# Comprehensive Fishery Survey of Twin Valley Lake

## Iowa County, Wisconsin 2018-2019

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WISCONSIN
DEPT. OF NATURAL RESOURCES

SPORT FISH RESTORATION

Lake and Location

Twin Valley Lake, Iowa County (WBIC 1245800)

Governor Dodge State Park

Physical/Chemical Attributes

Morphometry: 136 Acres, maximum depth 32 feet

Watershed: Mill Creek

Lake type: Drainage, impoundment of Mill Creek

Water clarity: Low

Littoral substrate: Sand and silt

Trophic status: Eutrophic

Aquatic vegetation: Curly leaf pondweed, Sago, Monorail, Elodea, and Eurasian water-milfoil

Invasive species: Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Rusty Crayfish

Winterkill: Infrequent

Boat landings: One public boat landing is available.

Other features: The lake is surrounded by public lands within Governor Dodge State Park and has multiple opportunities for shore fishing and one boat launch. There is also a public beach available. Only electric motors are allowed on Twin Valley Lake. Twin Valley Lake is a class A2 Muskellunge water.

Purpose of Survey

Largemouth Bass, Muskellunge and Walleye Population Estimates

Assess Largemouth Bass, Muskellunge, Panfish, and Walleye size structure

Dates of Fieldwork

SN1 fyke net surveys conducted March 26 through April 12 of 2018 and April 5$^{th}$ through April 22$^{nd}$ of 2019.

Electrofishing surveys conducted April 19, 2018 (SE 1), May 9, 2018 (SE2), and October 17, 2018 (FE).

Fishery

The Twin Valley Lake fishery consists of Black Crappie, Bluegill, Largemouth Bass, Muskellunge, Pumpkinkseed, Walleye, and Yellow Perch.

**Executive Summary**

A comprehensive survey of Twin Valley Lake, Iowa County, was conducted during the 2018 and 2019 season. The primary focus of this survey was to estimate abundance and size structure of Muskellunge and Walleye and assess relative abundance and size structure of other gamefish and panfish in Twin Valley Lake.

Spring surveys estimated the Walleye population at 6.2 adult fish per acre with fyke net catch rates at 3.32 per net night, a slight decrease from 6.8 adults per acre in 2013. The Muskellunge population was slightly lower in 2018 than it was in 2013. Estimated adult Muskellunge in 2018 was 1.2 fish per acre with netting catch rates at 0.52 per net night, compared to 1.4 adults per acre in 2013. A total of 339 Yellow Perch were captured during netting at 2.49 per net night, slightly lower than 2.64 per net night during 2013 sampling. Spring electrofishing surveys for bass and panfish captured 460 Largemouth Bass at 99.35 fish per mile, 755 Bluegill at 755 per mile, and 28 Black Crappie at 28 fish per mile. Largemouth Bass catch rates were lower than 2013, whereas Bluegill catch rates increased dramatically from the 454 sampled in 2013.

Overall, the Twin Valley Lake fishery is diverse and productive. Management actions for these species will include maintaining the a moderate-high abundance of Walleye with continued stocking efforts, further reducing the density of Muskellunge to continue increasing growth rates and size structure while maintaining class A2 designation, maintaining the moderate-high density of Largemouth Bass to sustain predation on Bluegill, and continuing to provide a harvest oriented panfish fishery.

## Introduction

Twin Valley Lake is a 136-acre impoundment located in Iowa County, Wisconsin that was created in 1967 as an impoundment of Mill Creek. Twin Valley Lake is a eutrophic, drainage lake with a maximum depth of 32 feet. Inlets to Twin Valley Lake include Cox Hollow Lake and Halverson Lake, two smaller impoundments upstream. Both Cox Hollow and Twin Valley Lake are impoundments of Mill Creek. One dam regulates the waterbody on the southeast side of the lake and flows out to Mill Creek.

The lake contains a number of gamefish including Black Crappie (*Pomoxis negromachulatus*), Bluegill (*Lepomis machrochirus)*, Green Sunfish (*Lepomis cyanellus*), Largemouth Bass (*Micropterus salmoides*), Muskellunge (*Esox masquinongy*), Pumpkinseed (*Lepomis gibbosus*), Walleye (*Sander vitreus*), Yellow Perch (*Perca flavescens*), Black Bullhead (*Ameiurus melas*), and Brown Bullhead *(Ameiurus nebulosus*). Non-game and forage fish include Brook Silverside (*Labidesthes sicculus*), Common Carp (*Cyprinus carpio*), Fathead Minnow (*Pimephales promelas*), and White Sucker (*Catostomus commersoni*). Invasive species are also present in Twin Valley Lake and include the Chinese Mystery Snail (*Bellamy chinensis*), Curly-Leaf Pondweed (*Potamogeton crispus*), Eurasian Water-Milfoil (*Myriophyllum spicatum*), and Rusty Crayfish (*Orconectes rusticus*).

A variety of surveys have been completed on Twin Valley Lake since 1966. These include general surveys, baseline monitoring surveys, special regulation evaluations, as well as standardized fishery assessments. This is the second comprehensive fishery survey conducted on Twin Valley Lake but is the first comprehensive fishery survey report. The primary objectives of the survey were to assess the Largemouth Bass, Muskellunge, panfish and Walleye populations.

Management of the fishery in Twin Valley Lake has varied over the years and current regulations follow the statewide regulations for all species except Walleyes, Saugers, and hybrids must be a minimum of 18 inches with a daily bag limit of one (Table 1). Historically, gamefish have been managed under a variety of statewide and special regulations. In 1997, the 18-inch minimum length limit and daily bag limit of 3 was implemented for Walleye. This was enacted to manage for quality fishing opportunities by increasing the population size structure. In 2000, the statewide daily bag limit for panfish was changed and an unlimited number of panfish could be harvested. At the time, the panfish population in Twin Valley Lake exhibited high densities, low size structure, and was considered stunted. This regulation was implemented to increase growth and size structure by reducing density through harvest. This unlimited bag limit regulation was removed on January 1, 2019 and replaced with the general statewide regulation to provide regulation consistency. Muskellunge and Largemouth Bass are managed under the general statewide regulations.

Stocking has been common practice in Twin Valley Lake since its construction in 1966. Early stocking events consisted of Walleye, Muskellunge and Northern Pike x Muskellunge hybrids during the first 10 years. Since 1984, a variety of game fish, including Channel Catfish, Saugeye, Largemouth Bass, Black Bullheads, and forage fish, including Fathead Minnows, and White Suckers, have been stocked. Recent stocking events have focused mainly on Muskellunge and Walleye (Table 2). Walleye are stocked as large fingerlings at 10 fish per acre (roughly 1359 fish) every other year. Prior to 2012, Walleye were stocked on an annual basis. Muskellunge have also been stocked annually as large fingerlings at 1 fish per acre. However, in 2016 stocking rates of Muskellunge were reduced to an every-other year rotation to reduce densities

and increase size structure. Overall, stocking has contributed significantly to the fishery in Twin Valley Lake and efforts will continue in the future.

**Methods**

Spring sampling began in late-March 2018 following standard Wisconsin Department of Natural Resources spring netting (SN1) procedures listed in the WDNR fish management handbook (Simonson 2015). Between March 26 and April 12, 16 net lifts were conducted on 8 nets for a total effort of 136 net nights to capture, measure, and mark adult Muskellunge and Walleye to estimate abundance. All Muskellunge that could be visually sexed as mature individuals were marked with a top caudal (TC) fin clip and scanned for the presence of a passive integrated transponder (PIT) tag. If no tag was found, a PIT tag was given. Additionally, Walleyes that could be visually sexed as mature individuals or that were greater than 15 inches were marked with a top caudal fin clip. Fyke nets (standard 4' x 6', ¾" bar mesh) were set at ice-out and lifted daily except on one occasion, in which the nets sat for 2 nights. Nets were set in locations that have been previously determined as spawning sites (Figure 1). On April 19, immediately after fyke netting was completed, a single, entire shoreline, night boomshocker electrofishing survey was conducted to recapture Walleyes to estimate abundance. Largemouth Bass ≥8 inches captured during SN1 and SE1 surveys were also marked with a TC clip for estimating adult abundance. Dorsal spines from Walleye and Largemouth Bass, anal spines from Yellow Perch, otoliths from Bluegill, and anal fin rays from Muskellunge were collected for age estimation and analysis.

Following both the SN1 and the SE1 surveys, we conducted a Spring Electrofishing 2 (SE2) survey targeting centrachids. One boat operator and two experienced technicians, using 3/8" mesh dip nets conducted the surveys. The primary objective for this survey was to collect

and measure bass and panfish, and recapture previously marked Largemouth Bass to conduct a population estimate. A night boomshocker electrofishing survey was conducted on May 9th. Two, one-half mile bass/panfish stations were sampled and all centrarchids were collected (Figure 2). A minimum of 250 panfish from each species were dipped from the tub and measured. For the remaining shoreline, only bass were targeted. Dorsal spines from Largemouth Bass and otoliths from panfish were collected for age estimation and analysis.

A fall electrofishing (FE) survey was also conducted on Twin Valley Lake in 2018. The objective of this survey was to assess fall/juvenile Walleyes recruiting to the population. On October 17th, an entire shoreline, nighttime electrofishing survey was completed. All Walleyes, along with other gamefish were collected to calculate catch per unit effort (CPUE).

A spring netting effort was also completed during the spring of 2019 to recapture Muskellunge marked in the spring of 2018 to conduct a population estimate. Between April 6 and April 22, 14 net lifts were conducted on 8 nets for a total of 136 net nights to capture and measure adult Muskellunge to check for TC clips and PIT tags to determine recaptures. Fyke nets were lifted daily except on three occasions, in which the nets soaked for 2 nights.

Age estimation and analysis was conducted for those structures that were collected during the spring fyke netting and spring electrofishing surveys. Walleye and Largemouth Bass dorsal spines and Muskellunge fin rays were collected at a minimum of ten structures per 1 inch length bin. Bluegill otoliths, Yellow Perch anal spines, and Black Crappie dorsal spines were collected at a minimum of five structures per 0.5 inch length bin. All structures were placed in individual scale envelopes corresponding to individual fish. Once dried, fin rays were embedded in expoxy, cross sectioned using a low speed diamond blade saw, sanded with 1000 grit sandpaper, and if necessary polished to acheive maximum clarity. Spines were dried, cut near the base, sanded to

acheive maximum clarity, and illuminated with a fiber optic light. Two readers then aged each structure until an age was agreed upon. If a discrepancy existed, a third reader was called upon to assist in age agreement.

Data Analysis

Catch per unit effort was computed for all species collected during spring netting and electrofishing surveys. This was described as either electrofishing CPUE (fish per mile) or netting CPUE (number per net night). Computing CPUE allows us to compare species catch rates in Twin Valley Lake to catch rates among lake class and to other fisheries across the state. Summary statistics such as mean, minimum, and maximum lengths were also calculated for comparison within Twin Valley Lake and to other fisheries statewide.

Walleye and Largemouth Bass population estimates were calculated using the Chapman's modification of the Peterson mark-recapture estimator (Ricker 1975):

$$N = \frac{(M+1)(C+1)}{(R+1)} - 1,$$

where $C$ = number of captured individuals in the electrofishing sample, $M$ = number of marked individuals during fyke netting, $R$ = number of previously marked individuals observed in the electrofishing sample.

To estimate the abundance of Muskellunge in Twin Valley Lake, the Bailey's modification of the Peterson mark-recapture estimator was used (Ricker 1975):

$$N = \frac{M(C+1)}{R+1},$$

where $C$ = number of Muskellunge captured in the 2019 SN1 survey, $M$ = number of Muskellunge marked during the 2018 SN1 survey, and $R$ = number of marked Muskellunge

observed in the 2019 SN1 survey. Only adult Muskellunge ≥ 30 inches were marked during SN1 in 2018. During the recapture period in 2019, only Muskellunge ≥ 32 inches were counted when calculating the population estimate, to account for growth between marking and recapture periods.

Size structure of each species sampled was described using length frequency histograms and the proportional size distribution (PSD) index (Guy et al. 2007). Proportional size distribution refers to the number of individuals that are of a specified length or greater, divided by the number of fish of stock length or greater. For example, the $PSD_{15/10}$ of Walleyes was calculated as follows:

$$PSD_{15/10} = \frac{\text{number of fish} \geq 15 \text{ in}}{\text{number of fish} \geq 10 \text{ in}} \text{ x } 100$$

Proportional size distribution was also calculated for Muskellunge ($PSD_{38/30}$), Largemouth Bass ($PSD_{12/8}$), and Bluegill ($PSD_{6/3}$).

Age structure and growth rates of differnent species were also calculated. Age length keys were used to assign ages and assess age structure of the entire sampled population from a subsample of aged fish. Fish from the aged subsample had their age estimated from observed structures. Ages were then assigned to unaged fish in the whole sample based on their observed lengths and the proportion of ages at each length, using 0.5 inch length bins. Mean length at age was computed using all fish after age assingment and compared to statewide averages to determine relative growth rates. Age structure was analyzed using age frequency histograms. Individual fish from each species that had weights associated with lengths were used to calculate relative weights (Wr) using methods provided in Anderson and Neumann (1996).

Muskellunge Survival to age-6 was also calculated by multiplying the proportion of age-6 fish to adult fish (> age-4), by the population estimate to estimate total number of six year olds. This number was then compared to the number of the cohort stocked in 2012 to determine survival.

## Results

A total of 8 gamefish and panfish species were collected during the comprehensive survey in 2018. This included Black Crappie, Bluegill, Green Sunfish, Largemouth Bass, Muskellunge, Pumpkinseed, Walleye and Yellow Perch. A total of 1,987 fish were collected during the SN1 surveys, 344 during the SE1 survey, 1,253 during the SE2 survey and 379 during the FE survey (Table 3). During SN1 surveys Bluegill had the highest catch rates for panfish at 706 fish (5.2 per net night) followed by Yellow Perch at 339 fish (4.5 fish per net night), Black Crappie at 240 fish (1.76 per net night), and Pumpkinseed at 123 fish (0.9 per net night). Gamefish catch rates were highest for Walleye at 452 fish (3.32 per net night), followed by Muskellunge at 71 fish (0.52 per net night), and Largemouth Bass at 42 fish (0.31 per net night). Walleye were specifically targetted during the SE1 survey and therefore had highest catch rates at 236 fish (47.2 per mile). Catch rates during the SE2 survey targeting bass and panfish were highest for Bluegill at 755 fish (755 fish per mile) followed by Largemouth Bass at 460 fish (99.4 fish per mile). Only gamefish were targetted during the FE survey where Largemouth Bass had the highest catch rates at 318 fish (59.7 fish per mile).

### Walleye

A total of 294 adult (sexually mature or >15 inches) Walleyes were marked during the SN1 surveys with 234 total adults captured, including 82 marked Walleyes recaptured during the SE1 survey. This translates to an estimated adult Walleye population at 834 fish (6.2 per acre) with 95% CIs [705, 1008] and a CV of 8.8. This is similar to 2013 where the Walleye population was estimated at 6.8 adult Walleye per acre. Population estimates were also calculated for Walleye >15 inches as well as Walleye greater than the minimum harvest size of 18 inches. These estimates came out to 532 fish (3.9 per acre) with 95% CIs [426, 693] and 214 fish (1.6

per acre) with 95% CIs [142, 366] respectively. Size structure was also much higher in 2018 with a $PSD_{15/10}$ value of 65 compared to 14 in 2013. Length of Walleyes captured during spring surveys ranged from 11.1 inches to 26.4 inches, with an average of 16.5 (SD = 3.2; Figure 3). Female Walleyes, to no surprise, had a greater mean length averaging 20.0 inches, compared to 14.9 inches for Males. When sex could be determined males were sampled with greater frequency, sampling a total of 296 individual males compared to only 133 females. Growth rates were similar to statewide averages according to mean length at age (Figure 4). Both male and female Walleyes from ages 3-7 dominated the population, with steep declines beyond age-7 presumably due to harvest once fish reach 18 inches (Figure 5). Interestingly, age-4 and age-6 year classes were represented in the population age structure, even though stocking didn't occur in 2014 or 2012. This is likely due to aging error rather than the occurrence of natural reproduction in those years. Relative weights of Walleyes sampled during spring fyke netting indicated good condition overall with a mean relative weight of 88 (SD = 8.75; Figure 6). In fact, 86% of the population exhibited relative weights over 80 and 7% of the population was above 100 (Figure 6).

YOY Walleye

The catch rate of young-of-year (YOY) Walleye was 0 fish per mile during the fall electrofishing survey. This is typical of Twin Valley Lake which does not have any documented natural recruitment.

Muskellunge

During the spring fyke netting surveys of 2018, a total of 65 sexually mature individual Muskellunge were captured and marked. During the spring fyke netting surveys of 2019, 56 fish

were captured (>32”) with a total of 21 individual fish recapped from 2018. Using the Baileys modification of the Peterson Index, the Muskellunge population was estimated at 168 fish with 95% CIs [124, 248] and a CV at 16.3%, resulting in a density of 1.2 fish per acre. This is a slight decrease from 2014, where the population was estimated at 191 fish (1.4 per acre). Average size of Muskellunge from 2018 spring netting surveys was 36.8 inches (SD = 2.9) with a minimum size of 30.6 and a maximum size of 43.0 (Figure 7). This was an increase from surveys conducted in 2014 where the average size of Muskellunge was 35.6 inches. Size structure was also high with a $PSD_{38/30}$ value of 28. Mean length at age values exhibited good growth rates up until age 7, where mean length at age of older fish seemed to slow (Figure 8). Age-7 Muskellunge dominated the fishery in 2018, with mean lengths of approximately 36 inches (Figure 9). Fourteen of the total Muskellunge sampled during 2018 were known age fish. Reader agreement between estimated age and known age was 100%. Muskellunge sampled during spring fyke netting indicated good condition with a mean relative weight of 90 (SD = 9.3; Figure 10). In fact, 89% of the population exhibited relative weights over 80 and 11% of the population above 100. Survival to age-6 of the Muskellunge stocked in 2012 was 12%. This is low compared to other Muskellunge fisheries in the area (Madison Chain Lake Waubesa = 18%; Madison Chain Lake Wingra = 43%; Oele 2017; Oele 2018). Summary metrics from the 2019 spring Muskellunge recapture survey were very similar to the data collected in 2018. Overall, 60 fish were captured with a mean length was 36.5 inches (SD = 6.0) with a minimum size of 8.5 inches and a maximum size of 45 inches.

Largemouth Bass

A total of 590 Largemouth Bass were collected during spring fyke netting and electrofishing surveys in 2018. Adult population estimates were calculated by marking bass ≥8

inches during both SN1 and SE1 surveys. The SE2 survey was used as the recapture event to estimate population size. Overall, 104 Largemouth Bass were marked during the SN1 and SE1 surveys, with 436 adult fish captured during the SE2 survey, and 10 marked fish recaptured. Population estimates were calculated at 4,170 fish with 95% CIs [2387, 7885] and a CV of 28.5%, resulting in a density of 30.7 adult fish per acre. This CV, although acceptable, is high and reduces our confidence in the population estimate. Typically, CV's <10% are excellent, 10-20% are good, 20-30% are acceptable, and >30% are unacceptable. Largemouth Bass CPE during late spring electrofishing was calculated at 99.4 fish per mile, exhibiting a decrease from 2014 where CPE's were calculated at 120 fish per mile. When compared to other lakes in the warm, dark, complex lake classification, Twin Valley Lake ranks high. Median catch rates for all other lakes was 17.4 fish per mile with the $75^{th}$ percentile coming in at 37.3 fish per mile. Average length of fish captured was 11.6 (SD = 2.7) inches with lengths ranging from 3 to 19.2 inches (Figure 11). Size structure of the Largemouth Bass population increased substantially from 2014 surveys, with a $PSD_{12/8}$ value of 43, compared to 15 in 2014. Even with high catch rates, growth of Largemouth Bass seems to be good with mean length at ages slightly greater than statewide averages for all ages younger than 6 (Figure 12), whereas beyond age 6, growth seems to slow down. The age-2 and 3 year-classes dominated the fishery with excellent reproductive success occurring in 2015 and 2016, followed by fish from ages 5-6 ranging in lengths from 13-15 inches on average (Figure 13). Largemouth Bass sampled during spring electrofishing were in excellent condition overall with a mean relative weight of 101 (SD = 17.8; Figure 14). In fact, 95% of the population exhibited relative weights over 80 and 50% of the population above 100.

Bluegill

A total of 755 Bluegill were sampled during the late spring electrofishing surveys in Twin Valley Lake. Catch per effort was calculated at 755 fish per mile. This was an increase from 2013, where catch rates of Bluegill were lower at 454 fish per mile. When compared to other lakes in the warm, dark, complex lake classification, Twin Valley Lake still ranks high. Median catch rates for all other lakes was 117 fish per mile with the 75$^{th}$ percentile coming in at 196 fish per mile. Mean length of all measured (540 fish) Bluegills in the late spring electrofishing effort averaged 6.50 (SD = 0.55) inches with a minimum of 4.2 inches and a maximum of 7.8 inches (Figure 15). Bluegill showed good growth rates in Twin Valley Lake, reaching 6.5 inches by the age of 4 years on average (Figure 16). Interestingly, growth began to taper off by age 7 and fish older than 8 showed smaller size structure than younger fish, perhaps indicating increased growth rates of young fish within the last 7 years as well as harvest of the faster growing fish. Age 3 and 4 Bluegill representing size ranges from approximately 5.5-6.5 inches dominated the fishery (Figure 17). However, overall size structure looks good for a southern lake based on the $PSD_{6/3}$ of 85.

Yellow Perch

A total of 339 Yellow Perch were sampled during the spring fyke netting surveys in Twin Valley Lake. Catch per effort was calculated at 2.49 per net night. This was a slight decrease from 2013, where catch rates of Yellow Perch were 2.64 per net night. When compared to other lakes in the warm, dark, complex lake classification, Twin Valley Lake ranks low. Median catch rates for all other lakes was 3.77 per net night. Mean length of all measured Yellow Perch in the SN1 survey averaged 7.2 (SD = 0.85) inches with a minimum of 4.8 inches and a maximum of 9.9 inches (Figure 18). Yellow Perch showed good growth rates in Twin Valley Lake, reaching 7.5 inches by the age of 4 years on average (Figure 19). Age 3 and 4 Yellow Perch representing

size ranges from approximately 7-7.5 inches dominated the fishery (Figure 20). Interestingly, growth began to taper off by age 6 and fish older than 6 showed smaller size structure than younger fish. This may be due to harvest of faster growing females that are selected once reaching acceptable size to anglers. Of those fish that were collected and sexed during spring netting, 64% were males while 36% were females, indicating skewed sex ratios.

Other Panfish

Black Crappie, Pumpkinseeds, and Green Sunfish were also sampled during the SN1 and SE2 surveys. A total of 240 Black Crappie were sampled during SN1 surveys with a catch rate of 1.76 per net night and 28 crappies were sampled during the SE2 survey with a CUPE of 28 fish per mile, exhibiting a decrease from 43 fish per mile in 2014. Mean length was 8.9 (SD = 0.3) inches with a minimum of 5.3 and a maximum of 10.8 inches (Figure 21). Black Crappie showed good growth rates, reaching nearly 9 inches by the age of 3 years on average (Figure 22). The age-3 year-class dominated the fishery (Figure 23). Unfortunately, not enough fish were captured to calculate a PSD. Pumpkinseeds were also sampled during the SN1 and SE2 surveys. 123 Pumpkinseeds were sampled during the SN1 survey with a catch rate of 0.9 per net night and 10 were sampled during the SE2 survey. Mean length was 6.4 inches and sizes ranged from 3 to 7.9 inches (Figure 24). Fourteen Green Sunfish were sampled during SN1 surveys ranging from 3 to 7.1 inches with a mean length of 5.2 inches.

**Discussion**

Overall, Twin Valley Lake is a popular fishery among anglers and an important resource for southwestern Wisconsin. Twin Valley Lake resides within Governor Dodge, the fourth largest state park in Wisconsin. The lake gets a lot of attention from both anglers and recreational

boaters alike along with its sister lake, Cox Hollow, which also resides within the park. This park attracts approximately 500,000 visitors per year for a variety of recreational opportunities, including fishing. This makes for an extremely valuable resource and managing for diverse fishing opportunities should be a focus.

The Walleye population is considered abundant in Twin Valley Lake and the fishery is completely dependent on stocking. Walleyes are stocked at a rate of 10 large fingerlings per acre on odd years and these stocking events are needed to sustain the fishery as natural reproduction has never been documented in the lake. The Walleye fishery is currently managed for quality fishing opportunities, hence the 18-inch minimum length limit and daily bag limit of 3 fish. We will continue to manage for quality fishing opportunities as long as growth rates do not exhibit declines. In fact, since the last survey in 2013, growth rates have increased dramatically. Mean length at age-5 was 13.5 inches in 2013 compared to 17.2 in 2018. This is surprising, given that the population density remains similar. However, stocking rates were reduced in 2012 to every other year, likely reducing competition between Walleye and among other predators. Management objectives will include maintaining at least 4 adult Walleyes per acre. Currently, mean age at length for 18-inch Walleyes is 5.7 years. If growth slows beyond a mean age of 6 years at 18 inches, changes in stocking or size/bag limits may be prescribed. However, based on past surveys, the Walleye population is trending in a positive direction.

The Muskellunge fishery in Twin Valley Lake is healthy and abundant and considered an A2 fishery. The Muskellunge population is currently at 1.2 fish per acre and anglers fishing Twin Valley Lake expect good action. As an A2 Muskellunge lake, these waters should provide the most consistent angling action, and may have potential to produce some larger fish. In 2019, fyke net surveys produced some of the largest fish sampled to date, with fish approaching 45 inches.

This is likely resulting from decreases in stocking efforts, which reduces density and increases growth rates. This can be seen in Figure 8, as growth rates seem to slow beyond the age of 6 years. As we continue to stock at lower densities these growth rates should increase as the younger fish recruit to larger age and size classes. Management goals include the continued stocking efforts on an every-other year rotation with the goal of reducing the population to approximately 1 adult fish per acre. Reducing density to this size, should in theory, increase the ability to grow larger fish, while also providing consistent angling action and maintaining the class A2 designation.

Largemouth Bass in Twin Valley Lake are very abundant and are currently approaching almost 31 bass per acre. From 2010-2014 a total of 29,162 Largemouth Bass were stocked into Twin Valley Lake. Although, these stocking events didn't seem to contribute significantly to the population and since 2014, there has been no stocking of Largemouth Bass. It seems the population is stable at this high density and surprisingly growth follows the statewide trend and relative weights are high, averaging 101 (Figure 12; Figure 14). We will continue to manage the Largemouth Bass population under the statewide regulation of 5 fish over 15 inches. If the growth rate substantially decreases regulation changes may be proposed.

The Twin Valley Lake panfish populations are much healthier than they've been in recent years. This may be a result from reductions in stocking rates of Muskellunge and Walleye as this has reduced total fish densities in Twin Valley Lake, allowing for better growth overall. During the mid-2000's panfish in Twin Valley Lake, mainly Bluegill, were considered a stunted population. This population exhibited high densities and low size structure with few fish reaching desirable size for harvest. Since 2003, the Bluegill, Black Crappie, and Yellow Perch populations have been increasing in size structure. Bluegill have increased from an average of

4.8 inches in length to 6.5 inches, Black Crappie have increased from 5.9 inches to 6.6 inches on average, and Yellow Perch have increased from 5.85 inches to 6.44 inches. Evidence from the previously stunted Bluegill population can be seen in the older, slow-growing fish, whereas fish younger than 6 years show good growth rates above and beyond the statewide standards (Figure 16). Maintaining a moderate-high density of Largemouth Bass in Twin Valley Lake will likely help maintain larger size structure of these panfish populations moving forward. We will continue to monitor the panfish size structure and densities on a four-year rotation to assess changes in size structure of this harvest-oriented panfish fishery.

**Management Recommendations**

1) **Goal:** Maintain current Walleye abundance and quality size structure.

   **Objective:** Maintain >4 adult Walleye per acre and PSD > 60.

   **Strategy:** Continue stocking Walleye at 10 large fingerlings per acre every other year and keep the current quality size regulation.

2) **Goal:** Reduce density of Muskellunge to improve growth, condition, and size structure.

   **Objective:** Reduce density to 1 adult Muskellunge per acre.

   **Strategy:** Continue stocking large fingerling Muskellunge at 1 fish per acre every other year to maintain class A2 Muskellunge status.

3) **Goal:** Maintain moderate-high density of Largemouth Bass and provide predation pressure on bluegills.

   **Objective:** SE2 catch rates at 50-75 fish per mile and mean length at age-6 at or greater than statewide mean (14.5 inches).

   **Strategy:** No stocking of Largemouth Bass. Monitor population in 2022 to assess population density. If catch rates >75 fish per mile or mean length at age dips below 13.5 inches at 6 years of age, consider regulation change.

4) **Goal**: Manage for harvest-oriented panfish fishery.

   **Objective**: Maintain Bluegill PSD >60 and increase CPUE of >8" fish to 5 fish per mile during SE2 surveys. Increase catch rates of Yellow Perch during SN1 surveys to 3.8 fish per net night (median value for warm-dark-complex lakes statewide).

   **Strategy**: Manage for a moderate-high Largemouth Bass population density to act as biological control on panfish to prevent stunting. Maintain statewide regulation of 25 fish, no minimum length limit.

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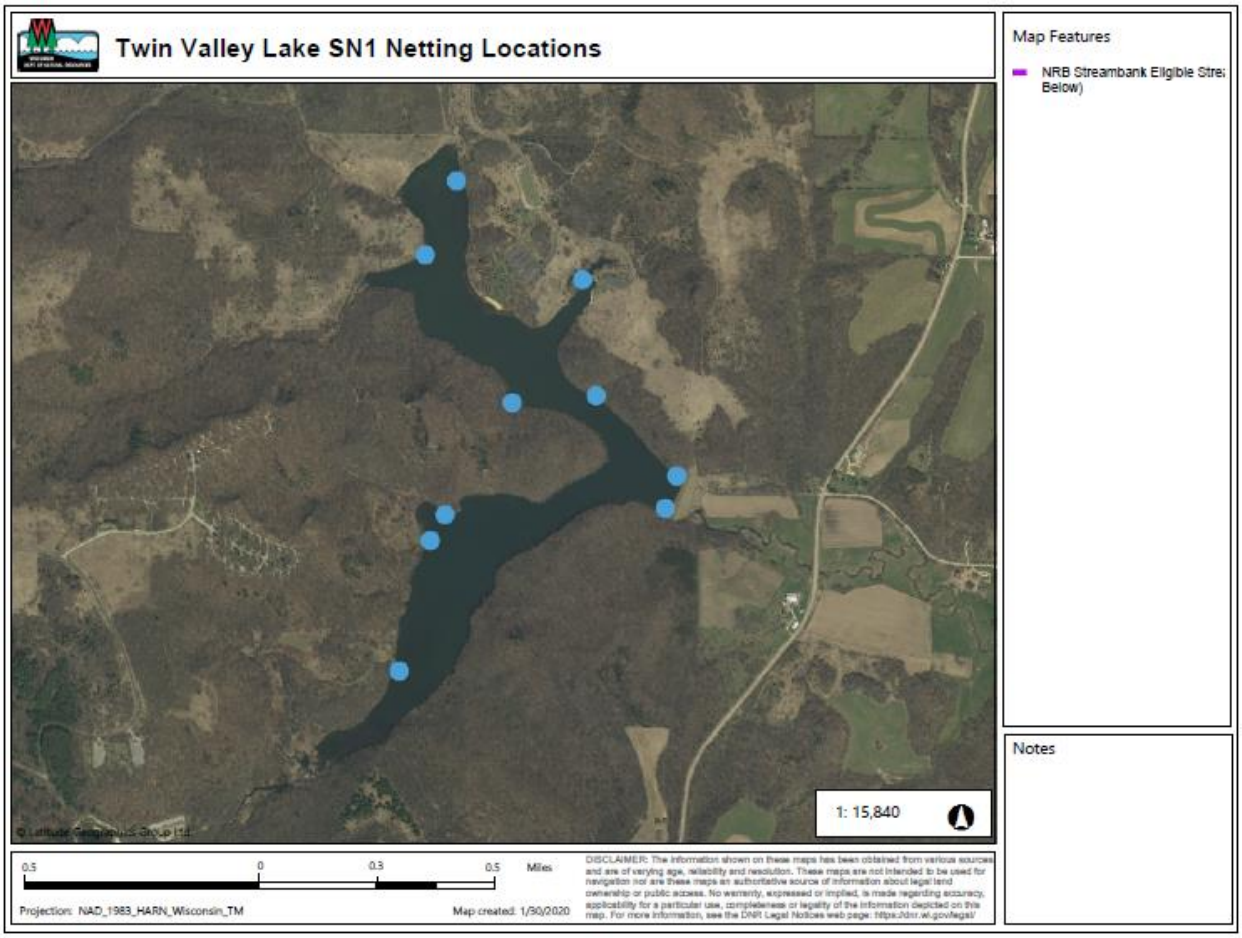


Figure 1. Netting locations from SN1 surveys in Twin Valley Lake.

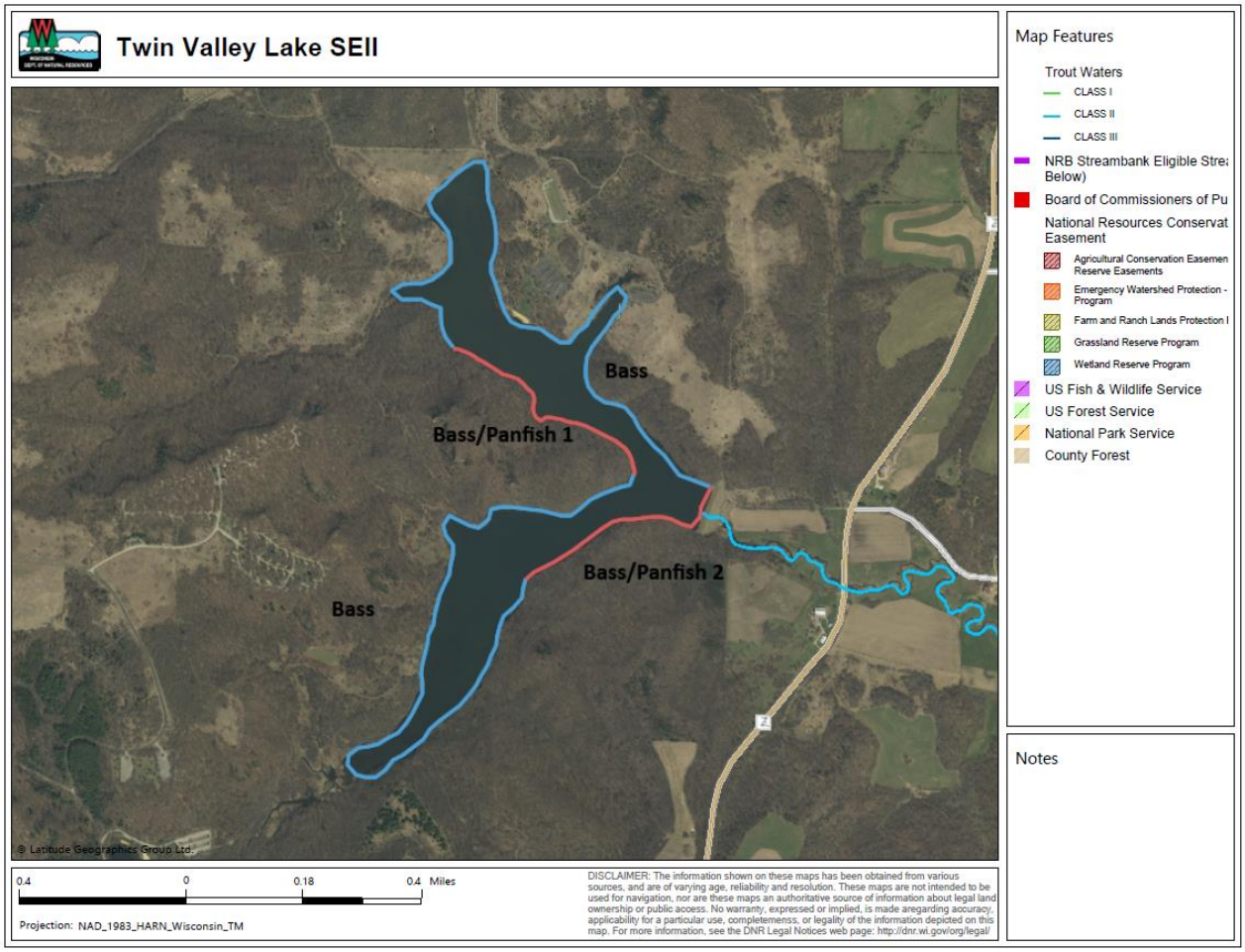


Figure 2. Bass/Panfish stations sampled during SE2 surveys.

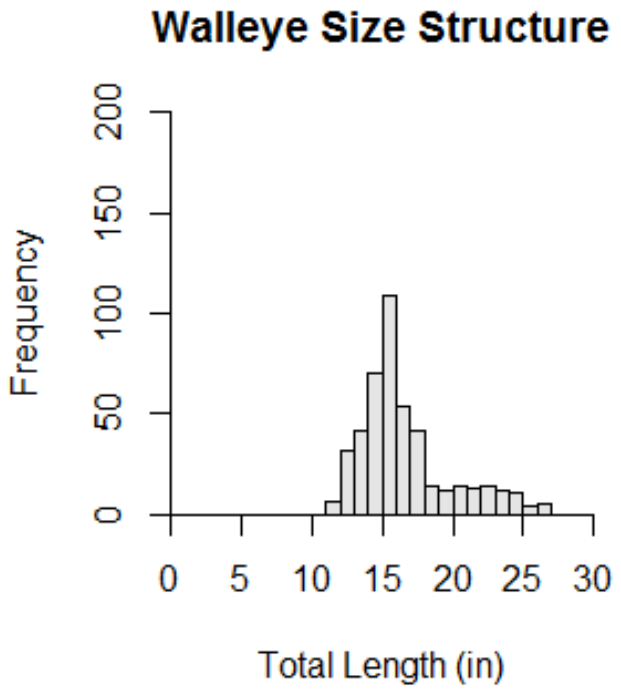


Figure 3. Walleye size structure from individual fish captured during spring fyke netting surveys.

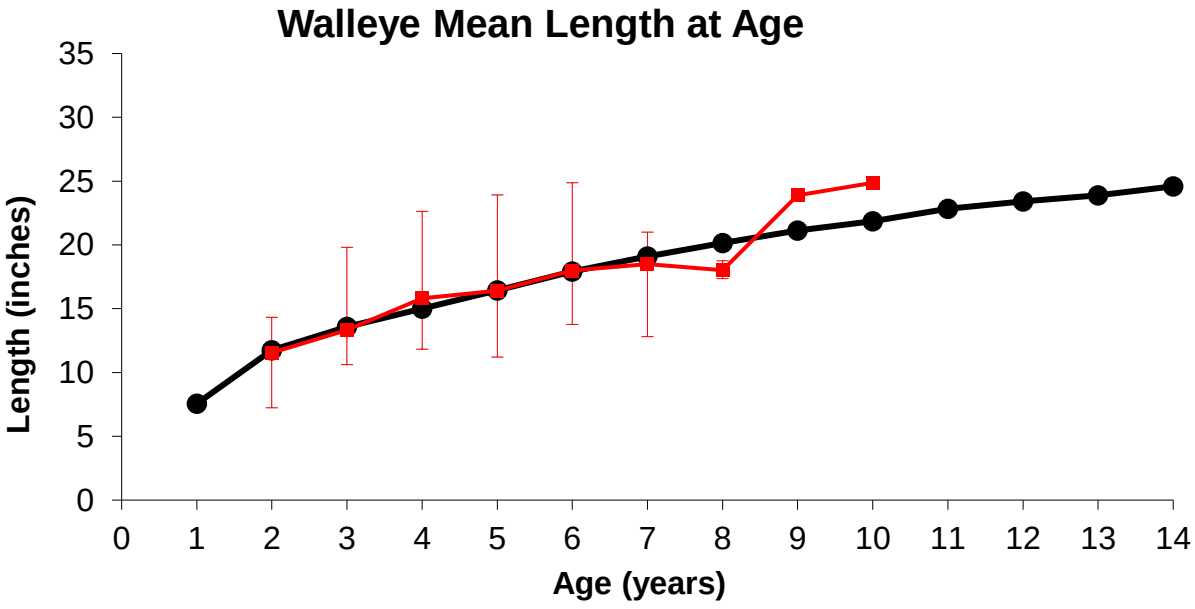


Figure 4. Walleye growth rates in comparison to statewide averages. Twin Valley Lake values are shown in red with error bars, statewide averages are shown in black.

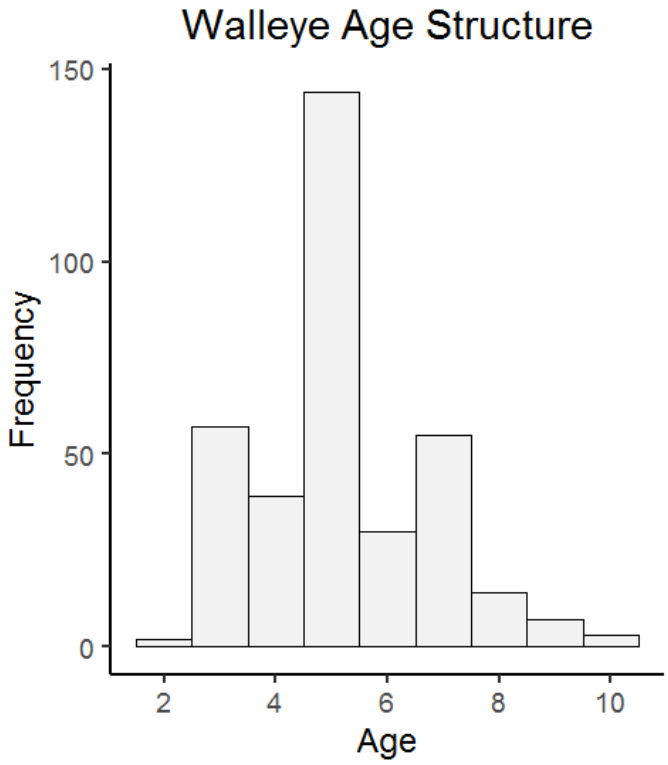


Figure 5. Age structure of all Walleye collected during spring sampling in Twin Valley Lake. Lengths from aged fish were extrapolated and applied to unaged fish using age-length keys.

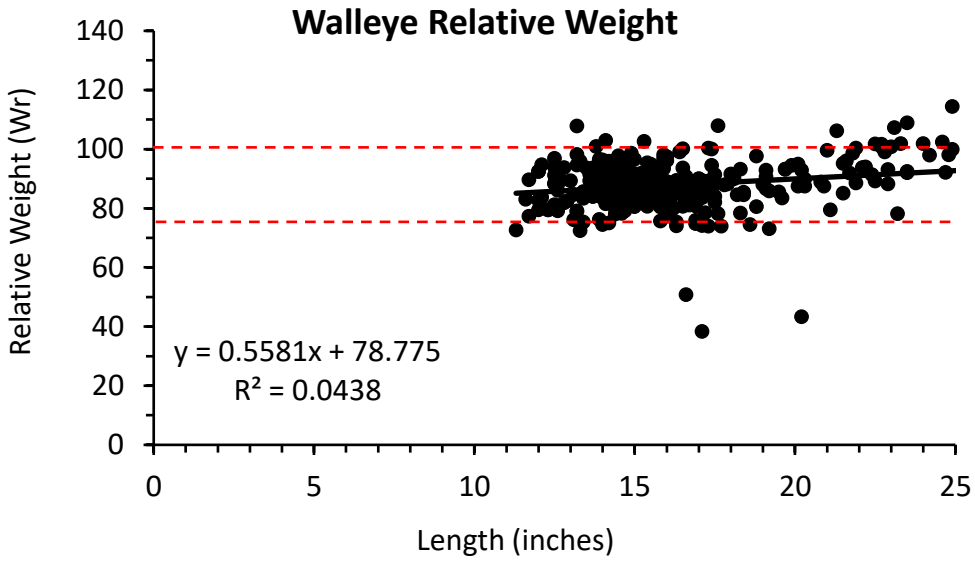


Figure 6. Relative weights of all Walleye sampled during spring fyke netting surveys. Fish between 75 and 100 (designated by red dashed lines) are considered within the normal range.

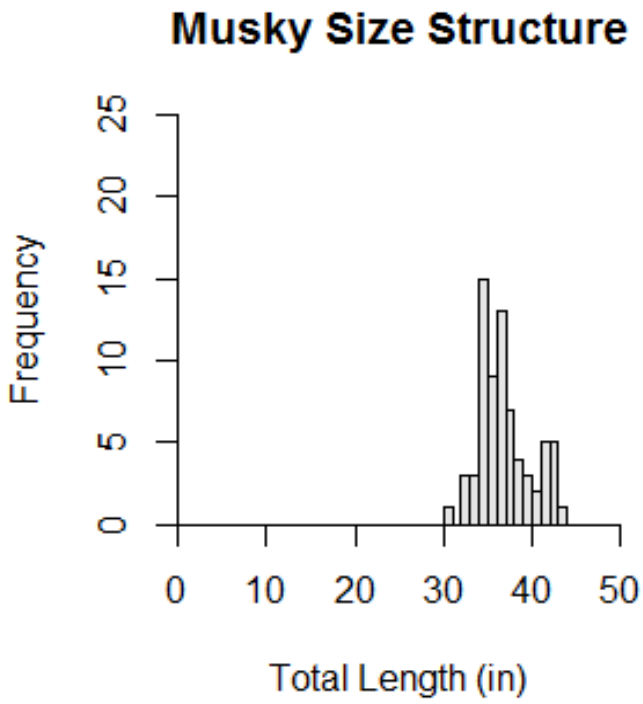


Figure 7. Muskellunge size structure from individual fish captured during spring fyke netting surveys.

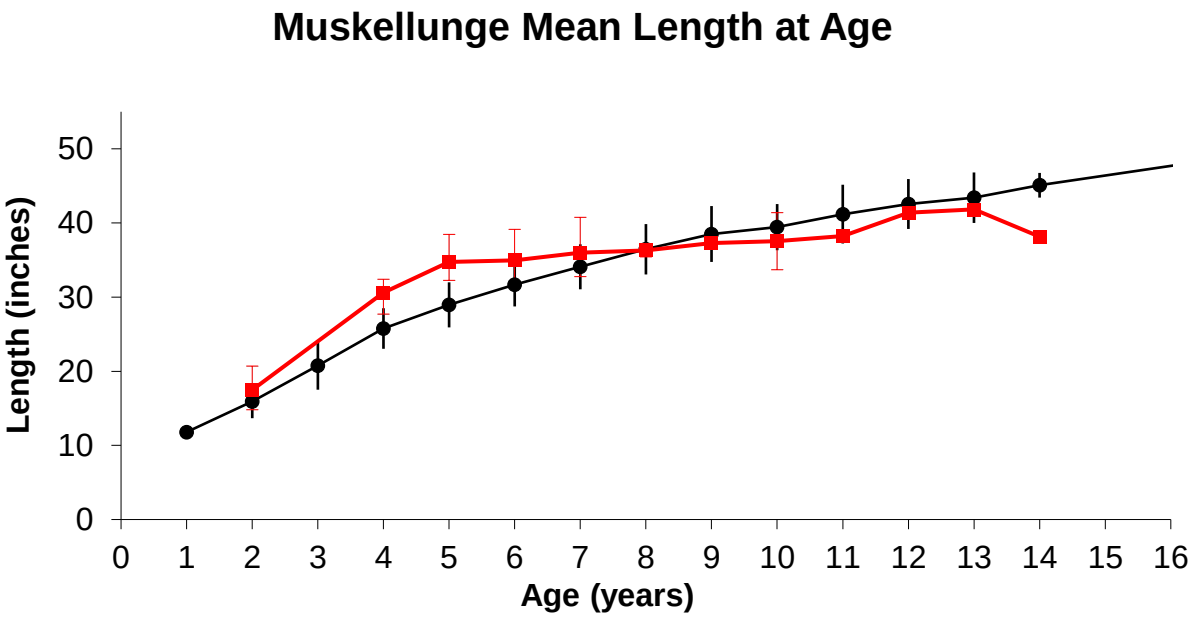


Figure 8. Muskellunge growth rates in comparison to statewide averages. Twin Valley Lake values are shown in red with error bars, statewide averages are shown in black

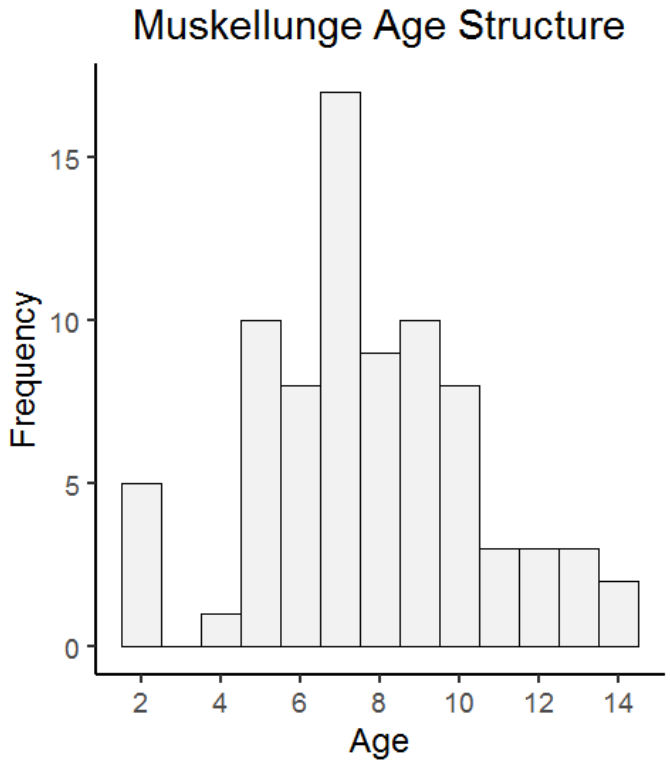


Figure 9. Age structure of all Muskellunge collected during spring sampling in Twin Valley Lake. Lengths from aged fish were extrapolated and applied to unaged fish using age-length keys.

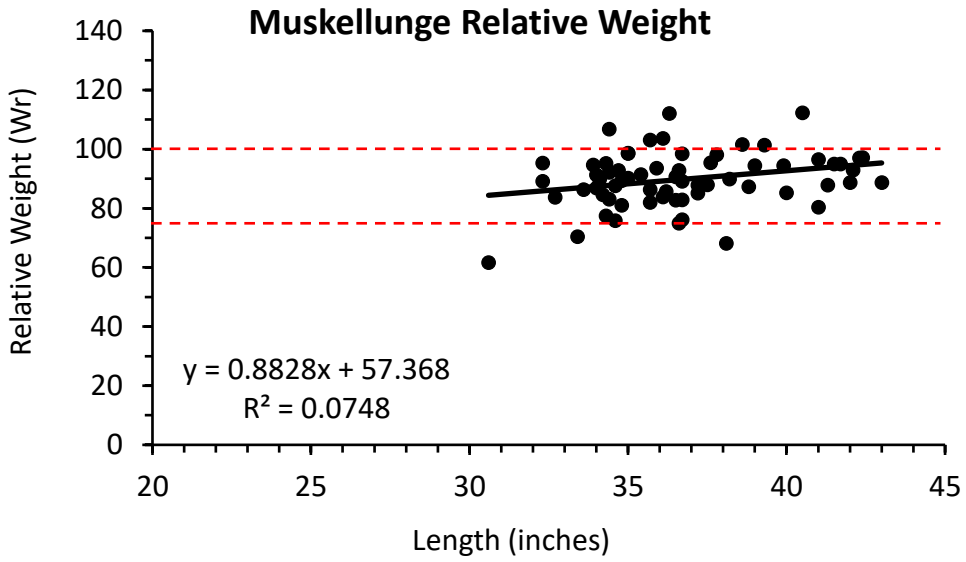


Figure 10. Relative weights of all Muskellunge sampled during spring fyke netting surveys. Fish between 75 and 100 (designated by red dashed lines) are considered within the normal range.

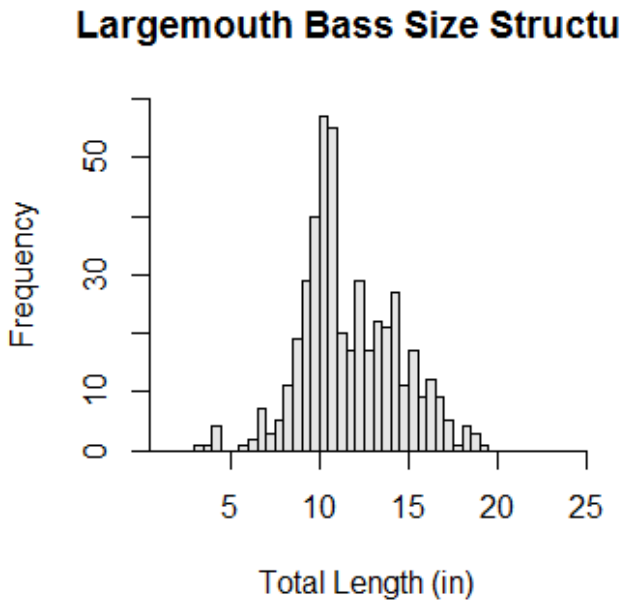


Figure 11. Largemouth Bass size structure from individual fish captured during spring electrofishing surveys.

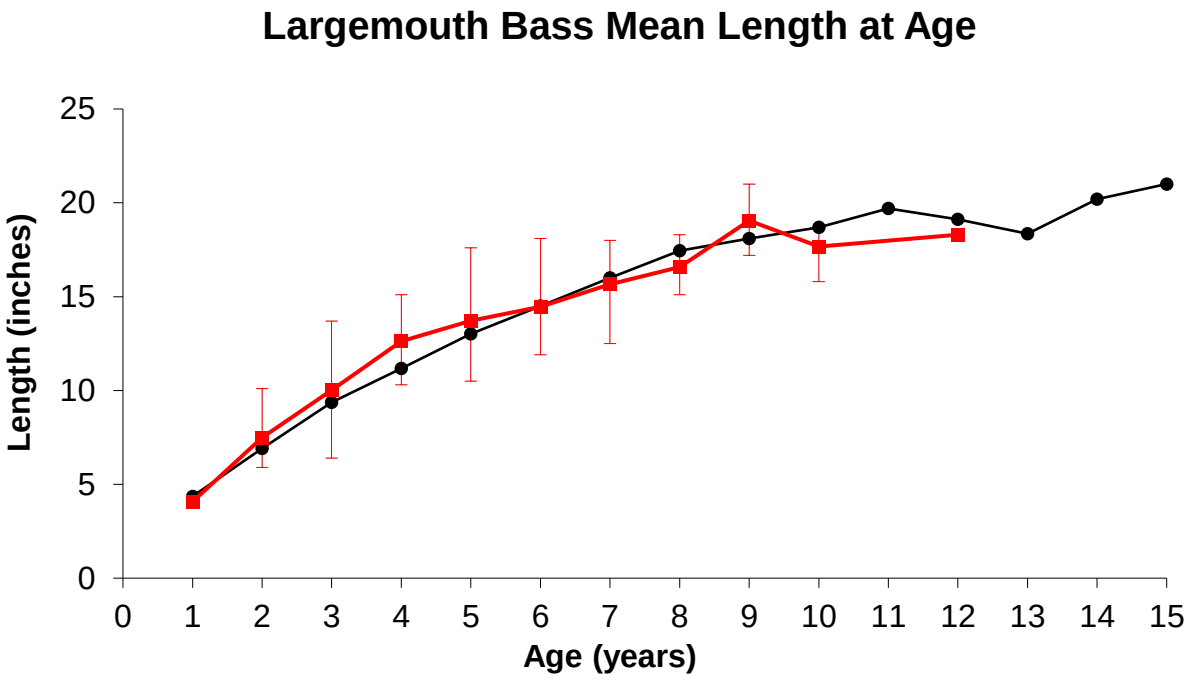


Figure 12. Largemouth Bass growth rates in comparison to statewide averages. Twin Valley Lake values are shown in red with error bars, statewide averages are shown in black.

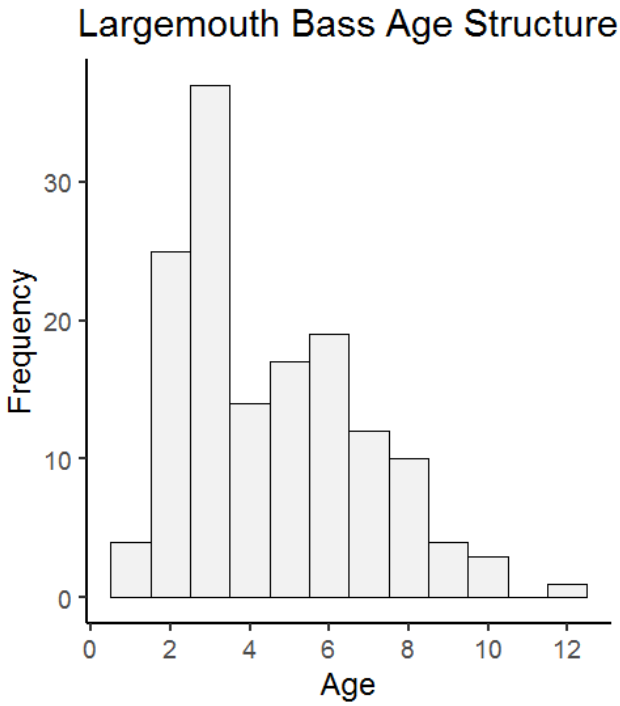


Figure 13. Age structure of all Largemouth Bass collected during spring sampling in Twin Valley Lake. Lengths from aged fish were extrapolated and applied to unaged fish using age-length keys.

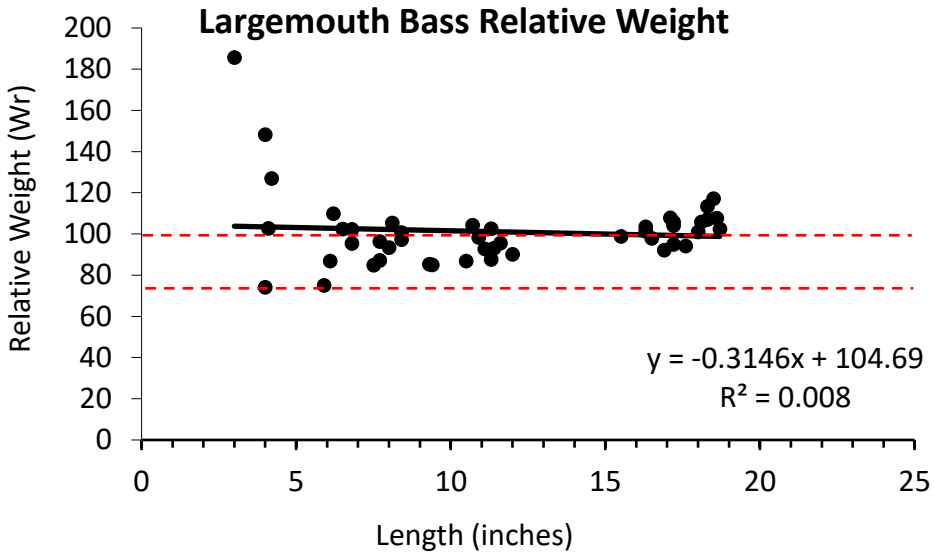


Figure 14. Relative weights of all Largemouth Bass sampled during spring electrofishing surveys. Fish between 75 and 100 (designated by red dashed lines) are considered within the normal range.

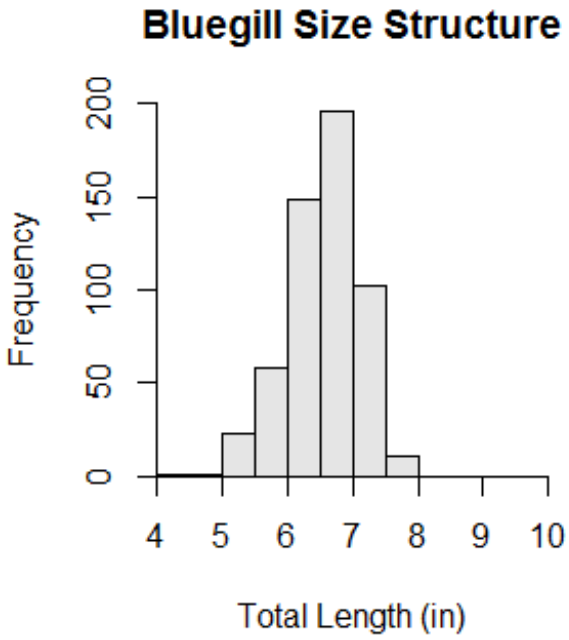


Figure 15. Bluegill size structure from individual fish captured during spring electrofishing surveys.

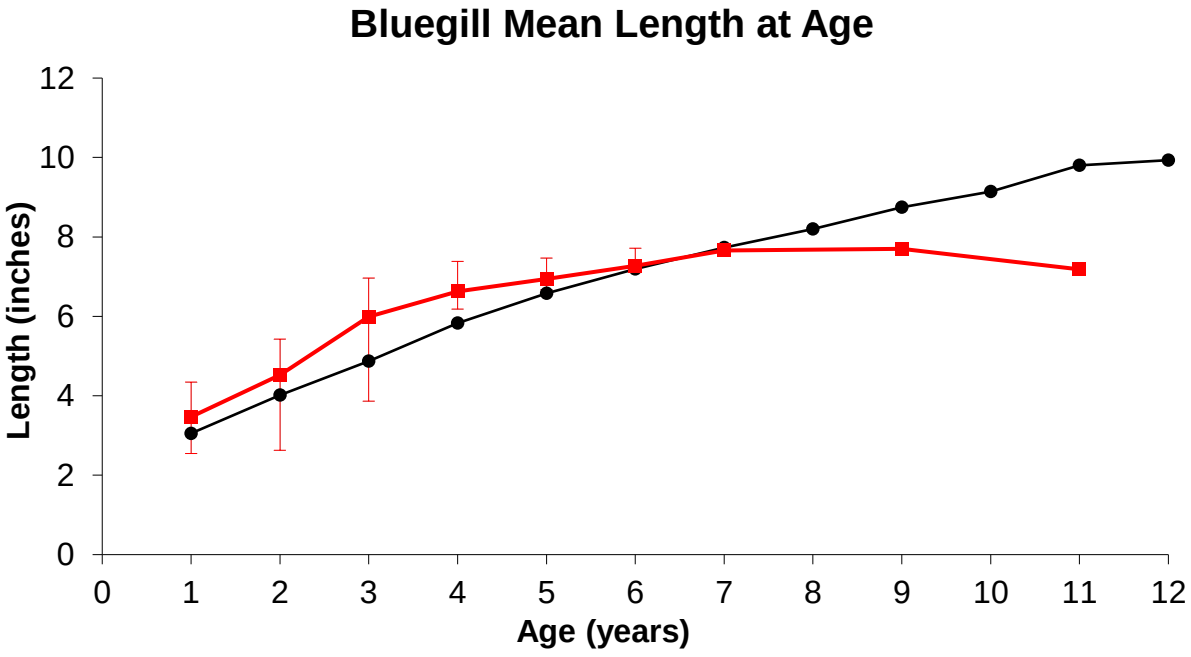


Figure 16. Bluegill growth rates in comparison to statewide averages. Twin Valley Lake values are shown in red with error bars, statewide averages are shown in black.

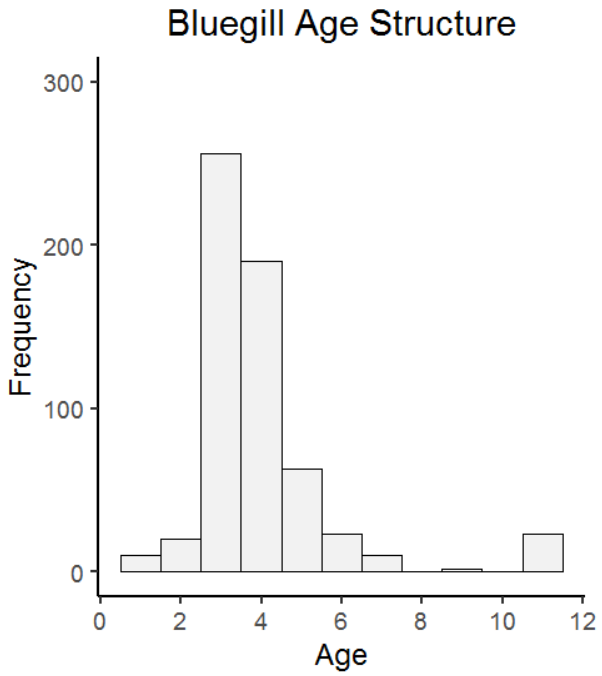


Figure 17. Age structure of all Bluegill collected during spring electrofishing in Twin Valley Lake. Lengths from aged fish were extrapolated and applied to unaged fish using age-length keys.

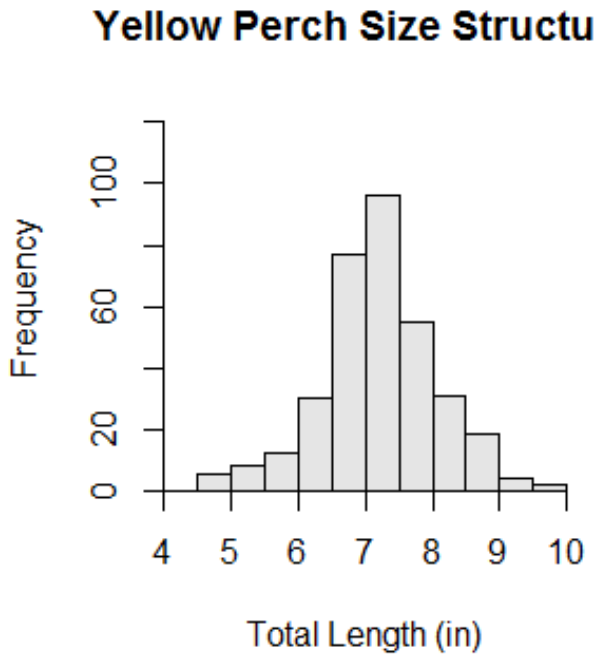


Figure 18. Yellow Perch size structure from individual fish captured during spring fyke netting surveys.

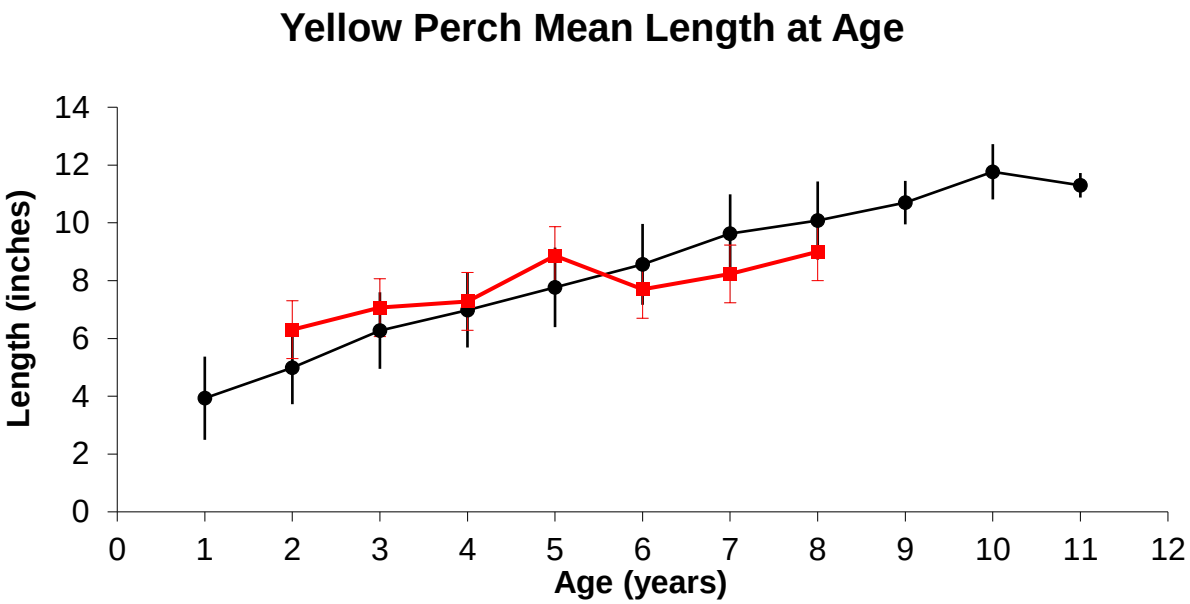


Figure 19. Yellow Perch growth rates in comparison to statewide averages. Twin Valley Lake values are shown in red with error bars, statewide averages are shown in black.

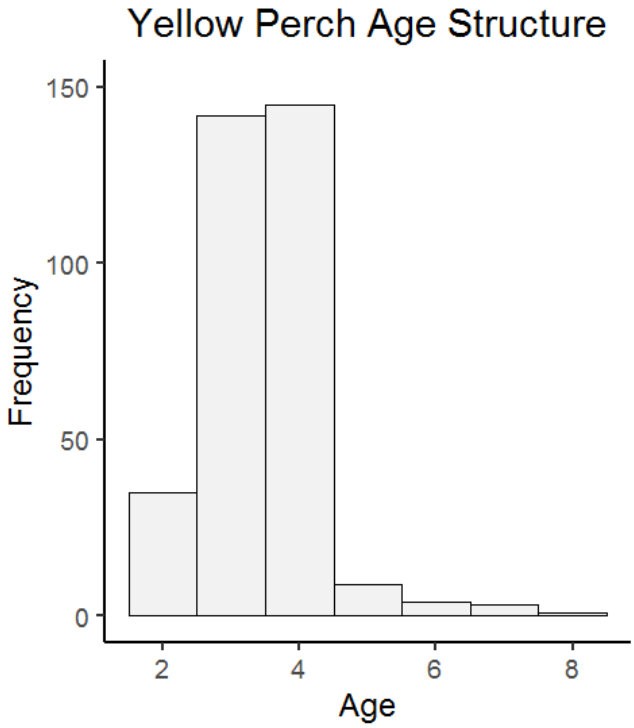


Figure 20. Age structure of all Yellow Perch collected during spring sampling in Twin Valley Lake. Lengths from aged fish were extrapolated and applied to unaged fish using age-length keys.

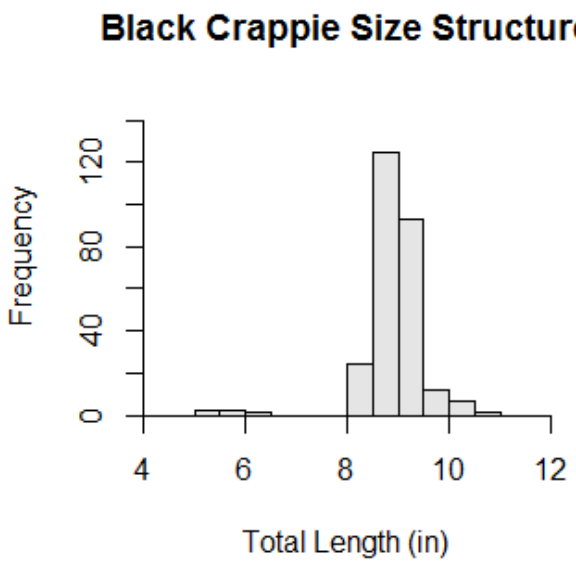


Figure 21. Black Crappie size structure from all individual fish captured during spring netting and electrofishing surveys.

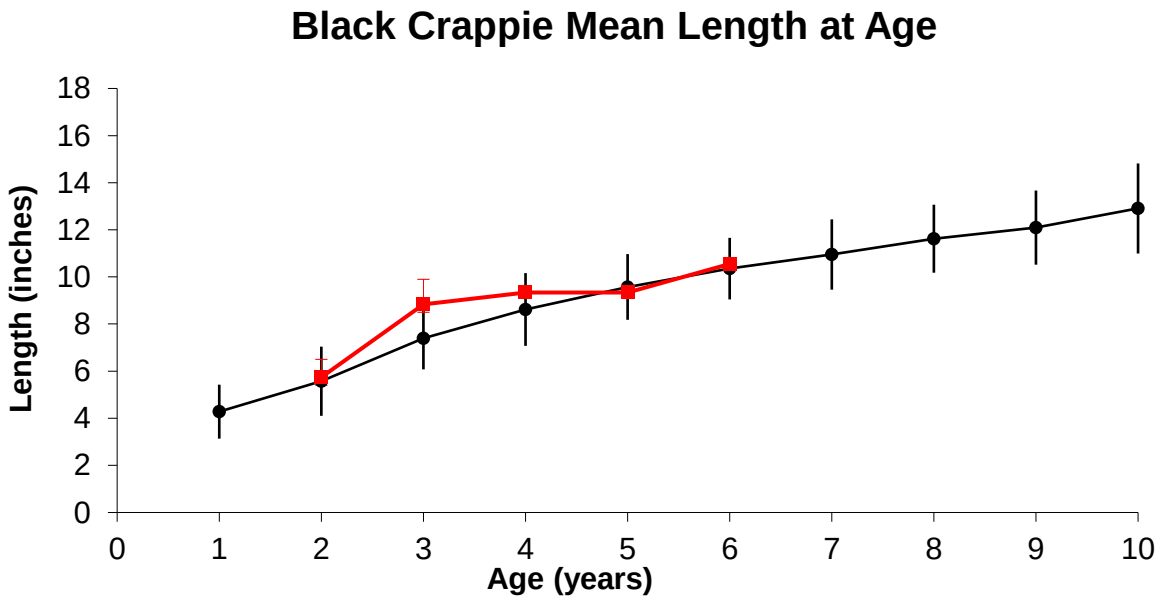


Figure 22. Black Crappie growth rates in comparison to statewide averages. Twin Valley Lake values are shown in red with error bars, statewide averages are shown in black.

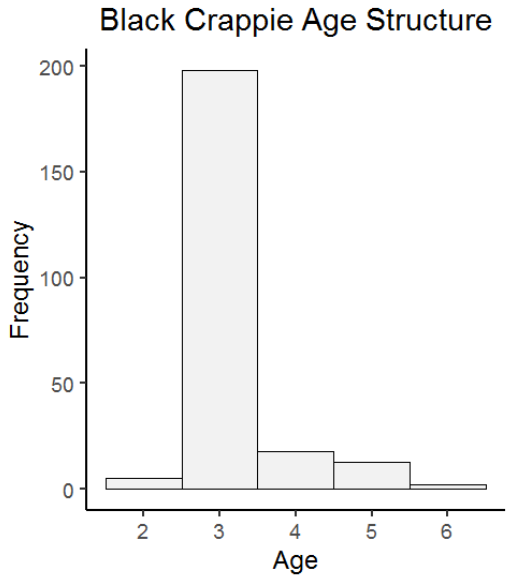


Figure 23. Age structure of all Black Crappie collected during spring sampling in Twin Valley Lake. Lengths from aged fish were extrapolated and applied to unaged fish using age-length keys.

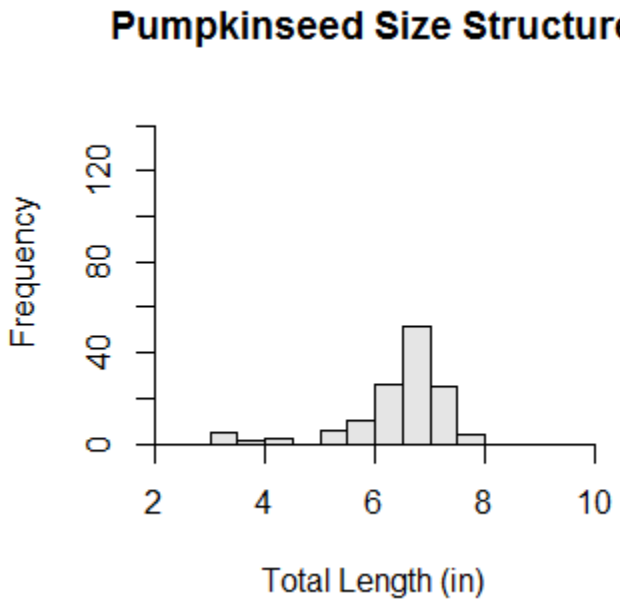


Figure 24. Pumpkinseed size structure from all individual fish captured during spring netting and electrofishing surveys.

Table 1. Current hook and line fishing regulations for gamefish and panfish on Twin Valley Lake.

| Species | Open Season | Daily Limit | Minimum Length |
|---|---|---|---|
| Largemouth Bass | May 5 - March 3 | 5 | 15 inches |
| Panfish | Open All Year | 25 | None |
| Muskellunge | May 5 - March 3 | 1 | 40 inches |
| Walleye, Saugers or Hybrids | May 5 - March 3 | 3 | 18 inches |

Table 2. Fish stocking records for Twin Valley Lake, Iowa County, Wisconsin since 2010.

| Year | Species | Strain (Stock) | Age Class | Number Fish Stocked |
|---|---|---|---|---|
| 2010 | LARGEMOUTH BASS | UNSPECIFIED | LARGE FINGERLING | 820 |
| 2010 | WALLEYE | UNSPECIFIED | LARGE FINGERLING | 1530 |
| 2010 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 150 |
| 2011 | WALLEYE | MISSISSIPPI HEADWATERS | LARGE FINGERLING | 1520 |
| 2011 | WALLEYE | ROCK-FOX | FRY | 94400 |
| 2011 | LARGEMOUTH BASS | UNSPECIFIED | LARGE FINGERLING | 3800 |
| 2011 | MUSKELLUNGE | UPPER CHIPPEWA RIVER | LARGE FINGERLING | 150 |
| 2012 | LARGEMOUTH BASS | UNSPECIFIED | LARGE FINGERLING | 3800 |
| 2012 | LARGEMOUTH BASS | UNSPECIFIED | LARGE FINGERLING | 11000 |
| 2012 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 150 |
| 2013 | LARGEMOUTH BASS | UNSPECIFIED | LARGE FINGERLING | 5947 |
| 2013 | WALLEYE | UNSPECIFIED | LARGE FINGERLING | 1520 |
| 2013 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 79 |
| 2013 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 79 |
| 2014 | LARGEMOUTH BASS | UNSPECIFIED | LARGE FINGERLING | 3795 |
| 2014 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 73 |
| 2014 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 75 |
| 2015 | WALLEYE | MISSISSIPPI HEADWATERS | LARGE FINGERLING | 1359 |
| 2015 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 73 |
| 2015 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 75 |
| 2016 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 49 |
| 2016 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 10 |
| 2016 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 69 |
| 2016 | MUSKELLUNGE | UPPER WISCONSIN RIVER | LARGE FINGERLING | 23 |
| 2017 | WALLEYE | MISSISSIPPI HEADWATERS | LARGE FINGERLING | 1359 |
| 2018 | MUSKELLUNGE | UNSPECIFIED | LARGE FINGERLING | 97 |
| 2019 | WALLEYE | MISSISSIPPI HEADWATERS | LARGE FINGERLING | 1359 |

Table 3. Summary of catch rates for gamefish and panfish sampled during spring and fall surveys.

| | Black Crappie | Bluegill | Largemouth Bass | Muskellunge | Pumpkinseed | Walleye | Yellow Perch |
|---|---|---|---|---|---|---|---|
| **Total Catch** | | | | | | | |
| SN1 | 240 | 706 | 42 | 71 | 123 | 452 | 339 |
| SE1 | | | 88 | 20 | | 236 | |
| SE2 | 28 | 755 | 460 | | 10 | | |
| FE | | | 318 | 5 | | 56 | |

| | Black Crappie | Bluegill | Largemouth Bass | Muskellunge | Pumpkinseed | Walleye | Yellow Perch |
|---|---|---|---|---|---|---|---|
| **CPUE** | | | | | | | |
| SN1 (number/net night) | 1.76 | 5.19 | 0.31 | 0.52 | 0.9 | 3.32 | 2.49 |
| SE1 (number/mile) | | | 17.6 | 4 | | 47.2 | |
| SE2 (number/mile) | 28 | 755 | 99.35 | | 10 | | |
| FE (number/mile) | | | 59.66 | 0.94 | | 10.51 | |