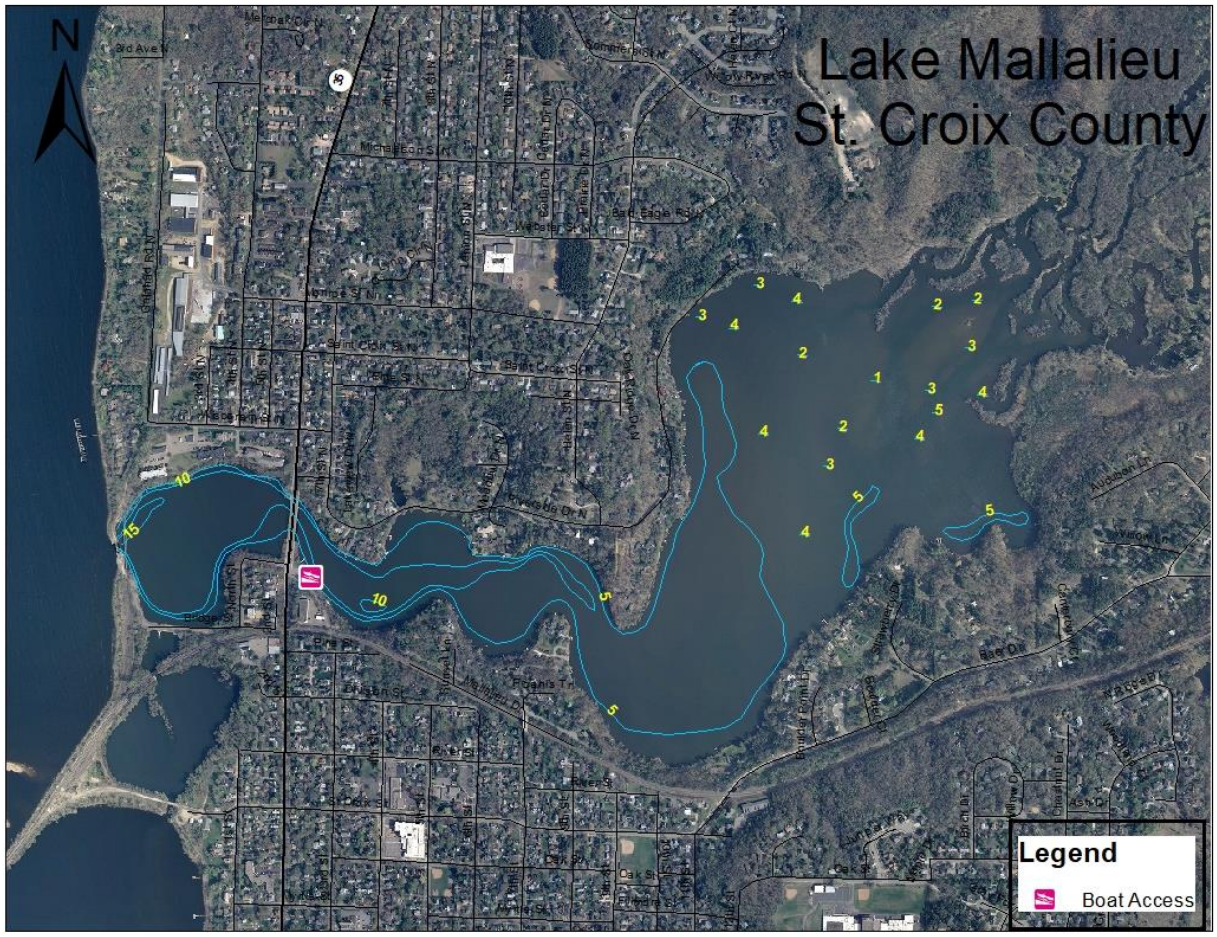
WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Fisheries Survey Report for Lake Mallalieu, St. Croix County, 2021

WATERBODY IDENTIFICATION CODE 2607100



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Introduction

Lake Mallalieu is a 270 acre flowage on the Willow River dividing the cities of Hudson and North Hudson and is the downstream-most impoundment on the Willow River. The flowage discharges directly into the St. Croix River. Lake Mallalieu is hyper-eutrophic with poor water quality due to high phosphorus levels, high algal concentrations, and poor water clarity. The lake has been on the 303(d) impaired waters list since 2004. It has approximately 5 miles of shoreline with a mean depth of 5 feet and a maximum depth of 17 feet. The primary land use in the watershed is urban/residential, agriculture and woodlands. Aquatic invasive species found in Mallalieu include rusty crayfish (*Orconectes rusticus*), Eurasian water milfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*). A public boat landing is located on the southwest side of the lake.

Lake Mallalieu is classified as a Simple Riverine lake in Wisconsin's lakes classification system, which compares lakes with similar lakes in terms of trophic status, thermal regime and fish community. Historically, the lake consisted of a notable Largemouth *Micropterus salmoides* and Smallmouth Bass *Micropterus dolomieu* fishery with a low density panfish fishery. These species remain as the dominant species today. Walleye were stocked experimentally in the lake in the 1940s and 50s and stocking was unsuccessful. High densities of Common Carp *Cyprinus carpio* are of concern to the lake district and other users of the lake. Lowering lake levels to desiccate carp spawn and contracting with commercial fishermen to remove carp has been unsuccessful in the past and are no longer recommended.

Methods

SURVEY EFFORT

Lake Mallalieu was surveyed in the spring of 2021 using boat electrofishing gear to assess the current status of the fish community. After water temperature reached 55° F, a night of electrofishing (SEII) was conducted to target bass and panfish species. The entire shoreline was divided into three stations that were approximately 2 miles in length each with 1 short station at 0.65 miles for a total of 4.65 miles surveyed. Within each of these 2.0 mile stations, a ½ mile substation was sampled for all fish species. All Common Carp observed during these substations were counted to obtain relative abundance estimates. Only gamefish species were captured within the remaining 1.5 mile stations. Spring electrofishing was conducted with a pulsed DC miniboom shocker with two booms and one dip netter.

All gamefish were counted and measured and a subsample of 5 per each ½ inch length group of both sexes (if possible) were weighed and aging structures were removed for age analysis in the lab. Otoliths were removed from Largemouth Bass, Smallmouth Bass, Bluegill *Lepomis macrochirus*, Black Crappie *Pomoxis nigromaculatus* and Yellow Perch *Perca flavescens*.

ANALYSIS

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-14) was also calculated for Largemouth and Smallmouth Bass as a measure of the proportion of fish in the population larger than 14 inches or harvestable length.

Results

GAMEFISH

Largemouth and Smallmouth Bass are the dominant gamefish species in Lake Mallalieu and were the only species of gamefish captured in the 2021 survey other than 4 Brown Trout *Salmo trutta*. Largemouth Bass were slightly more abundant than Smallmouth Bass with catch rates (at 36.6/hour or 23.9/mile for Largemouth Bass and 31.4/hour or 20.4/mile for Smallmouth Bass. These catch rates were in the 50th percentile when compared to other Simple Riverine lakes throughout the state for Largemouth Bass and were in the 90th percentile for catch rates of Smallmouth Bass in similar lakes. Largemouth Bass ranged in length from 3.0 to 19.5 inches with a mean length of 11.0 inches (Figure 1). Size distribution of Largemouth Bass was also good with a PSD value of 51 and an RSD-14 value of 45. Condition of individual Largemouth Bass was very good with a mean Wr value of 122. Smaller, younger fish tended to be in slightly better condition with larger and older fish in slightly poorer condition. However, this was not a significant relationship and larger older fish (>15 inches) were still in very good condition with a mean Wr=116. Recruitment of Largemouth Bass was relatively strong in 2020 and 2019 with poor year classes in 2016-2018 and a missing year class in 2018 (Figure 2). Growth of Largemouth Bass was good with median length at age at or slightly higher than the statewide median length at age of Largemouth Bass in other Simple Riverine classified lakes (Figure 3).

Smallmouth Bass ranged in length from 2.0 to 19.0 inches with a mean length of 12.0 inches (Figure 4). Size distribution as indexed by PSD was also good with a PSD value of 60 and an RSD-14 value of 29. Condition of Smallmouth Bass was very good with a mean Wr value of 108. A similar insignificant relationship was observed for Smallmouth Bass condition with larger, older fish (>15.0 inches) in relatively poorer condition than younger, smaller fish. However, all fish were in good condition with very few fish having Wr values less than 95. Recruitment of Smallmouth Bass was relatively consistent within the lake with strong year classes in 2017-2019 and poorer year classes in 2015 and 2016 (Figure 5). Smallmouth Bass growth rates were comparable to the statewide growth rates with median length at age of fish for all age classes at or slightly above the statewide median (Figure 6).

No Northern Pike *Esox Lucius* were collected during the survey or observed and only 3 were surveyed in the previous 2013 survey. Brown Trout collected during the survey ranged in length from 12.5 to 20.4 inches.

PANFISH

All panfish species were in low abundance during the survey. Only 4 Bluegill were surveyed and ranged in length from 2.5 to 7.8 inches. A total of 7 Black Crappie were collected and ranged in length from 6.4 to 9.8 inches. Yellow Perch were also present in very low abundance with a total of 3 collected that ranged in length from 7.6 to 9.1 inches. Catch rates for each species were 4.0/mile, 8.0/mile and 3.0/mile for Bluegill, Black Crappie and Yellow

Perch respectively Catch rates for Bluegill were in the 5th percentile for lakes in the same lake classification. A single 7.6 inch Rock Bass *Ambloplites rupestris* was also collected. No further analysis was conducted for panfish species due to low sample sizes.

Discussion

Bass populations within Lake Mallalieu appear to have improved in regards to recruitment and abundance since the last survey in 2013 (Figure 7). Very few juvenile Largemouth or Smallmouth Bass were captured in the previous survey. The current survey identified consistent and strong recruitment of Smallmouth Bass annually in 2017-2019 and Largemouth Bass produced a strong year class in 2019. The age-1 year class was absent for Smallmouth Bass and was weak for Largemouth Bass. Recruitment is still somewhat erratic which is to be expected in flowages that are subject to flow irregularities and subsequent alteration in habitat. Invasive species including Rusty Crayfish, Eurasian Water Milfoil and Curly-Leaf Pondweed may have altered habitats as well which has direct effects on fish populations present. However, because of relatively more consistent recruitment in the more recent years, the size structure of both Largemouth and Smallmouth Bass populations was good with an adequate proportion of fish in the sample approaching trophy sizes along with several year classes of juvenile fish present indicating a more balanced fish population when compared to the previous survey. Growth rates of Bass were good and median length at age was at or above the Statewide median length at age for bass populations within the same lakes classification, indicating density dependent factors are not at play. The proportion of Smallmouth Bass larger than 14 inches experienced a decline since the previous survey from a RSD-14 of 42 in 2013 to an RSD-14 of 29 in 2021. If further declines in the size structure of fish larger than the harvestable size are documented in future fish surveys, harvest regulation changes may be needed to protect these larger fish. Length frequency analysis likely indicates higher mortality of fish in the 14-16 inch range.

While Bass populations appear to be stable and are currently in moderate to high abundances, panfish abundance has declined over the past 20 years (Figure 7). A decline in panfish populations was documented between the 2001 and 2006 surveys and Bluegill abundance has remained low since the 2013 survey. These species, along with Bass, are generally highly dependent on aquatic macrophytes and large woody debris as habitat and are likely suppressed because of a lack or degradation of littoral habitat. Poor water quality and invasive species can also limit macrophyte growth in the littoral zone and influence the species that are present. Several lake drawdowns have also occurred within Mallalieu in 1983, 1998-99 and 2004-05. Fluctuations in water level via drawdowns can have impacts on macrophyte species survival and densities. For all years surveyed for aquatic plants, Lake Mallalieu has been within the lowest quartile of lakes in the state and in the North Central Hardwoods Region for diversity and abundance of aquatic plants (Konkel 2005). High occurrence of disturbance tolerant plant species and low occurrence of disturbance intolerant plant species has resulted in poor ratings for the Aquatic Macrophyte Community Index (Konkel 2005).

Altogether, Mallalieu has undergone several major disturbances in the form of winter drawdowns, shoreline development, poor water quality, introduction of invasive species and the application of broad-spectrum chemical treatments. Aquatic plant management in the form of chemical applications can result in substantial impacts to centrarchid species because of their reliance on healthy macrophyte populations for habitat throughout their life

histories. Chemical application of 2-4-D has been shown to have negative impacts on the development of fish in the larval stages by influencing behavior and therefore reducing survival (DeQuattro and Karasov 2016; Dehnert et al. 2018; Dehnert et al. 2019). Another study in northeastern Wisconsin documented the impacts of 2-4-D treatments on fish recruitment on a whole lake scale via lethal and sublethal mechanisms (Schleppenbach et al. 2022). Therefore, poor water clarity and quality along with a history of lake disturbances has likely influenced the decline and present state of the panfishery. While Lake Mallalieu has not undergone chemical treatments in recent years, decisions to treat in the future should take fisheries concerns into account.

Future fisheries management should focus on maintaining the quality bass fishery that is present and improving habitat for bass and panfish species. Best Management Practices should be highly encouraged within the watershed to prevent nutrient and sediment runoff and erosion and subsequent loading into Lake Mallalieu to improve degraded water quality. Near shore woody habitat is limited within the lake and fish habitat projects should focus on enhancing this habitat type through installation of tree drops and fish sticks projects. Involvement of shoreline owners in buffer strip enhancement, promotion of aquatic vegetation and woody debris habitat projects is encouraged to promote the fishery and aid in the recovery of the panfishery.

References

Dehnert, G.K., M.B. Freitas, Z.A. DeQuattro, T. Barry and W.H. Karasov. 2018. Effects of Low, Subchronic Exposure of 2,4-Dichlorophenoxyacetic Acid (2,4-D) and Commercial 2,4-D Formulations on Early Life Stages of Fathead Minnows (*Pimephales promelas*). Environmental Toxicology and Chemistry, 37: 2550–2559.

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Konkel, D. 2005. Changes in the Aquatic Plant Community and the Long-Term Impact of Winter Drawdown on Eurasian Watermilfoil and the Native Plant Community Lake Mallalieu, St. Croix County 1991-2005. Wisconsin Department of Natural Resources Report.

Schleppenbach, B.T., G. Matzke, S.L. Shaw and G.G. Sass. 2022. Fish and Zooplankton Community Responses to the Cessation of Long-Term Invasive Eurasian Watermilfoil (*Myriophyllum spicatum)* Chemical Treatments in a North-Temperate, USA Lake. Fishes 7: 165.

Table 1. Number of individual species captured during an electrofishing survey of Lake Mallalieu in spring, 2021.

SPECIES	NUMBER CAUGHT	MEAN LENGTH (IN)	PERCENT ≥ 14 IN	PERCENT ≥ 18 IN
Largemouth Bass	111	10.8	30	7
Smallmouth Bass	96	12.2	30	9
Brown Trout	4	16.0	75	25
Northern Pike	0			
Bluegill	4	4.8		
Black Crappie	8	9.2		
Yellow Perch	3	8.2		
Bluntnose Minnow	150			
Common Carp	13			
Creek Chub	8			
Emerald Shiner	1			
Golden Shiner	2			
Logperch	2			
Rock Bass	1			
Silver Redhorse	2			
Spottail Shiner	18			
Trout-Perch	2			
White Sucker	212			

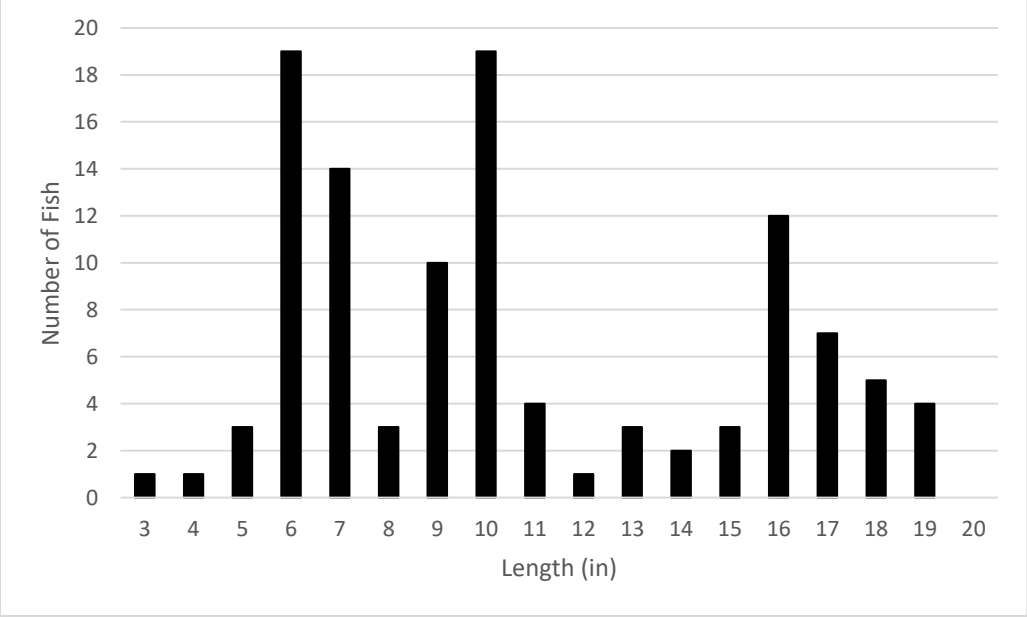

Figure 1. Length frequency distribution of Largemouth Bass collected from Lake Mallalieu in spring, 2021.

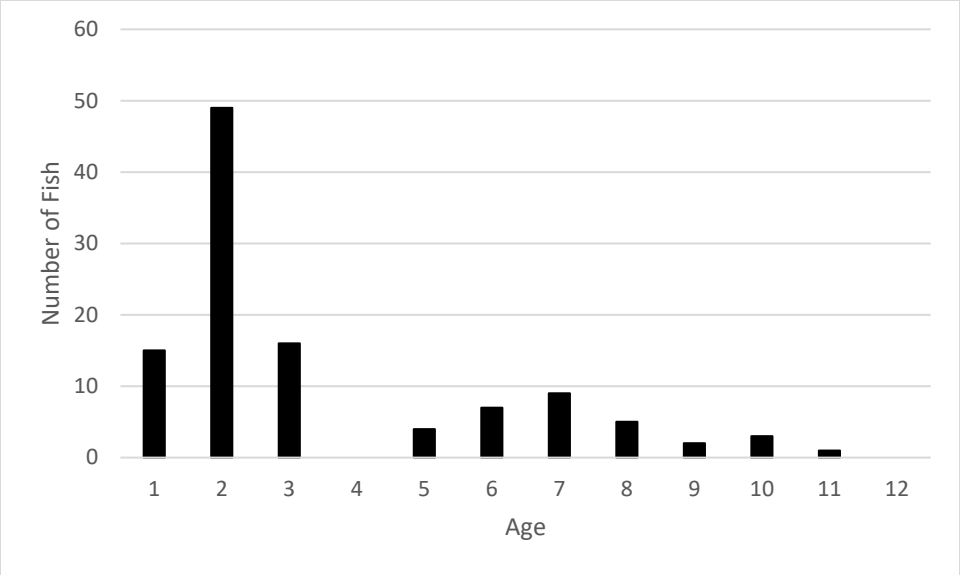

Figure 2. Age frequency distribution of Largemouth Bass collected from Lake Mallalieu in spring, 2021.

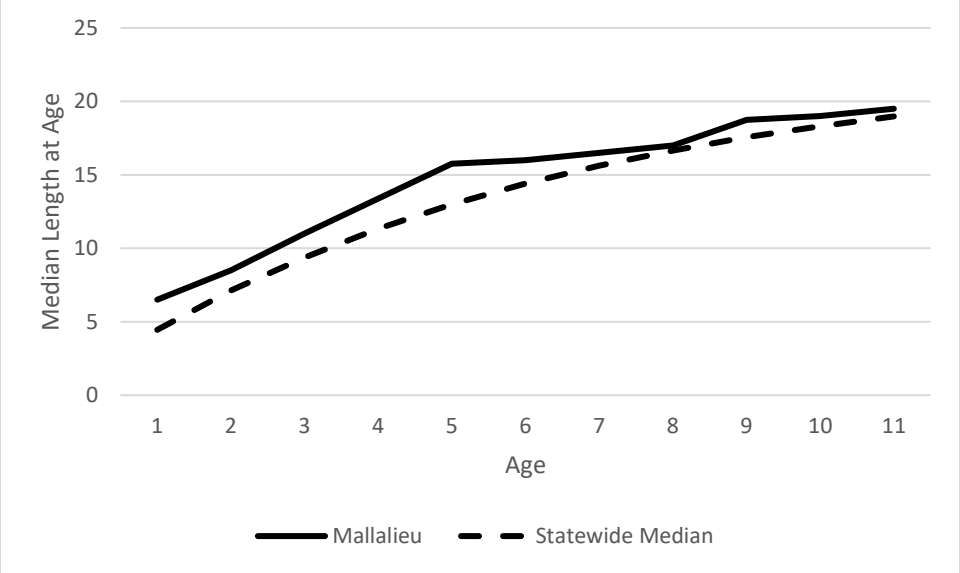

Figure 3. Median length at age of Largemouth bass collected from Lake Mallalieu in spring, 2021 and Statewide median length at age of Largemouth Bass in Simple Riverine Lakes across the state.

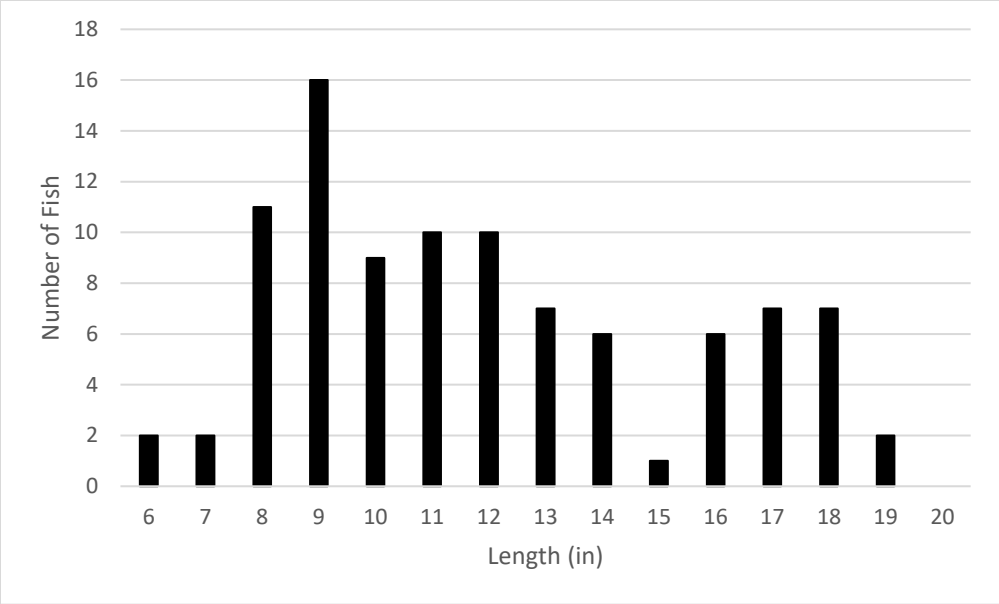

Figure 4. Length frequency distribution of Smallmouth Bass collected from Lake Mallalieu in spring, 2021.

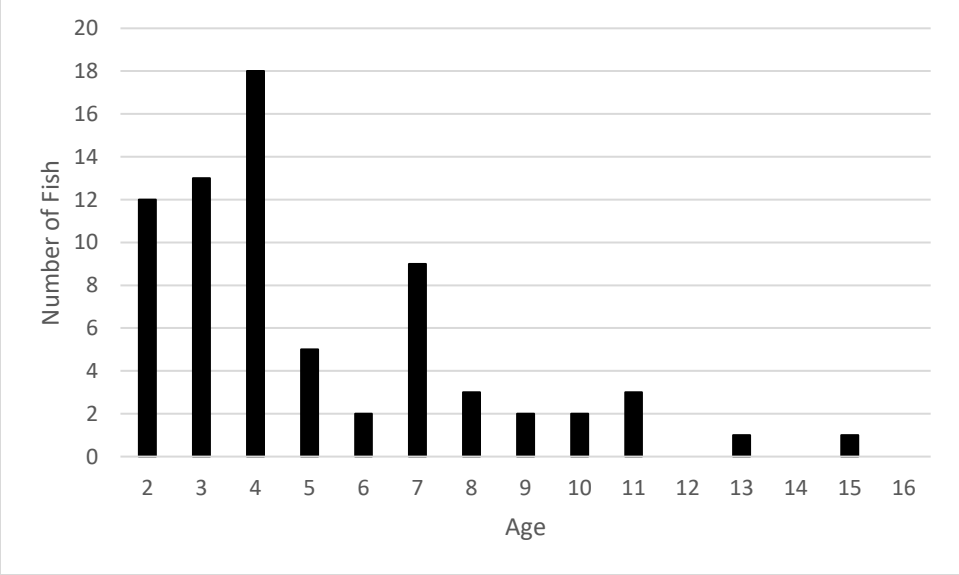

Figure 5. Age frequency distribution of Smallmouth Bass collected from Lake Mallalieu in spring, 2021.

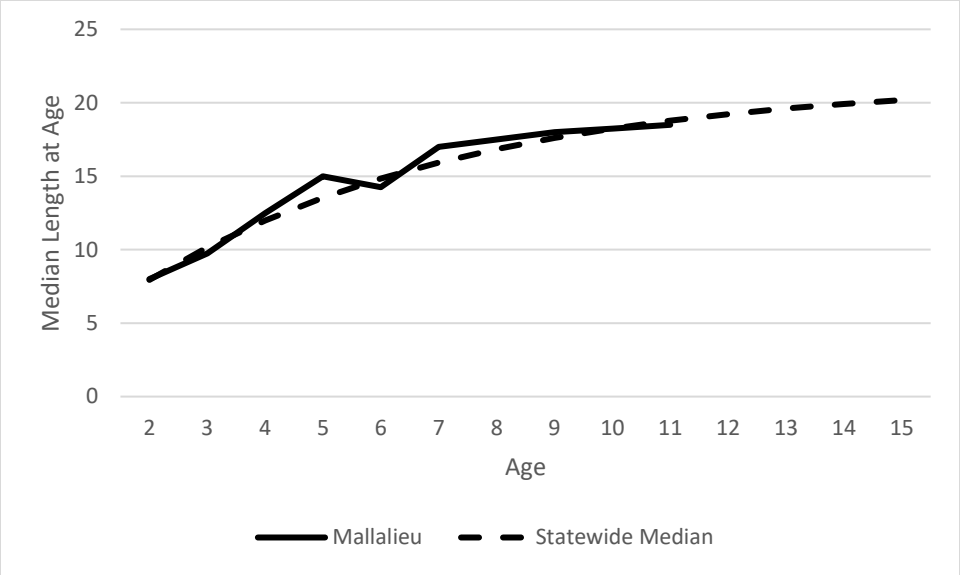

*Figure 6. Median length at age of Smallmouth bass collected from Lake Mallalieu in spring, 2021 and Statewide median length at age of Smallmouth Bass in Complex Riverine Lakes across the state. *no data was available for Simple Riverine Lakes Smallmouth Bass length at age. Therefore, Complex Riverine data was used as a substitute.*

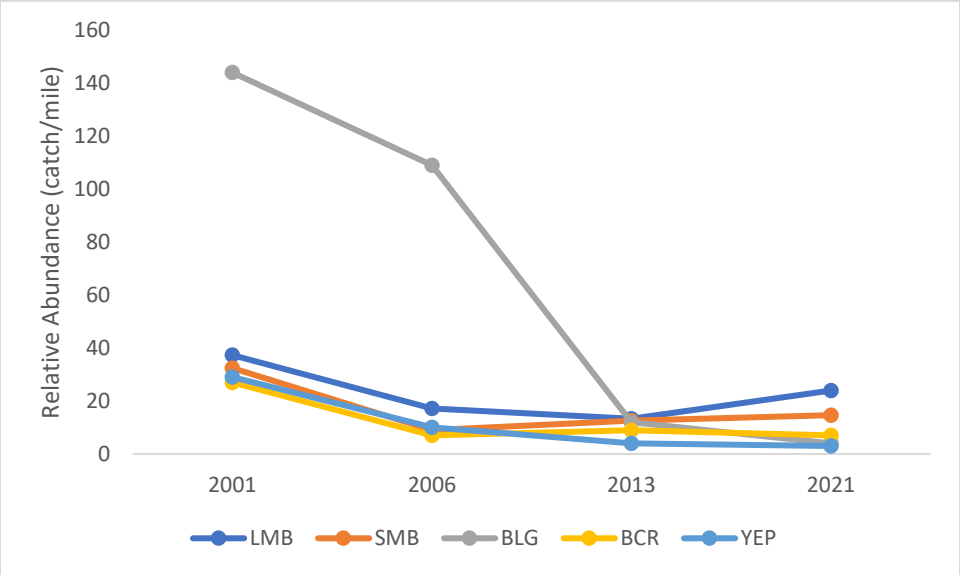

Figure 7. Relative abundance (catch/mile) of Largemouth Bass (LMB), Smallmouth Bass (SMB), Bluegill (BLG), Black Crappie (BCR) and Yellow Perch (YEP) collected in surveys since 2001.