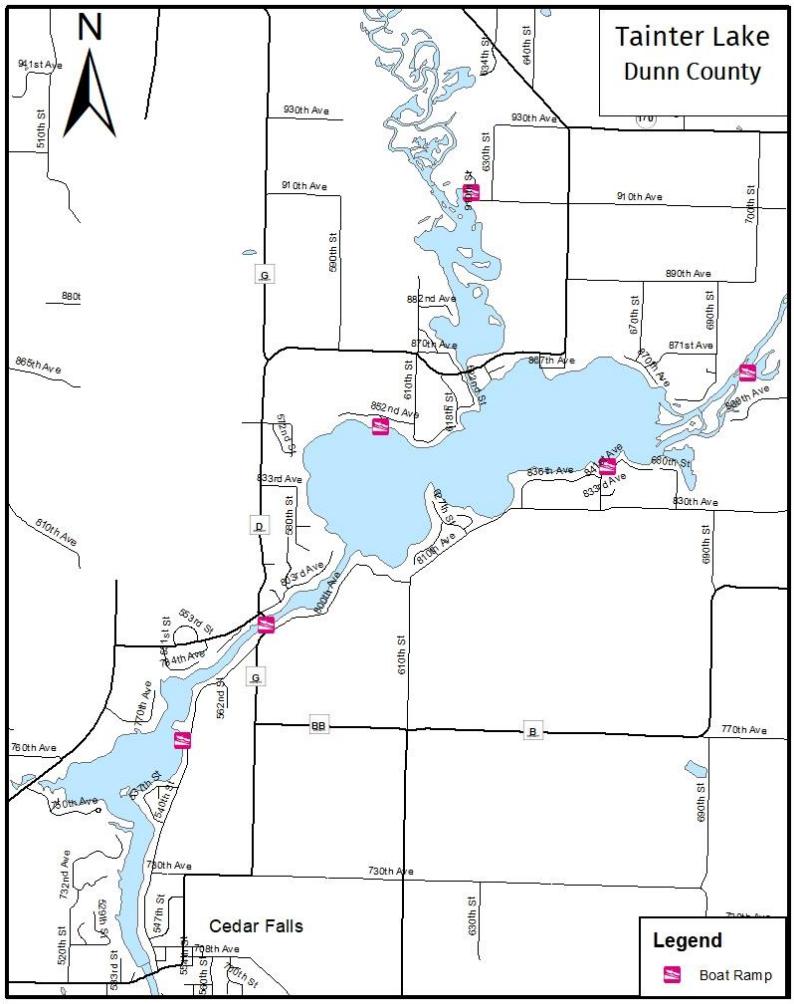
WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Tainter Lake 2022 Fisheries Survey Report

WBIC 2068000



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Executive Summary

Tainter Lake is a hypereutrophic flowage that supports a productive and popular sport and pan-fishery. As part of Fisheries Management's rotational lake monitoring, a survey was conducted in the spring of 2022. Fyke nets and lake electrofishing were used to survey the state of the current fishery. Walleye, smallmouth bass and yellow perch were abundant and exhibited excellent size structure. Northern pike, largemouth bass, bluegill and black crappie were present in relatively low abundance for Complex Riverine lakes within Wisconsin but still represent important and popular fisheries within the lake. All species are fully supported by natural reproduction and no stocking occurs or is recommended, with the exception of muskellunge stocking if DNR hatchery production of fingerling Muskellunge increases and local support for this effort is present. The current fishing regulations are appropriate for the fish species present based on the 2022 survey. Fisheries habitat improvements are recommended in order to enhance near shore habitat for multi-species benefits.

Introduction

Tainter Lake is a 1,752 acre hypereutrophic flowage created by Northern States Power Company's Cedar Falls Hydro Dam. It is located on the Red Cedar River north of Menomonie in central Dunn County. The Hay River is also a major tributary to the lake. Tainter Lake has a maximum depth of 37 feet and consists of three sections of water, the Hay River Bay, the upper lake basin and lower flooded river channel. It has a large watershed area that is predominately influenced by agriculture. Water quality is a major issue with excessive phosphorus loading which leads to severe blue-green algae blooms during the summer and fall periods.

There are four public boat landings and one private landing on Tainter Lake including Kleist Landing, Lamb's Creek County Park, Champney Park (no longer accessible), Northwest Landing and Elk Point Resort.

Tainter Lake is located within the Ceded Territory and is occasionally speared in the Spring by Ojibwe tribal members. Angling pressure is high on Tainter Lake, and the lake is popular destination for both open water and ice fishing.

The lake is classified as a Complex Riverine Lake within the Wisconsin Lake's Classification system in order to compare lakes within similar qualities in terms of trophic status, thermal regime and fish community. No stocking occurs in Tainter Lake, and all species are dependent on natural reproduction. Muskellunge *Esox masquinongy* fingerlings are stocked in upstream waters including Big Moon and Rice Lakes, and the Red Cedar River in Barron County.

During the early 2000's, FERC relicensing efforts made several changes to Dam operations on Tainter Lake. One major change was the addition of a rubberized

bladder system in 2005 that could be inflated and deflated to stabilize water levels more efficiently than the old flashboard system. Prior to the installation of this structure, the historic wooden flashboard system would fail during high flow events and cause a 4-5 foot drawdown usually during the spring of the year when many fish had just completed or were in the process of spawning. With more stable water levels during this critical time period, improvement of the fishery was anticipated to occur over time.

The only special fishing regulation on the lake is a 10-bag limit for panfish. This regulation was changed in 2006 when the bag limit was reduced from 25 to 10. Increasing abundance of panfish populations since the 1998 survey was evident in 2012 and may have been influenced by the reduced bag limit. This survey will allow for a more comprehensive review of the success of the regulation in improving panfish populations.

SURVEY EFFORT

Tainter Lake was surveyed in the spring of 2022 using fyke nets and electrofishing gear to assess the status of the current fish community. Immediately after ice out on April 11th, 10 fyke nets (3x6 ft, 0.75-inch mesh and 4x6 ft, 0.5-inch nylon mesh) were set targeting northern pike *Esox lucius* and walleye *Sander vitreus* (SNI survey). Nets were lifted daily for eight days for a total of 55 net nights. All walleye and northern pike were marked with fin clips during netting. A daytime electrofishing run (SEI survey) was conducted on the Red Cedar River from Colfax, WI to Russian Slough to increase the sample size of walleye and to target fish utilizing the river for spawning. Additionally, after water temperature reached 55° F, two nights of electrofishing (SEII survey) were conducted to target bass and panfish species. The entire shoreline was divided into six stations that were approximately 2 miles in length each. Within each of these stations, a ½ mile substation was sampled for all fish species. All common carp *Cyprinus carpio* observed during these substations were counted to obtain relative abundance estimates. Only gamefish species were captured within the remaining 1.5-mile stations. In the fall, after water temperature dropped below 70° F, two nights of electrofishing were conducted on the entire shoreline in five 2-mile stations to sample young-of-year walleye. Spring and fall lake electrofishing was conducted with a pulsed DC maxiboom shocker with two booms and two dip netters. A pulsed DC miniboom shocker was used to survey the Red Cedar River in the spring for walleye.

Methods

All gamefish were counted and measured and a subsample of five per each ½ inch length group of both sexes (if possible) were weighed and aging structures were removed for age analysis in the lab. Gender was determined for each walleye, muskellunge and northern pike. Dorsal spines were removed from walleye for aging. Otoliths were removed from largemouth bass *Micropterus salmoides*, bluegill

Lepomis macrochirus, black crappie *Pomoxis nigromaculatus* and yellow perch *Perca flavescens* and anal fin rays were removed from muskellunge. All muskellunge captured were tagged with a PIT tag. Cleithra were removed from a subsample of northern pike in the 18–19-inch range.

Data analysis included calculation of catch rates for each species (CPE-Catch per unit effort) as a measure of relative abundance. Condition of individual fish was estimated by computing relative weight (Wr) for each fish based on length and weight where a value of 100 or higher indicates very good condition and values less than that resulting in poorer condition. Size structure of each species was evaluated by creating length frequency distributions and computing Proportional Size Distribution (PSD) which is a measure of the proportion of fish equal to or larger than stock size and equal to or larger than quality size fish in the population. Relative Stock Density (RSD-Preferred) was also calculated for walleye and northern pike as a measure of the proportion of fish in the population larger than preferred size (20 inches-walleye, 28 inches-northern pike). Growth rates of walleye were calculated by analyzing median length at age and compared to other lakes within the same lakes classification. 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.

Results

WALLEYE

A total of 1,719 walleye were captured during spring surveys in 2022. Walleye catch rates in fyke nets were low during the survey with relative abundance of walleye resulting in 0.75 per net night. CPE of walleye collected during the Red Cedar River electrofishing run was 10.3 per mile or 23.1 per hour. The catch rate of walleye during the SEII survey was 89.8 per mile; the majority of fish collected during this survey were juvenile fish with an mean length of 8.8 inches. Walleye ranged in length from 4.5 to 27 inches with a mean length of 16.5 inches (95^{th} percentile) during the spring netting and electrofishing surveys (Figure 1). PSD of adult walleye collected during the SEI and SNI survey was 63. RSD-P of walleye was 21. Relative weight of walleye was 91. Based on residual analysis, recruitment of walleye was inconsistent with strong year classes in 2020 and 2015 (age-2 and age-7) and weak year classes in 2019 and 2017 (age-3 and age-5; Figure 2). Age-1 walleye were not fully recruited to sampling gear at the time of sampling and are underrepresented in the SE1 and SN1 surveys. Growth rates of walleye as measured by mean length at age were average when compared to lakes across the state within the same lakes classification (Figure 3). On average, 4.1 years were required for walleye to reach 15 inches or harvestable size. Female walleye required 7.2 years, on average, to reach 20 inches in length. Total annual mortality of walleye was estimated at 53% ($F = 165.64$, $df = 1$, $p = 0.0001$, $r^2=0.96$). Juvenile walleye surveyed in the fall were abundant with catch rates ranging

from 31.5 per mile in Station 5 to 212 per mile in Station 2 with an average CPE of 78.5 per mile (Figure 4). Lengths of Age-0 walleye ranged from 4.3 to 7.4 inches.

NORTHERN PIKE

A total of 91 northern pike were collected during the netting survey and 44 were collected during the spring electrofishing survey for a catch rate of 1.65 per net night (25^{th} percentile) and 3.7 per mile. Pike ranged in length from 7.5 to 35.2 inches with a mean length of 19.1 inches (75^{th} percentile; Figure 5) for all surveys combined. PSD for northern pike was 51 and RSD-P was 10. Relative weight of northern pike was 92. Northern pike exhibited consistent recruitment and growth rates were good with similar mean length at all age classes of fish to statewide mean length at age for northern pike within the same lakes classification (Figures 6 & 7). On average, northern pike reached 28 inches in 6.7 years. Mortality appeared to increase after northern pike reached the age of 6 of an average length of 25 inches. Total annual mortality was estimated at 26% ($F = 14.14$, $df = 1$, $p = 0.0001$, $r^2=0.64$).

MUSKELLUNGE

Three juvenile muskellunge were collected in surveys in 2022. They ranged in length from 11.9 to 20.3 inches. The age of the 19.5-inch muskellunge was 3 years of age and the age of the 20.3-inch muskellunge was 2 years of age.

SMALLMOUTH BASS

Smallmouth Bass were abundant during electrofishing surveys with a total of 798 collected that resulted in catch rates of 42.4 per mile (95^{th} percentile) or 76.3 per hour. Smallmouth bass ranged in length from 4.5 to 18.8 inches with an mean length of 11.7 inches (75^{th} percentile; Figure 8). PSD was 68 and RSD-P was 26. Smallmouth bass were in good condition with an average relative weight of 101. Residual analysis revealed consistent and strong recruitment of smallmouth bass (Figure 9). Growth rates of smallmouth bass were similar to the statewide average for smallmouth bass in Complex Riverine systems. The growth coefficient (k-value) estimated by the von Bertalanffy growth model was high (90^{th} percentile) and adequately described mean length at age ($k = 0.201$, $r^2 = 0.99$, $df = 1$, $P < 0.0001$; Figure 10). Smallmouth bass required approximately 4 years to reach harvestable size (14 inches). Total annual mortality of smallmouth bass was low at 15% ($F = 1.83$, $df = 1$, $p = 0.0001$).

LARGEMOUTH BASS

Largemouth bass were lower in abundance when compared to smallmouth bass during the survey with only 58 captured. Electrofishing catch rates resulted in 4.8 per mile (50^{th} percentile) of shoreline or 8.7 per hour. Lengths of largemouth bass ranged from 8.7 to 18.7 inches with an average length of 13.3 inches (99^{th} percentile; Figure 11). PSD of largemouth bass was 63 and RSD-P was 51. Relative weight was excellent at 116. Largemouth bass exhibited inconsistent recruitment and the age-3- or 2019-year class was the strongest with a relatively weak year class produced in 2017 (Figure

12). Growth rates of largemouth bass were good with fish growing at similar average rates of largemouth bass statewide in Complex Riverine lakes (Figure 13). Fish reached harvestable size (14 inches) in approximately 5 years.

BLUEGILL

Bluegill abundance was average during electrofishing surveys and resulted in a catch rate of 39.6 per mile (50th percentile) for a total of 119 captured. Lengths of captured bluegill ranged from 4.6 to 9.8 inches with an average length of 6.6 inches (95th percentile; Figure 14). PSD was 77 and RSD-P was 6. Bluegill were in good condition with an average relative weight of 97. Very few age classes of bluegill were represented within the sample. A large proportion of fish resulted from the age-3 (2019) year class (Figure 15). Bluegill exhibited excellent growth rates with fish growing substantially faster than the average statewide growth of Bluegill (Figure 16). The mean length of bluegill at age-3 was 6.7 inches in Tainter Lake while the statewide average length at age-3 was 5.2 inches. On average, bluegill reached 7 inches in length in 3.4 years.

BLACK CRAPPIE

Black crappie abundance was lower when compared to bluegill during the survey with a catch rate of 16 per mile during electrofishing runs and a total of 50 captured. Lengths ranged from 4.7 to 11.9 inches with an average length of 10.0 inches (95th percentile; Figure 17). PSD was 94 and RSD-P was 60. Black crappie exhibited relatively consistent recruitment with strong age-4, age-5 and age-6-year classes (Figure 18). The age-2 and age-3-year classes were relatively weak. Growth rates of black crappie were excellent and above the statewide average for black crappie in similar lakes (Figure 19). On average, black crappie reached 9 inches in 3.7 years. Mean length of black crappie at age 3 in Tainter Lake was 9.3 inches while the statewide mean length at age-3 was 7.7 inches.

YELLOW PERCH

Yellow perch were the most abundant panfish species captured during the survey with a total of 710 collected. Catch rates resulted in 12 per net night (75th percentile) and 16 per mile of electrofishing. Mean length of yellow perch was 7.8 inches (95th percentile) with lengths that ranged from 3.6 to 12.5 inches (Figure 20). PSD of yellow perch was 50. Recruitment of yellow perch appeared consistent based on age frequency analysis (Figure 21). Ages of yellow perch collected ranged from age-1 to age-15 with an average age of 2.8 years old. Growth rates of yellow perch were also excellent and faster than the statewide average growth of yellow perch in lakes within the same lakes classification (Figure 22). Age-3 yellow perch in Tainter Lake exhibited a mean length of 8.1 inches while the statewide average length of yellow perch at age-3 was 6.6 inches. Yellow perch reached 8 inches in 3 years and 10 inches in 7.5 years. Of note, using otoliths for age estimation, the estimated age of a single 10.6-inch female yellow perch collected in the survey was 15 years of age. This was the maximum age of yellow perch collected within the survey.

NON-GAME SPECIES

Redhorse species including silver redhorse *Mosostroma anisurum*, shorthead redhorse *Moxostoma macrolepidotum*, golden redhorse *Moxostoma erythrurum* and greater redhorse *Moxostoma valenciennesi* were grouped into redhorse species (Sp.) category to compare catch rates to prior surveys. Catch rates for redhorse species was 0.9 per net night for a total of 77 captured within the netting survey. White sucker *Catostomus commersonii* were present in low abundance with a total of 17 captured throughout the netting survey with a catch rate of 0.2 per net night. Common carp were scarce throughout the survey and none were captured and three were observed during electrofishing surveys. Bowfin were the most common non-game species captured with a total of 53 captured during the netting survey for a catch rate of 0.9 per net night.

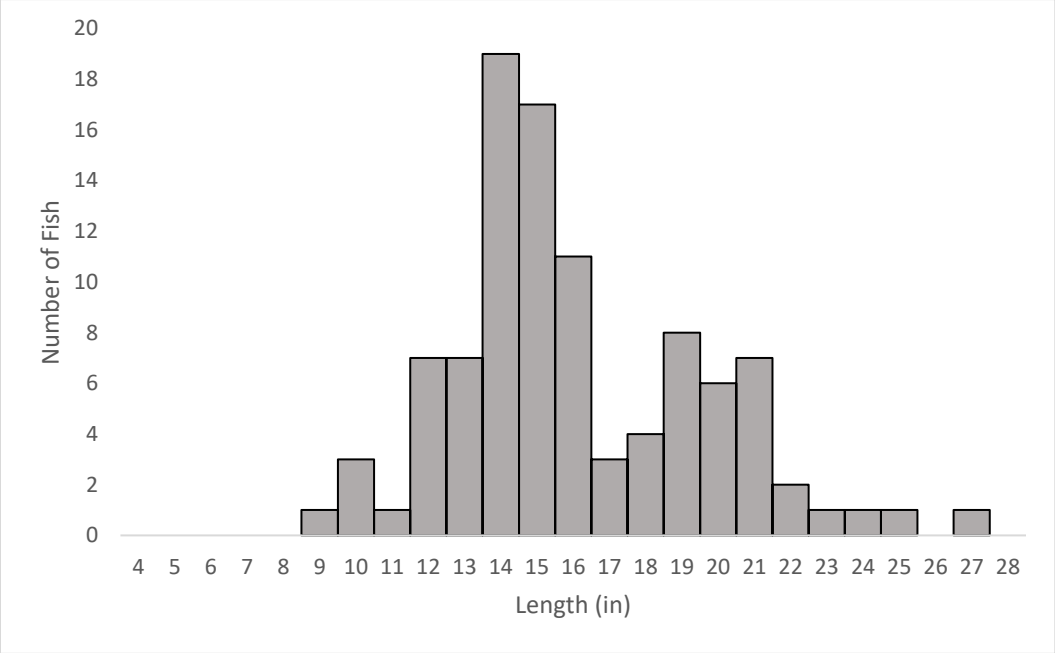

Figure 1. Length frequency distribution of Walleye from Tainter Lake and the lower Red Cedar River, 2022.

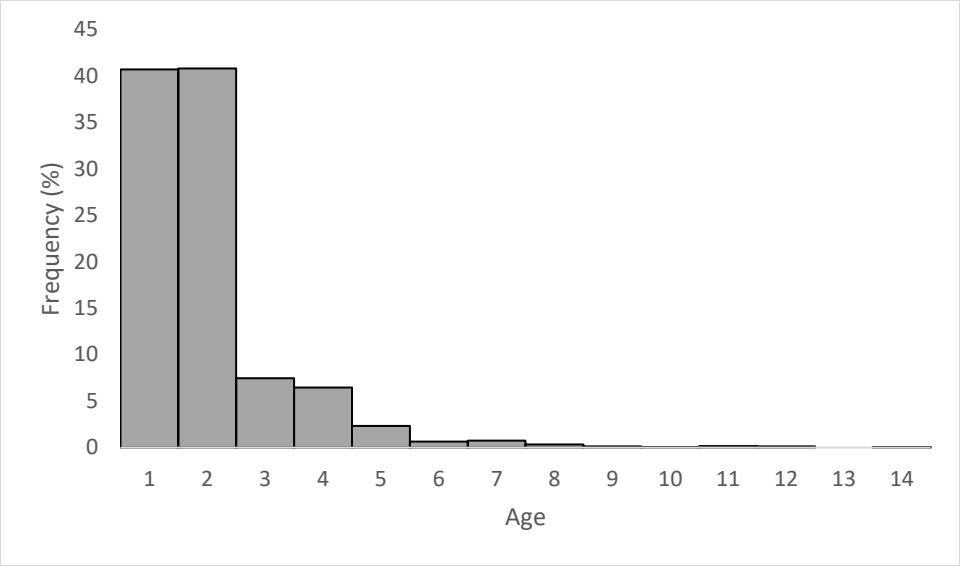

Figure 2. Age frequency distribution of walleye from Tainter Lake and the lower Red Cedar River, 2022.

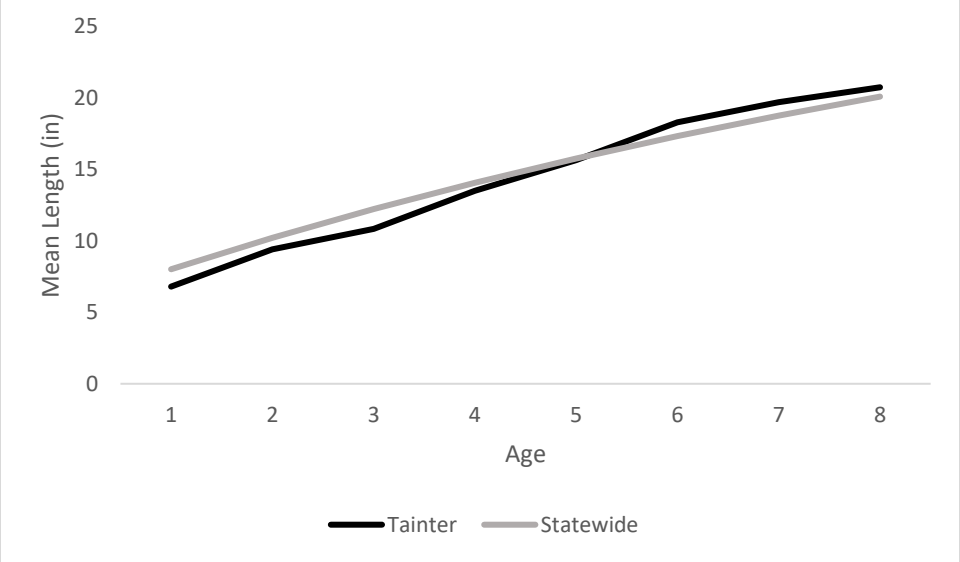

Figure 3. Mean length at age of walleye from Tainter Lake and the Lower Red Cedar River, 2022 and mean length at age of walleye from Complex River lakes across Wisconsin.

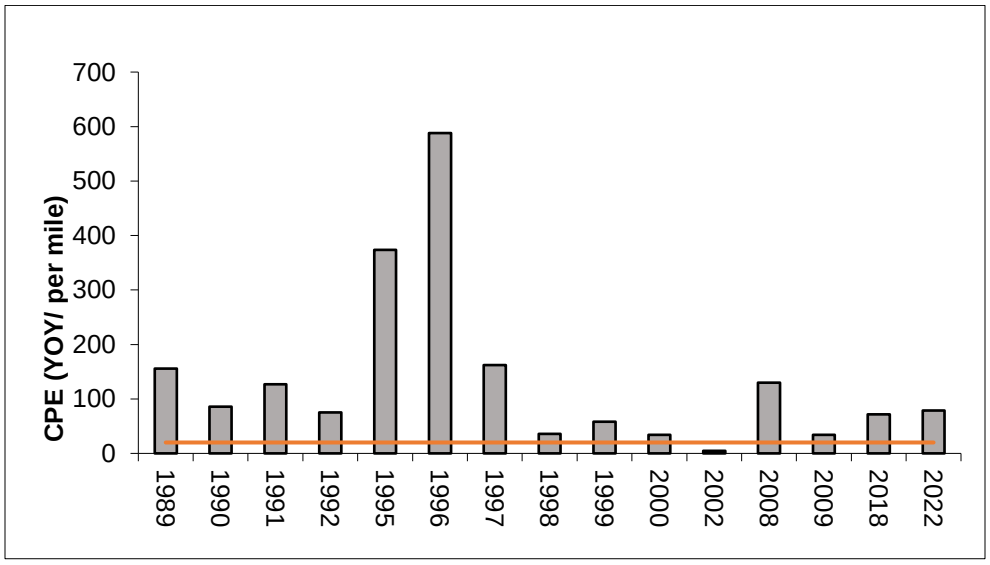

Figure 4. Relative abundance of young-of-year walleye in Tainter Lake captured in fall electrofishing surveys. Orange line represents 20 young-of-year/mile or abundance estimates that are likely to result in a meaningful year class.

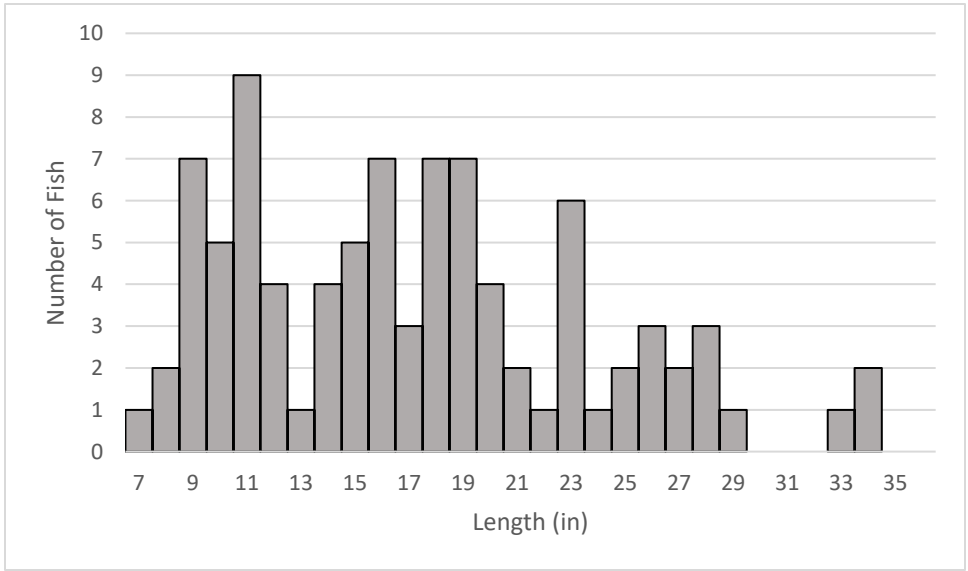

Figure 5. Length frequency distribution of northern pike from Tainter Lake, 2022.

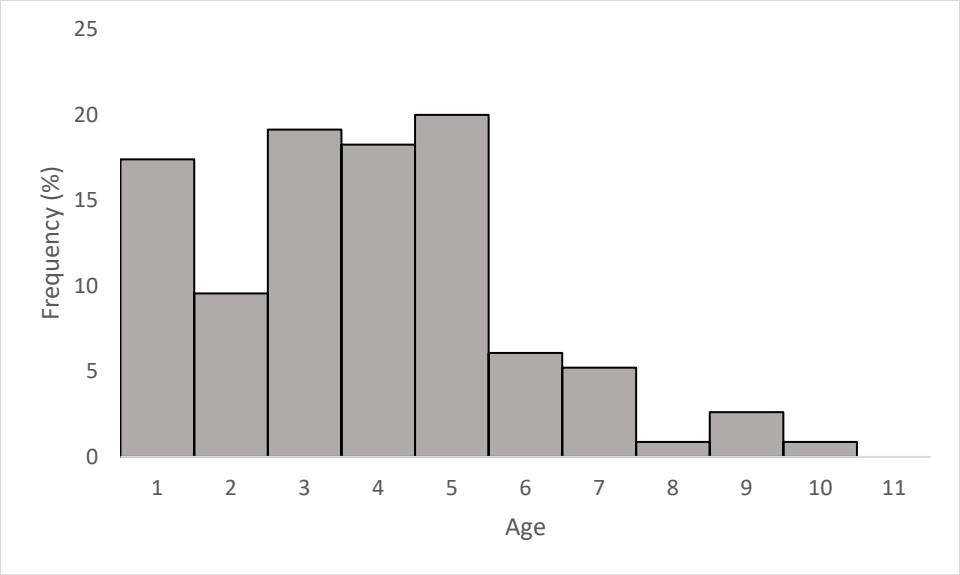

Figure 6. Age frequency distribution of northern pike from Tainter Lake, 2022.

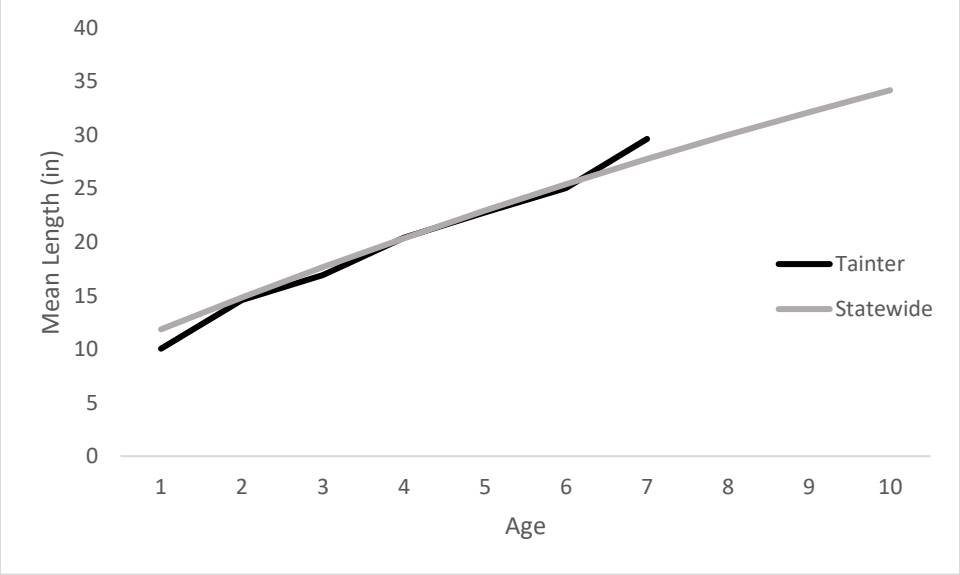

Figure 7. Mean length at age of northern pike from Tainter Lake during spring 2022 and mean length at age of northern pike from Complex Riverine lakes across Wisconsin.

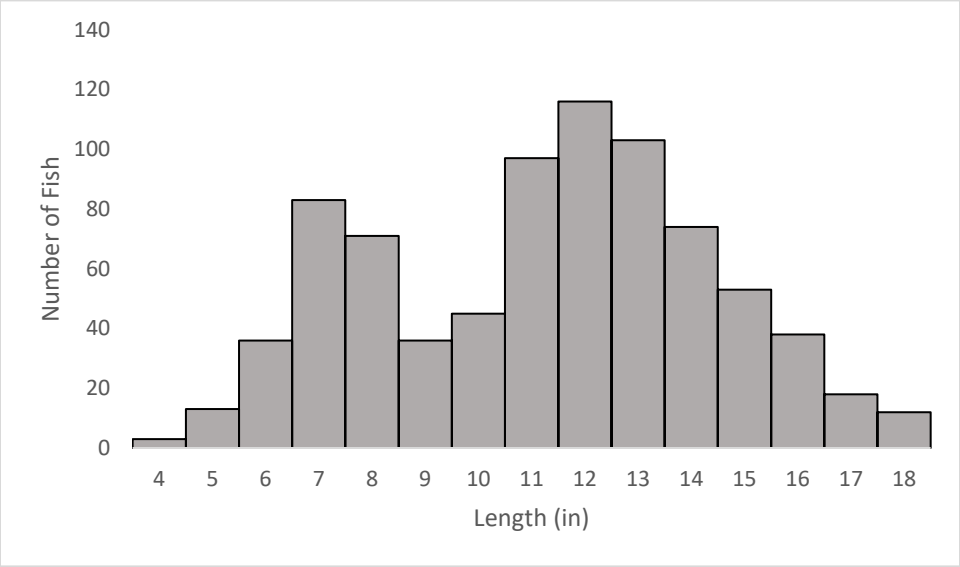

Figure 8. Length frequency distribution of smallmouth bass from Tainter Lake collected via nighttime boat electrofishing during spring 2022.

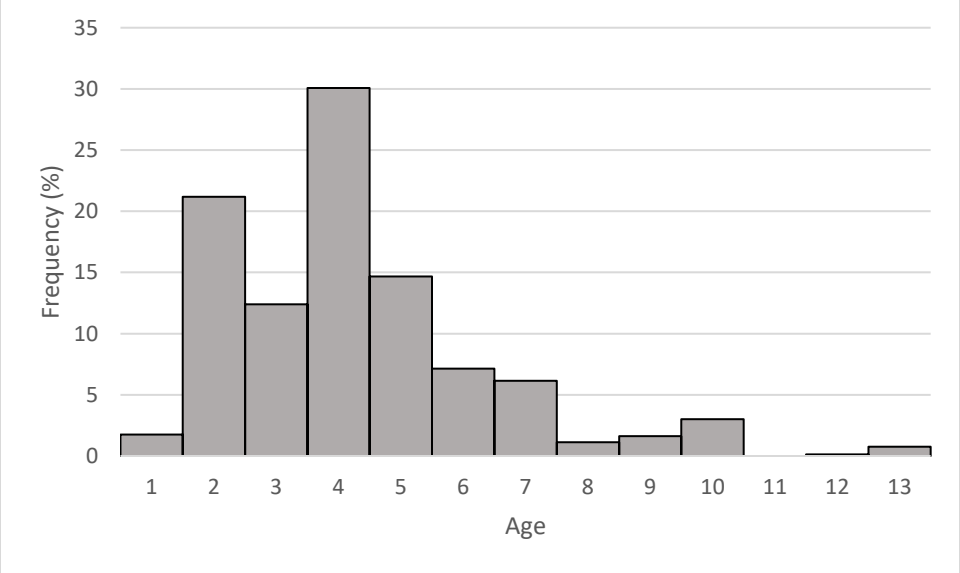

Figure 9. Age frequency distribution of smallmouth bass from Tainter Lake collected via nighttime boat electrofishing during spring 2022.

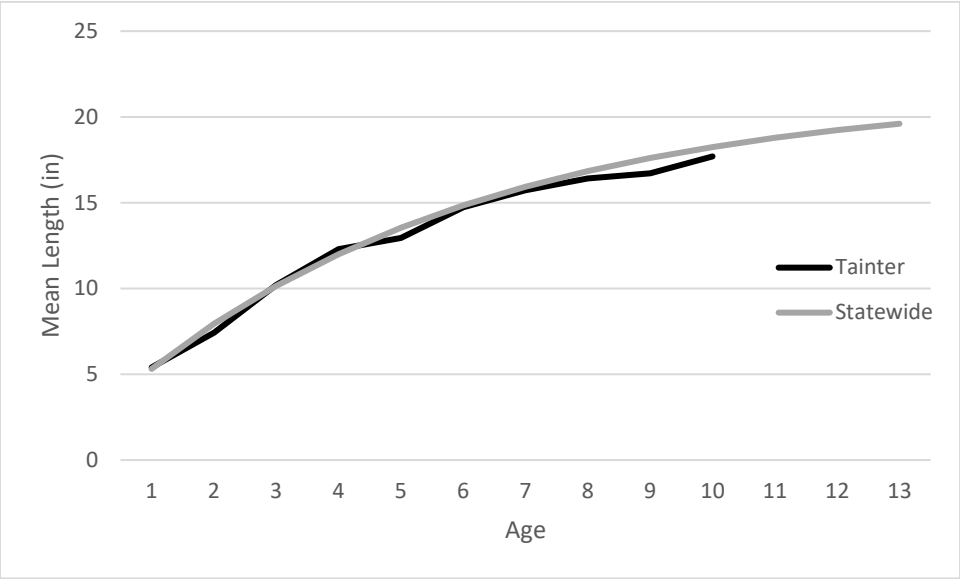

Figure 10. Mean length at age of smallmouth bass from Tainter Lake collected via nighttime boat electrofishing during spring 2022 and mean length at age of smallmouth bass from Complex Riverine lakes across Wisconsin.

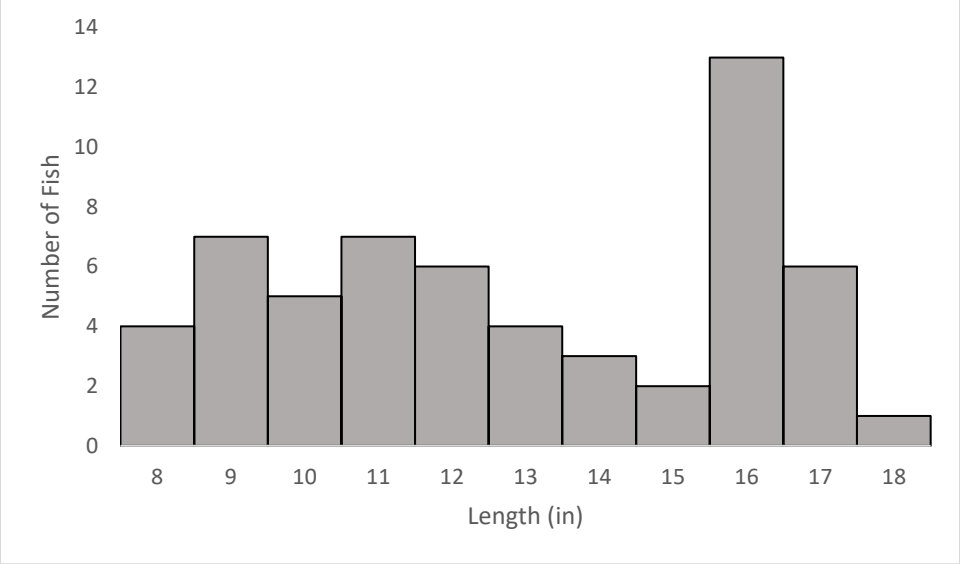

Figure 11. Length frequency distribution of largemouth bass from Tainter Lake collected via nighttime boat electrofishing during spring 2022.

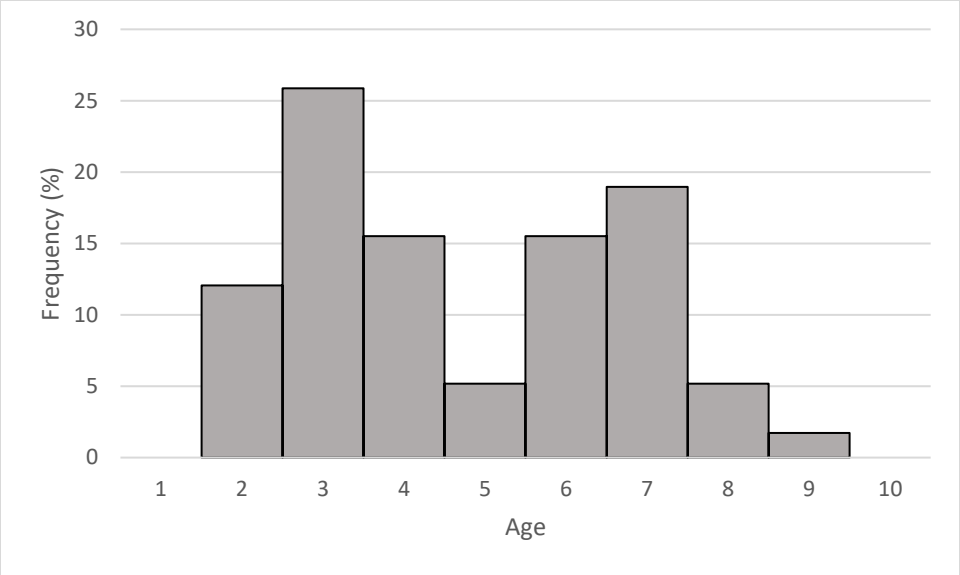

Figure 12. Age frequency distribution of largemouth bass from Tainter Lake collected via nighttime boat electrofishing during spring 2022.

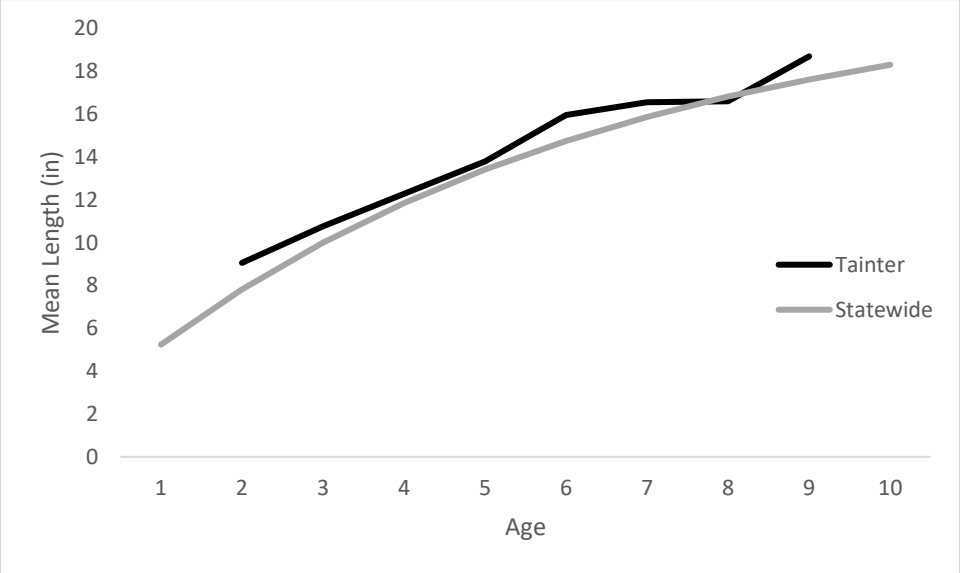

Figure 13. Mean length at age of largemouth bass from Tainter Lake collected via nighttime boat electrofishing during spring 2022 and mean length at age of largemouth bass from Complex Riverine lakes across Wisconsin.

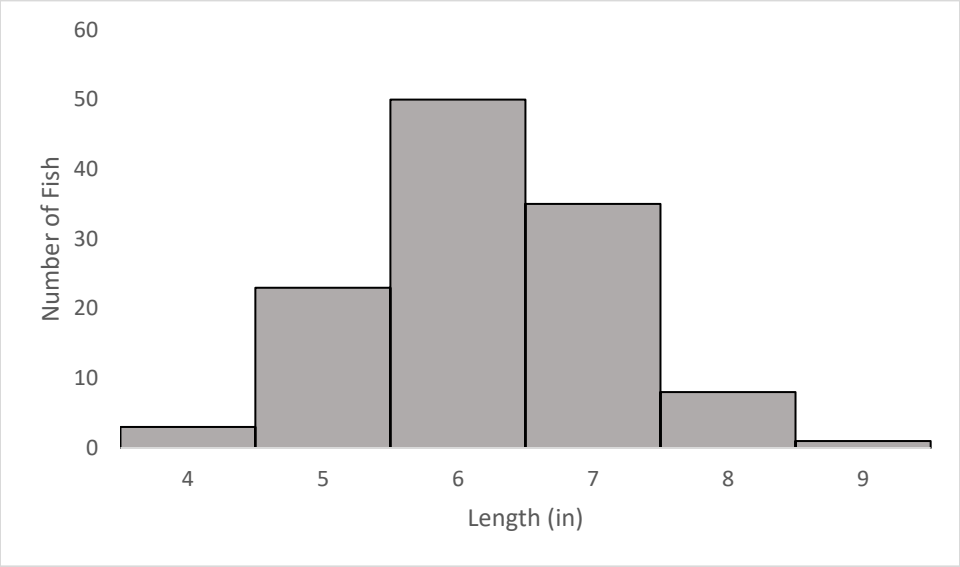

Figure 14. Length frequency distribution of bluegill from Tainter Lake collected via nighttime boat electrofishing during spring 2022.

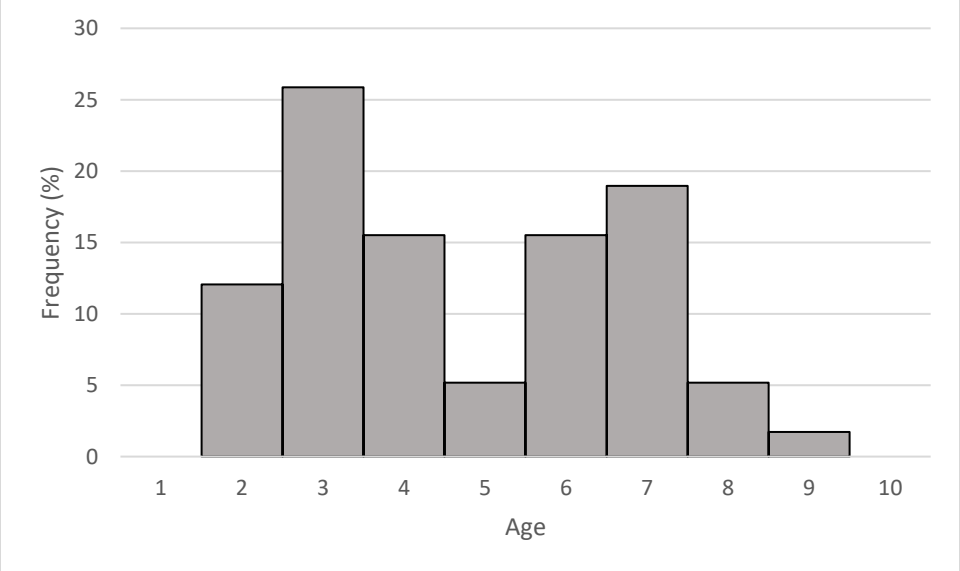

Figure 15. Age frequency distribution of bluegill from Tainter Lake collected via nighttime boat electrofishing during spring 2022.

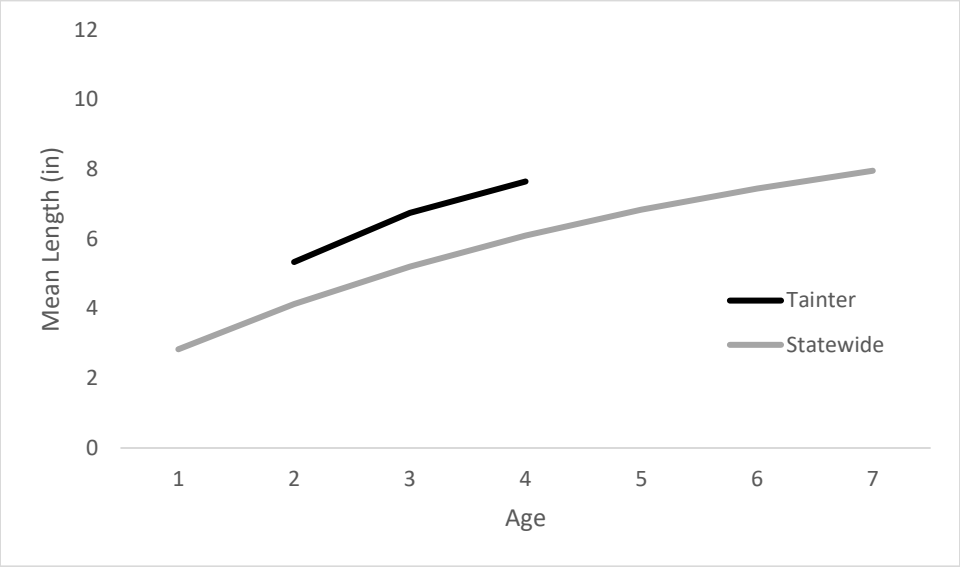

Figure 16. Mean length at age of bluegill from Tainter Lake collected via nighttime boat electrofishing during spring 2022 and mean length at age of bluegill from Complex Riverine lakes across Wisconsin.

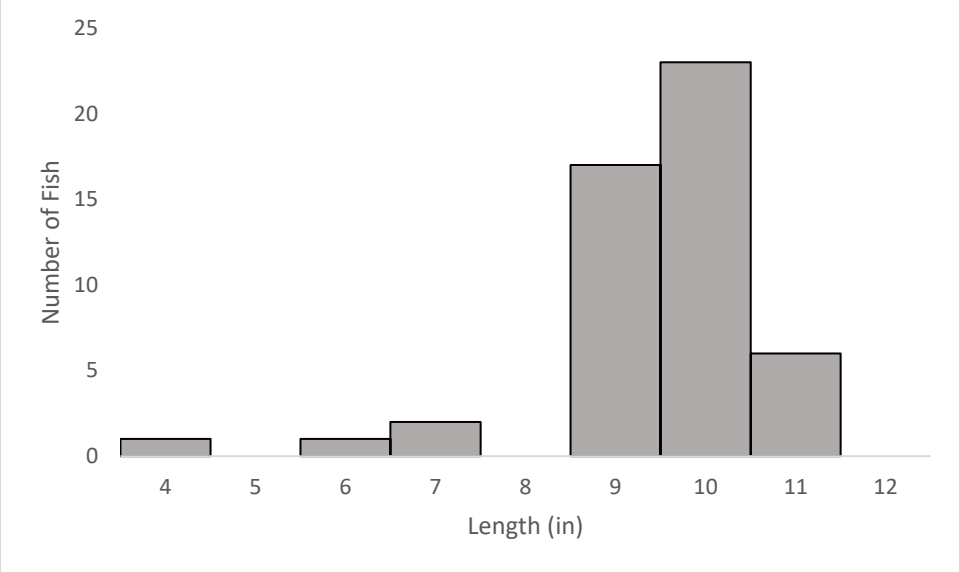

Figure 17. Length frequency distribution of black crappie from Tainter Lake collected via nighttime boat electrofishing during spring 2022.

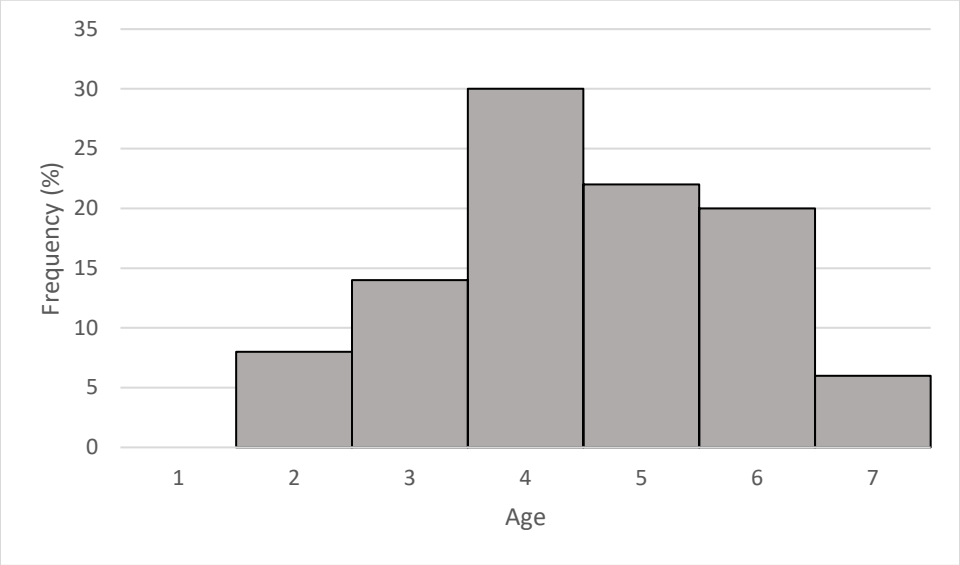

Figure 18. Age frequency distribution of black crappie from Tainter Lake collected via nighttime boat electrofishing during spring 2022.

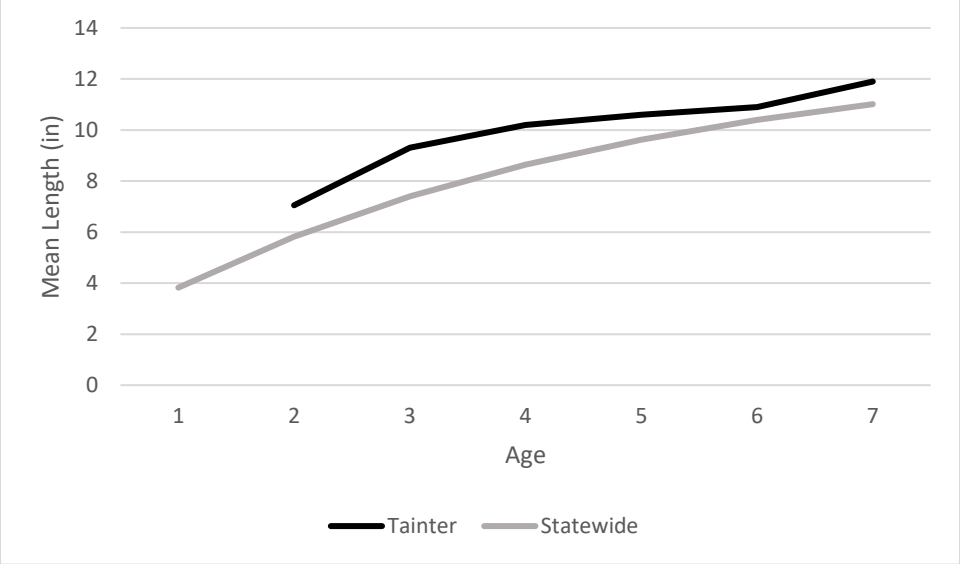

Figure 19. Mean length at age of black crappie from Tainter Lake collected via nighttime boat electrofishing during spring 2022 and mean length at age of black crappie from Complex Riverine lakes across Wisconsin.

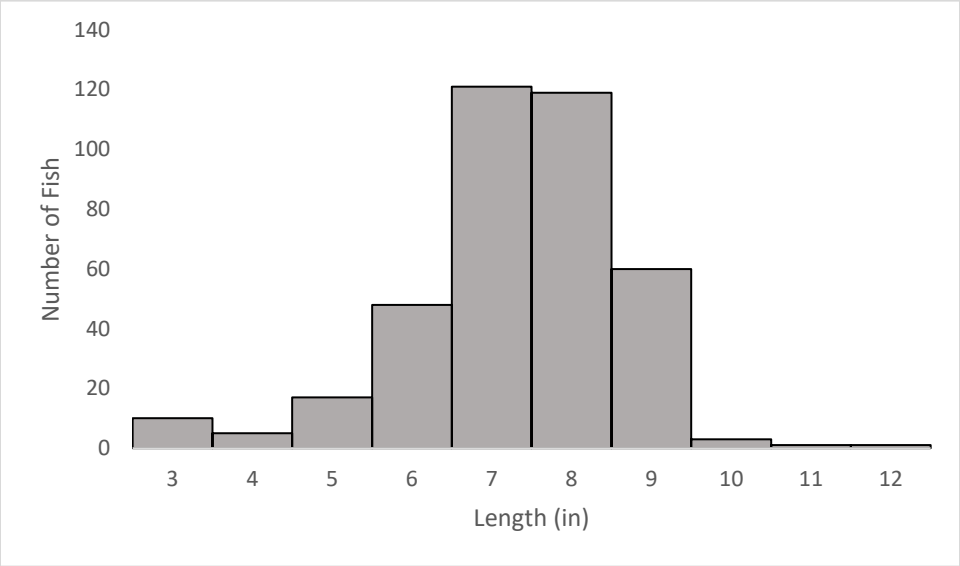

Figure 20. Length frequency distribution of yellow perch from Tainter Lake collected via fyke netting and nighttime boat electrofishing during spring 2022.

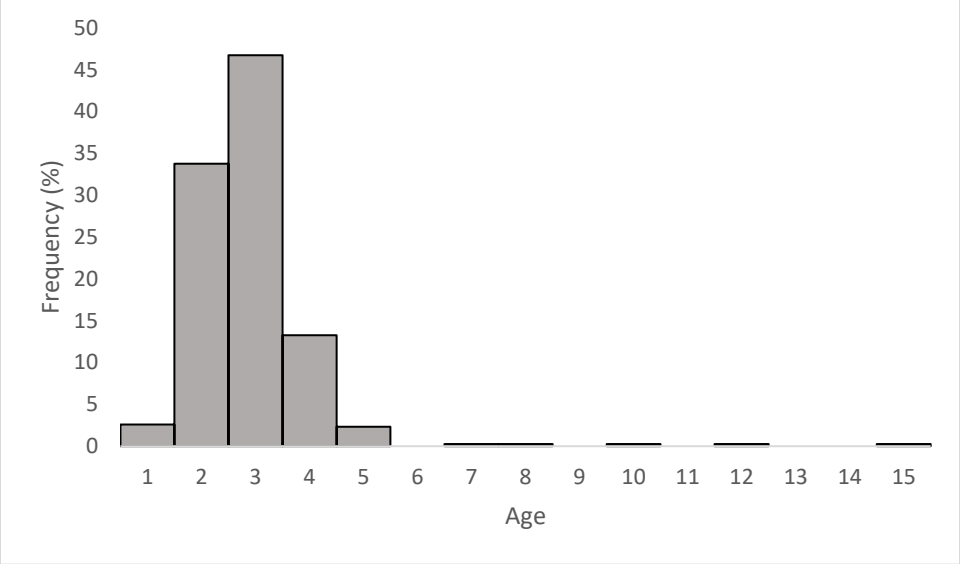

Figure 21. Age frequency distribution of yellow perch from Tainter Lake collected via fyke netting and nighttime boat electrofishing during spring 2022.

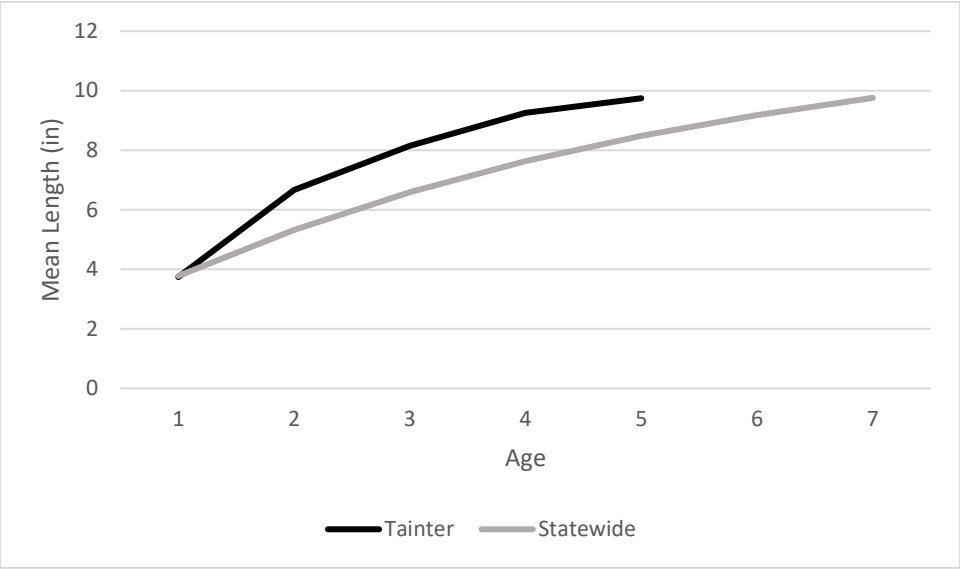

Figure 22. Mean length at age of yellow perch from Tainter Lake collected via fyke netting and nighttime boat electrofishing during spring 2022 and mean length at age of yellow perch from Complex Riverine lakes across Wisconsin.

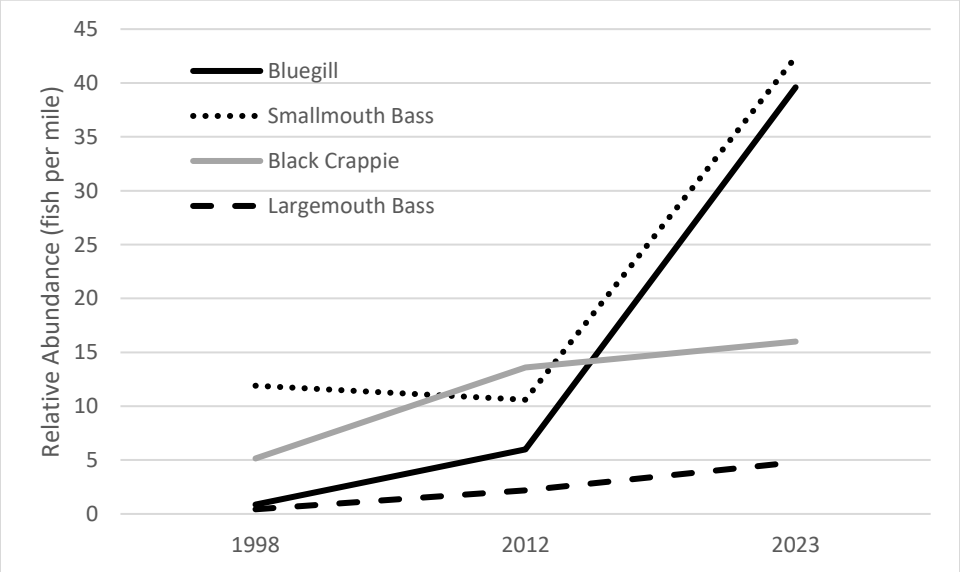

Figure 23. Relative abundance of bluegill, smallmouth bass, black crappie and largemouth bass captured during electrofishing surveys on Tainter Lake in 1998, 2012 and 2023.

*Table 1. Species summary of fish collected from Tainter Lake during spring 2022 via fyke nets and electrofishing. (Percentiles are calculated from Complex Riverine Lakes in Wisconsin). *Indicates species was only targeted during electrofishing sampling.*

SPECIES	NUMBER COLLECTED	CATCH RATE (PERCENTILE)	LENGTH RANGE	MEAN LENGTH
Walleye	1719	0.75 per net night	4.5-27.0	16.5
Northern pike	135	1.65 per net night (25)	7.5-35.2	19.1
Muskellunge	3	-	11.9-20.3	-
Smallmouth bass*	798	42.4 per mile (95)	4.5-18.8	11.7
Largemouth bass*	58	4.8 per mile (50)	8.7-18.7	13.3
Bluegill*	119	39.6 per mile (50)	4.6-9.8	6.6
Black crappie*	50	16 per mile	4.7-11.9	10.0
Yellow perch	710	12 per net night (75)	3.6-12.5	7.8
Black bullhead*	2	-	-	-
Bowfin	53	0.9 per net night	-	-
Golden shiner*	4	-	-	-
Pumpkinseed*	3	-	-	-
Redhorse sp.	77	0.9 per net night	-	-
Rock bass*	19	-	-	-
Saugeye	1	-	-	-
White Bass	65	5.3 per mile	-	-
White sucker	17	0.2 per net night	-	-
Yellow bullhead*	2	-	-	-

Discussion

Overall catch rates of walleye were lower relative to the previous 2012 and 1998 surveys. Adult walleye have been consistently difficult to effectively survey in Tainter Lake in the spring due to spring migrations for spawning purposes. Prior surveys documented a large proportion of walleye in the lower Red Cedar and Hay Rivers after ice out while a smaller proportion of fish were found in the upper Red Cedar River (Swim et al. 2000). Long distance migrations by walleye are well documented within walleye's native range if unrestricted access to suitable spawning habitat is available (Colby et al. 1979). A 1992 tagging study of walleye in Tainter Lake and the Red Cedar River found walleye migrating up to 50-60 miles upstream in the spring (WDNR unpublished report 1992). Data from tagging studies and angler tag returns can provide valuable information; however, data is limited in that only the tagging and capture locations are known. Information regarding the seasonal timing of movements and the proportion of fish that utilize different habitats are still unknown. Alternate methods of tracking fish including hydroacoustic telemetry can shed light on these important factors to fully understand walleye movements, habitat use and connectivity as well as identifying potential sources of mortality.

Growth rates of walleye were average when compared to the statewide average in Complex Riverine lakes and was similar to growth rates observed during the 2012 and 1998 surveys. Growth rates of juvenile fish may be impacted by high abundance due to density dependent factors (Walters and Post 1993; Post et al. 1999, Sass et al. 2004). The size structure of adults was relatively good throughout the surveys with high PSD estimates, similar to previous surveys. Walleye exhibited inconsistent recruitment but generally produce large year classes as has been documented in 2018 and 2022. Young of year or juvenile Walleye abundance has been strong and consistent for the past couple decades and is relatively high when compared to similar waters. High annual mortality of walleye was also documented within Tainter Lake in 2022 and 1998. However, the difficulty of sampling large, older fish was likely the cause of the high mortality estimate in 2022. The 1998 survey resulted in high mortality estimates in the lake and lower Red Cedar River (54-72%). Walleye within these areas exhibited the highest mortality compared to the Hay River and Upper Red Cedar River during that survey. Hydroacoustic telemetry could assist with determining movement patterns and the proportion of fish that utilize different habitats which could help to determine potential causes of high mortality.

Northern pike have remained in relatively low abundance throughout the years and relative abundance during the 2022 survey was slightly lower than the previous 2012 survey. This is likely due to the overall lack of aquatic macrophytes within the Tainter Lake system. Low water clarity throughout much of the growing season limit macrophyte growth and colonization, thus limiting the fish abundance of species that prefer this habitat type, which includes northern pike. Some scattered small bays and the Hay River basin contain higher densities of aquatic macrophytes, and northern pike abundance is generally higher in these areas during certain times of the year. Size structure of northern pike was good (75th percentile for mean length) with 14% of fish larger than 26 inches which is similar to previous survey. Growth rates of northern pike were comparable to the statewide average and individual fish condition was excellent. Northern pike appeared to experience low total annual mortality; however, mortality appeared to increase for larger individuals (>25 inches) which may indicate high angler harvest. Continued monitoring of the population is recommended to document any further increases in mortality. With consistent low abundance estimates, relatively low rates of natural reproduction and high mortality for larger individuals, a more restrictive regulation may aid in improvement and sustainability of a quality northern pike population. A reduction in the bag limit and implementation of a minimum length limit may help to improve the size structure and protect northern pike until they reach quality and preferred lengths.

Three juvenile muskellunge were captured in 2022. Muskellunge have been present in very low densities in previous surveys as well, with angler reports throughout the years of large muskellunge present. The presence of muskellunge in previous surveys has been attributed to upstream stocking of large fingerlings in the upper Red Cedar River and Big Moon and Rice Lakes in Barron County. The Red Cedar River in Barron County and Rice Lake are stocked in odd years while Big Moon Lake is stocked during

even years; however, the last stocking on Big Moon Lake occurred in 2018 prior to this survey. Age analysis of the fish captured in 2022 resulted in fish from the 2019- and 2020-year classes. Therefore, there is likely a combination of low rates of natural reproduction and potential contribution from upstream stocking sources that provide recruitment for a limited muskellunge fishery to be present. Adequate muskellunge spawning habitat is present in the Hay River basin and off channel areas in the lower Red Cedar River. Forage is abundant is Tainter Lake and growth rates of fish in past surveys were excellent. Tainter was classified as a Class C muskellunge lake in 2019. Muskellunge stocking may be an option in future if hatchery stock availability improves and local conservation organizations and anglers are supportive.

Smallmouth bass relative abundance has dramatically increased in Tainter Lake relative to the 2012 (10.6 per mile) and 1998 (12 per mile) surveys (Figure 23). Centrarchids in general, are nest builders and are influenced by water level fluctuations during the spawning and hatching periods (Clark et al. 1998), and subsequent year class strength can be impacted. With more stable water levels in recent years because of the installation of the bladder system on the dam, smallmouth bass have likely benefitted as documented by improved recruitment and increased densities. Despite the increases in abundance, smallmouth bass exhibited good size structure, as well as growth and overall fish condition. Low annual mortality rates were documented in 2022 which has declined from relatively high total annual mortality of smallmouth bass in 1998 in which mortality was estimated at 41-75% (Swim et al. 2000). However, mortality was estimated from fish caught in fyke nets only which may have biased the sample with low catch rates of larger, older fish. Smallmouth bass are not effectively sampled with the use of fyke nets, while electrofishing provides a more unbiased and effective method of sampling the existing population (Beamesderfer and Rieman 1988; Milewski and Willis 1991). Angler harvest of smallmouth bass may have also declined since the 1998 survey with the change in angler attitudes towards a catch and release mentality for bass. A creel survey conducted in 1998 found that smallmouth bass were the 6th most harvested species and were the second most commonly caught species (WDNR unpublished data).

Largemouth bass have remained in low densities throughout the years but have shown slight increases in abundance from 1998 and through 2012. Largemouth bass have likely benefited from stable water levels during the spawning season that has resulted from the installation of the bladder system on the dam. Largemouth bass are a nest building species that construct nests in relatively shallow areas of lakes. Largemouth bass nest success can be dependent on stable water levels (Kohler et al. 1993). However, even with recent increases in densities, relatively low densities of largemouth bass in Tainter Lake compared to populations statewide, is likely due to the lack of suitable habitat in the form of aquatic macrophytes and other physical structure. Centrarchids in general, prefer to nest near patches of physical structure including woody debris and macrophytes (Noltie and Keenleyside 1987; Nack et al.

1993; Annett et al. 1996). Habitat in Tainter Lake is much more suitable for smallmouth bass with excellent gravel and cobble substrates and boulder habitat as well as the riverine influence on flow regimes. Along with low densities of largemouth bass, excellent size structure and condition was observed with 34% of fish larger than 16 inches. Bass size structure has improved since the 2012 survey. largemouth bass experience inconsistent recruitment and weak year classes in 2016-2018 were documented.

Panfish species exhibited excellent growth rates and were in relatively low to moderate densities with the exception of yellow perch that were observed in high density. The size structure of panfish species was good but a cropping effect of larger individuals was apparent, potentially indicating high angler exploitation once fish reach harvestable sizes. If fish are able to avoid sources of mortality, the growth potential of bluegill, black crappie and yellow perch is high. Bluegill in particular were in good condition and exhibited fast growth rates when compared to lakes statewide in Complex Riverine systems. Bluegill abundance has increased substantially since 1998 and appears to have been on a steady increase throughout the years. Improved dam operations that were made during FERC relicensing efforts in the early 2000's may be a contributing factor to this improvement as well as the reduction in the panfish bag limit from 25 to 10 that was enacted in 2006. Currently bluegill abundance is within the 50th percentile for Complex Riverine lakes across Wisconsin. Bluegill produced a relatively large year class in 2019. Fish from this year class will be 4 years old in 2023 and should be approaching 8 inches at that time. Anglers may experience excellent bluegill fishing within the coming open water and ice fishing seasons. The size structure of bluegill has remained good since the 1998 survey with similar PSD estimates. However, the abundance of large bluegill over 8 inches has declined since that time with RSD8 values dropping from 28 in 1998 to 7 in 2022. With excellent growth of panfish and low to moderate abundances, a further reduction in panfish bag limits may help to improve size structure and decrease mortality of larger fish in the population. The growth potential of all panfish species is high and an experimental panfish regulation of no more than 5 panfish of each species (bluegill, black crappie, yellow perch) with a total bag limit of 15 may be applicable if anglers are supportive.

Black crappie are growing substantially faster than the statewide average for black crappie in similar lakes. Abundance of black crappie has remained relatively similar to the 2012 survey. Inconsistent recruitment is common in Tainter Lake and for black crappie in general. No black crappie were captured larger than 12 inches potentially indicating high angling mortality. The previous creel survey documented black crappie as the most sought after and harvested species within Tainter Lake and angling pressure is likely still very high for the species based on angler preferences on Lake Menomin in 2021 (Schurrer and Yallaly 2023). The lack of aquatic macrophytes is also a limiting factor for black crappie. Improved dam operations that were made during FERC relicensing efforts in the early 2000's may be a contributing factor for this improvement which has likely improved conditions for black crappie

by creating more consistent flow regimes and water levels which can be a limiting factor in year class strength (Maceina and Stimpert 1998; Maceina 2003).
The reduction in bag limits for panfish from a 25-bag to a 10-bag limit in 2006 likely played a role as well in improvement of the crappie population.

Relative abundance of yellow perch was substantially higher than during the 2012 and 1998 surveys. Yellow perch growth rates and condition was exceptional; however, growth slows to below the statewide average for older fish and is variable after fish reach 5-6 years of age. Based on the current length distribution, few fish likely reach large sizes and mortality is likely high for fish older than 3 years of age of 8 inches. These characteristics indicate high angler exploitation as well. High total annual mortality was also observed in 1998 at 69% (Swims et al. 2000). Yellow perch abundance has likely improved because of more consistent water levels throughout the year provided by improvements in dam operations that were made during FERC relicensing efforts in the early 2000's in addition to the introduction of the 10-bag limit for panfish that was enacted in 2006.

Non-game species including redhorse species and white sucker were present in low densities during the 2022 survey (redhorse sp.-0.9 per net night; white sucker-0.2 per net night). Relative abundance of these species has declined relative to previous surveys in 2012 in which abundance of redhorse sp. was 2.6/net night and white sucker relative abundance was 0.45 per net night. The 1998 survey resulted in the highest relative abundances throughout survey years of 5.2 per net night for redhorse sp. and 1.2 per net night for white sucker. The reason for these declines in redhorse and sucker abundance is unknown but is likely due to changes in habitat within the lake with increasing siltation and lack of aquatic macrophyte habitats. These species are important forage species for predatory fish species and further declines are of concern. Bowfishing is also present on Tainter Lake and these fish are commonly targeted during the open water season. Common carp have remined in low abundance in surveys throughout the years including in 2022. Bowfin catch rates have remained relatively consistent during past surveys with the highest catch rates in 2012 of 3.2 per net night. Bowfin are a native predatory species and generally do not become overabundant.

Water quality is extremely poor in Tainter Lake and the lake is classified as impaired with impairments including excess algal growth, elevated pH and eutrophication due to high levels of phosphorus. The major contributor to high phosphorus levels within the lake result from upstream agricultural land usage within the Chetek and Red Cedar watersheds. Best management practices within these watersheds is highly encouraged to reduce phosphorus loading within Tainter Lake and Lake Menomin.

Despite impaired water quality, Tainter Lake supports a productive and diverse fishery that likely receives high amounts of angling pressure. The previous creel survey conducted in 1998 documented 17.5 angler hours per acre (25^{th} percentile).

This estimate was approximately 50% less than angler hours on Lake Menomin during the same timeframe. However, based on observations and angler reports, angler pressure on Tainter Lake is currently much higher than the previous estimate. Strong naturally reproducing populations of all major fish species are present and are not dependent on stocking. While poor water quality is detrimental in many aspects, fish populations can experience some benefits from the high productivity of the lake from bottom-up effects and increasing the overall base of the trophic structure. The current fishery reflects the habitat that is present within the lake. Smallmouth bass, walleye and yellow perch are in high abundance and reflect species that typically do best in a riverine environment. Forage for predator species such as walleye, smallmouth bass, northern pike and muskellunge appears to be adequate based on good growth and condition of these species. Panfish growth was above average and quality sized fish were present. More specifically, abundance of bluegill was previously very low two decades ago and populations have been increasing since that time. Nearshore habitat in the form of large woody debris is lacking on most shorelines and would aid in promoting centrarchid populations. Aquatic macrophytes are also very limited within Tainter Lake because of poor water clarity throughout much of the growing season due to high phosphorus levels and algal blooms. Maintenance and promotion of aquatic macrophyte beds should be encouraged and will aid in sustainability of the panfish, walleye and northern pike populations.

Recommendations

1. Promote installation of nearshore woody habitat in cooperation with lake shore owners and local conservation groups.
2. Consider stocking muskellunge in the future if large fingerlings become available and enlist public input on this management objective.
3. Investigate seasonal walleye movement between lake and river systems and determine sources of mortality.
4. Consider a reduced bag limit and minimum length limit for northern pike of a 26 inch minimum length limit and two fish bag limit and enlist public input on this proposal.
5. Consider an experimental panfish regulation of a total bag limit of 15 and no more than five of each species may be kept. Enlist public input on this proposal.
6. Consider an angler creel survey to determine changes in angler preferences and harvest rates for species since the 1998 creel survey.
7. Encourage best management practices within the watershed to aid in improvement of water quality and clarity and reduction of sedimentation which will enhance aquatic macrophyte reestablishment and overall aquatic system health.

8. Cooperatively work with newly formed Lake District to encourage and promote water quality improvements via methods that have scientifically been shown to support and/or promote the current fishery.
9. Tainter Lake was recently reclassified as a High Priority Lake and monitoring surveys should be conducted on a 5-year sampling rotation.

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