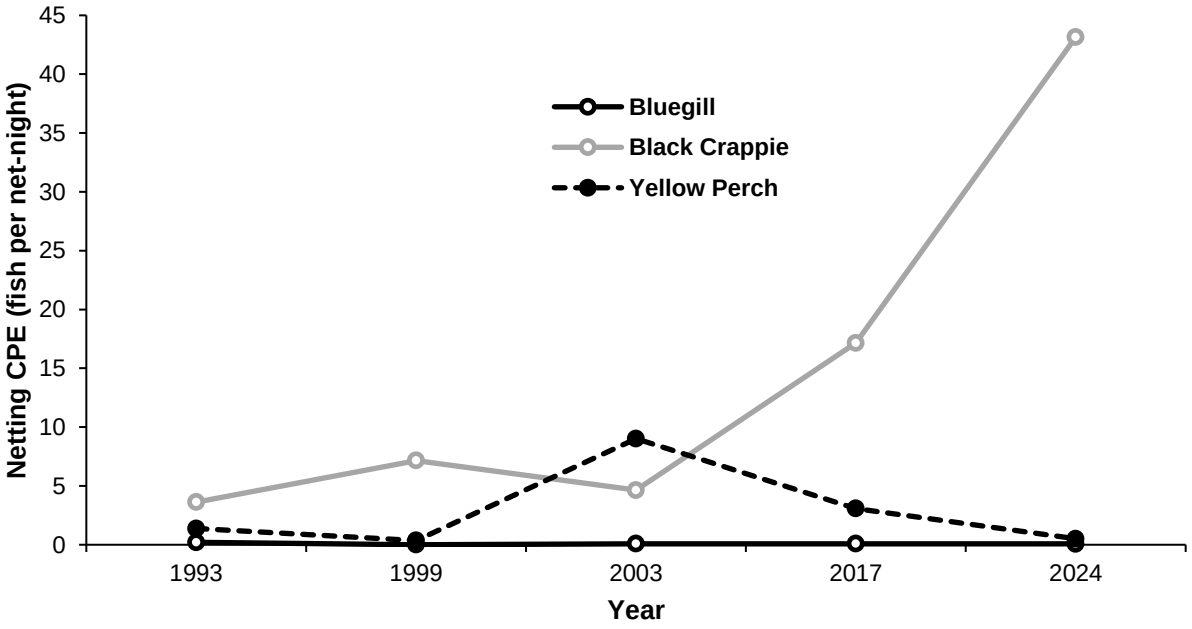

Figure 28. – Relative abundance (catch per effort; CPE) of bluegill, black crappie and yellow perch captured during spring fyke netting from the Big Eau Pleine Reservoir, Marathon County, Wisconsin in 1993, 1999, 2003, 2017 and 2024.

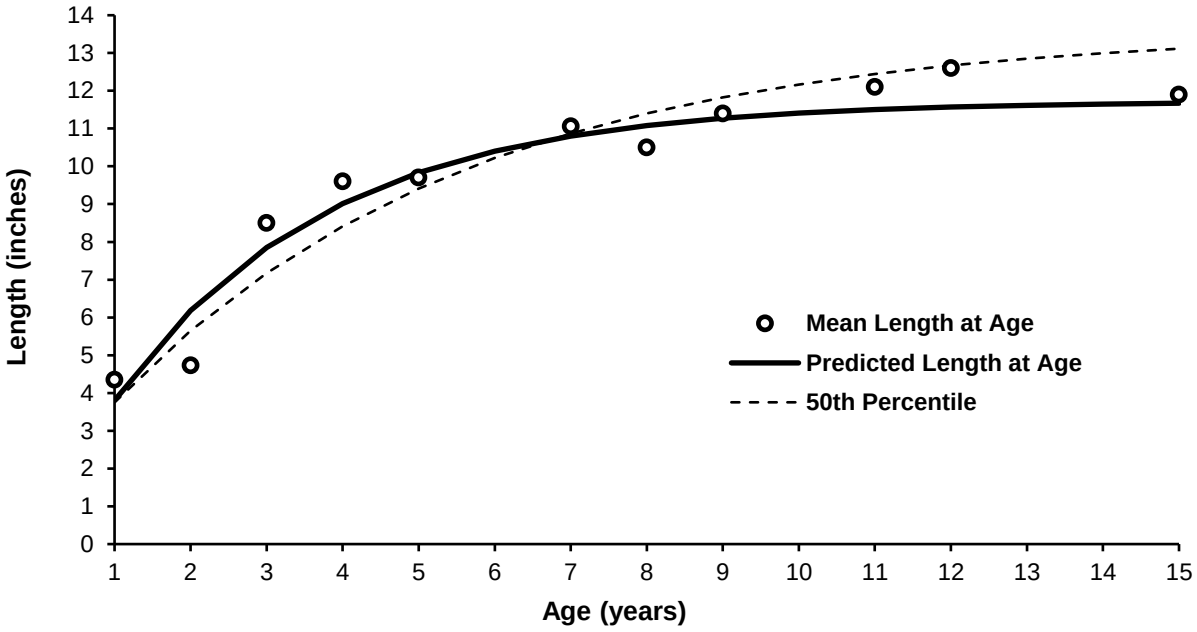

Figure 29. – Mean length-at-age and predicted length-at-age (von Bertalanffy, 1938) of black crappie captured in the Big Eau Pleine Reservoir, Marathon County, Wisconsin during 2024 compared to the 50th percentile lake class standards for Wisconsin's complex warm-dark lakes.

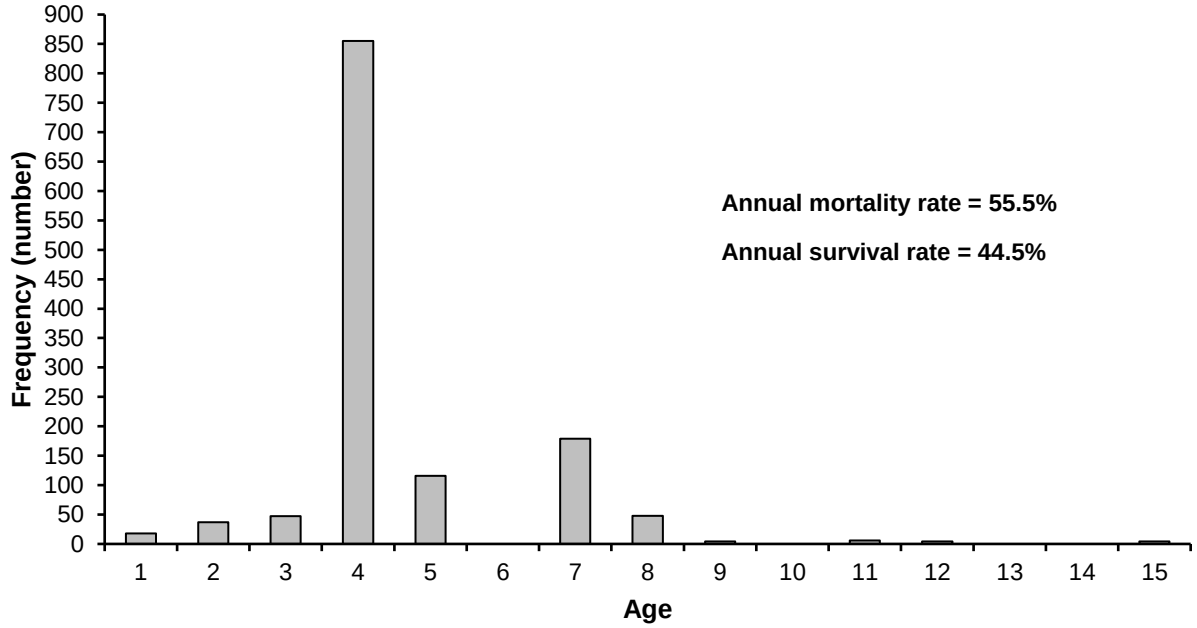

Figure 30. – Age-frequency distribution of black crappie including mortality and survival rate estimates calculated from catch curves incorporating all age ranges fully vulnerable to capture from the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 comprehensive survey.

Table 1. – Fisheries survey history from 1993-2024 on the Big Eau Pleine Reservoir, Marathon County, Wisconsin. Primary survey types include spring fyke netting (SN1 and SN2), spring electrofishing (SE1 and SE2) and fall electrofishing (FE).

Year	Survey Gear	Type	Primary Target Species	Primary Survey Purpose
1993*	Fyke net	SN1	Walleye and Northern Pike	Mark-recapture census
	Boom shocker	SE1	Walleye	Recapture
1994	Creel census	-	All species	Effort and harvest
1999*	Fyke net	SN1	Gamefish species	Mark-recapture census
	Boom shocker	SE1	Walleye	Recapture
2001	Boom shocker	FE	Juvenile Walleye	Recruitment monitoring
2003*	Fyke net	SN1	Gamefish species	Mark-recapture census
	Boom shocker	SE1	Walleye	Recapture
	Boom shocker	FE	Juvenile Walleye	Recruitment monitoring
	Mini fyke net	-	All species	General survey
	Creel census	-	All species	Effort and harvest
2004	Creel census	-	All species	Effort and harvest
2006	Boom shocker	SE1	Walleye	Walleye monitoring index
2009	Boom shocker	SE1	Walleye	Walleye monitoring index
2011	Boom shocker	SE1	Walleye	Walleye monitoring index
2012	Boom shocker	SE1	Walleye	Walleye monitoring index
2013	Boom shocker	SE1	Walleye	Walleye monitoring index
2014	Boom shocker	SE1	Walleye	Walleye monitoring index
2015	Boom shocker	SE1	Walleye	Walleye monitoring index
2016	Boom shocker	SE1	Walleye	Walleye monitoring index
	Boom shocker	FE	Walleye	Recruitment monitoring
2017*	Fyke net	SN1	Walleye and Northern Pike	Mark-recapture census
	Boom shocker	SE1	Walleye	Recapture
	Fyke net	SN2	Muskellunge	Relative abundance
	Boom shocker	SE2	Bass and Panfish	Relative abundance
	Boom shocker	FE	Juvenile Walleye	Recruitment monitoring
2018	Boom shocker	FE	Juvenile Walleye	Recruitment monitoring
2019	Boom shocker	FE	Juvenile Walleye	Recruitment monitoring
2020	Boom shocker	FE	Juvenile Walleye	Recruitment monitoring
2021	Boom shocker	FE	Juvenile Walleye	Recruitment monitoring
2022	Boom shocker	FE	Juvenile Walleye	Recruitment monitoring
2023	Boom shocker	FE	Juvenile Walleye	Recruitment monitoring
2024*	Fyke net	SN1	Walleye and Northern Pike	Mark-recapture census
	Boom shocker	SE1	Walleye	Recapture
	Fyke net	SN2	Muskellunge	Relative abundance
	Boom shocker	SE2	Bass and Panfish	Relative abundance
	Boom shocker	FE	Juvenile Walleye	Recruitment monitoring

**Indicates years treaty assessments or comprehensive surveys were conducted.*

Table 2. – Stocking history since 1972 for the Big Eau Pleine Reservoir, Marathon County, Wisconsin including average length (inches) and number of fish stocked.

Year	Species	Average Length	Number Stocked	Year	Species	Average Length	Number Stocked
1972	Muskellunge	3.0	500	1988	Muskellunge	11.0	500
	Catfishes	3.0	51,470	1990	Muskellunge	12.0	500
1973	Muskellunge	13.0	200	1992	Northern Pike	8.0	2,500
		8.0	695		Muskellunge	9.8	192
1974	Muskellunge	3.0	645	1996	Muskellunge	5.9	240
	Walleye	1.0	5,000,000	1998	Muskellunge	6.5	500
1975	Walleye	Fry	5,000,000	2000	Muskellunge	10.6	100
1976	Muskellunge	5.0	300	2002	Muskellunge	7.8	497
1977	Muskellunge	3.0	500	2004	Muskellunge	9.1	496
	Walleye	Fry	5,000,000	2006	Muskellunge	12.3	253
	Yellow Perch	Yearling	14,700	2007	Muskellunge	12.0	85
1978	Northern Pike	Fry	4,000,000	2010	Muskellunge	13.9	1,214
1979	Muskellunge	4.0	500	2012	Muskellunge	10.4	2,500
	Walleye	Fry	5,000,000	2013	Walleye	1.0	200,000
1980	Muskellunge	5.0	500			2.0	165,228
	Walleye	Fry	5,000,000	2014	Muskellunge	9.7	2,500
1981	Walleye	Fry	5,000,000		Walleye	1.0	500,000
1982	Muskellunge	3.0	500		Northern Pike	1.0	100,000
	Walleye	Fry	3,380,000	2015	Muskellunge	11.3	2,498
1983	Northern Pike	5.7	21,370		Walleye	1.0	1,000,000
	Walleye	1.0	5,000,000	2016	Muskellunge	11.2	2,500
1984	Muskellunge	8.0	500		Walleye	1.0	2,000,000
1985	Muskellunge	2.0	500	2017	Walleye	1.0	3,000,000
1986	Muskellunge	12.0	500	2018	Walleye	1.0	2,500,000
1987	Muskellunge	12.0	1,500	2019	Walleye	0.2	1,100,000

Table 3. – Hook and line fishing regulations on the Big Eau Pleine Reservoir, Marathon County, Wisconsin for fish species captured during the 2024 comprehensive survey.

Common Name of Fish	Season	Minimum Length Limit (inches)	Daily Bag Limit
Walleye	May 4, 2024 – March 2, 2025	15” 20-24” no harvest >24” only 1 fish	3
Muskellunge and Hybrids	May 25, 2024 – December 31, 2024	40”	1
Northern Pike	May 4, 2024 – March 2, 2025	32”	1
Largemouth Bass	May 4, 2024 – March 2, 2025	14”	5 bass in total
Smallmouth Bass			
Bluegill & Pumpkinseed	Open All Year	None	10 panfish in total
Black & White Crappie			
Yellow Perch			
Rock Bass	Open All Year	None	Unlimited
Rough Fish			
Bullheads			

Table 4. – Total number captured for all survey efforts (SN1, SE1, SN2, SE2 and FE) and total number captured during early spring fyke netting (SN1), early spring electrofishing (SE1), muskellunge fyke netting (SN2), late spring bass-panfish electrofishing (SE2) and fall juvenile walleye electrofishing (FE) in the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 comprehensive survey.

Common Name of Fish	Number of Fish Captured					
	All Surveys Total	Early Spring Fyke Net (SN1)	Early Spring Shocking (SE1)	Musky Fyke Net (SN2)	Late Spring Shocking (SE2)	Fall Juvenile Shocking (FE)
Black Crappie	10,842	9,880	-	894	68	-
Walleye	8,303	4,057	3,524	107	253	362
Northern Pike	478	444	3	29	2	-
Smallmouth Bass	160	106	31	8	15	-
Yellow Perch	120	115	-	1	4	-
Largemouth Bass	28	25	0	0	3	-
Bluegill	22	16	-	0	6	-
Muskellunge	11	4	4	1	2	0
Burbot	1	1	0	0	0	0
Rock Bass	1	0	-	1	0	-
Common Carp	5,134	4,289	-	845	-	-
Shorthead Redhorse	1,050	1,008	-	42	-	-
White Sucker	552	477	-	75	-	-
Yellow Bullhead	212	208	-	4	-	-
Golden Shiner	28	27	-	1	-	-
Golden Redhorse	22	19	-	3	-	-
Silver Redhorse	19	17	-	2	-	-
Black Bullhead	5	5	-	0	-	-
Gravel Chub	1	1	-	0	-	-
Total	**26,989**	**20,699**	**3,562**	**2,013**	**353**	**362**

Table 5. – Average length and length range of fish species captured during respective surveys where those species were targeted and length data was collected in the Big Eau Pleine Reservoir, Marathon County, Wisconsin during the 2024 comprehensive survey compared to the 25th – 75th percentile lake class standard maximum and average lengths for Wisconsin's complex warm-dark lakes.

Common Name of Fish	Surveys Targeted	Big Eau Pleine Reservoir		Lake Class Standards	
		Average Length (inches)	Length Range (inches)	Maximum Length (inches)	Average Length (inches)
Walleye	All surveys	15.2	5.5 – 31.5	19.4 – 24.7	8.9 – 15.0
Muskellunge	All surveys	26.7	12.8 – 47.7	34.7 – 38.9	17.3 – 21.7
Northern Pike	SN1, SE1, SN2, SE2	24.6	12.2 – 41.5	23.7 – 30.7	10.8 – 18.3
Smallmouth Bass	SN1, SE1, SN2, SE2	14.3	3.8 – 18.7	11.4 – 14.7	6.2 – 9.6
Largemouth Bass	SN1, SE1, SN2, SE2	13.8	6.0 – 17.7	13.4 – 16.7	6.1 – 10.1
Black Crappie	SN1, SE2	9.6	3.2 – 13.9	8.3 – 10.6	3.9 – 4.9
Yellow Perch	SN1, SE2	7.1	4.0 – 9.7	5.2 – 8.2	2.9 – 4.4
Bluegill	SN1, SE2	7.1	4.7 – 9.3	6.3 – 7.4	3.0 – 3.5

Table 6. – Relative abundance (catch per effort; CPE) of gamefish captured during spring fyke netting (SN1) from the Big Eau Pleine Reservoir, Marathon County, Wisconsin in 1993, 1999, 2003, 2017 and 2024 compared to the 25th – 75th percentile lake class standard for Wisconsin's complex warm-dark lakes.

Common Name of Fish	Fyke Net CPE (Catch Per Net-Night)					
	1993	1999	2003	2017	2024	Lake Class Standard
Walleye	22.9	68.2	96.6	22.4	17.7	0.4 – 5.8
Muskellunge	<0.1	0.1	0.3	0.1	<0.1	0.1 – 0.9
Northern Pike	1.2	11.0	13.3	5.4	1.9	0.6 – 3.7
Smallmouth Bass	<0.1	0.2	0.2	0.2	0.5	-
Largemouth Bass	<0.1	0	0.1	<0.1	0.1	-
Black Crappie	3.6	7.2	4.6	17.1	43.1	1.5 – 16.5
Yellow Perch	1.4	0.4	9.0	3.1	0.5	1.0 – 6.9
Bluegill	0.2	0	<0.1	<0.1	<0.1	-

Table 7. – Relative abundance (catch per effort; CPE) of gamefish captured during late spring electrofishing (SE2) from the Big Eau Pleine Reservoir, Marathon County, Wisconsin in 2017 and 2024 compared to the 25th – 75th percentile lake class standard for Wisconsin's complex warm-dark lakes.

Common Name of Fish	2024 Number Captured	Electrofishing CPE (Catch Per Mile)		
		2017	2024	Lake Class Standard
Walleye	253	25.2	37.2	-
Muskellunge	2	0.1	0.3	-
Northern Pike	2	0.2	0.3	-
Smallmouth Bass	15	0	2.2	0.4 – 2.7
Largemouth Bass	3	0.5	0.4	8.5 – 37.3
Black Crappie	68	4.0	10.0	-
Yellow Perch	4	2.0	0.6	-
Bluegill	6	0	0.9	54.1 – 195.9

Table 8. – Proportional size distribution (PSD) length categories (inches) used for fish collected from the Big Eau Pleine Reservoir, Marathon County, Wisconsin in 2024 (based on Anderson and Neumann 1996).

Common Name of Fish	Stock	Quality (PSD-Q)	Preferred (PSD-P)	Memorable (PSD-M)
Walleye	10	15	20	25
Northern Pike	14	21	28	34
Smallmouth Bass	7	11	14	17
Largemouth Bass	8	12	15	20
Black Crappie	5	8	10	12
Yellow Perch	5	8	10	12
Bluegill	3	6	8	10

Table 9. – Size Structure (%) of gamefish and panfish species for the Big Eau Pleine Reservoir, Marathon County, Wisconsin captured during the 2024 comprehensive survey.

Common Name of Fish	Sample Size	Quality (PSD-Q)	Preferred (PSD-P)	Memorable (PSD-M)
Walleye	5,199	52.3	4.2	1.0
Northern Pike	465	74.0	29.2	9.7
Smallmouth Bass	159	98.1	61.6	6.9
Largemouth Bass	26	92.3	30.8	0
Black Crappie	1,274	99.1	30.5	0.5
Yellow Perch	118	30.5	0	0
Bluegill	22	72.7	36.4	0