

## **Donnell Lake**

Cass County; T6S/R14W/Sec 35 and 36  
Surveyed May 13 – 16 and August 8, 2024

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### **Environment**

Donnell Lake is a 246-acre lake located near Vandalia in Cass County (Figure 1). Donnell Lake is located in the headwaters of a tributary to Christiana Creek. The tributary originates in Lily Lake and flows southwest to Lewis Lake. Lewis Lake is connected to Donnell Lake through a short channel through wetland. The tributary exits Donnell Lake on the south shore of the western bay of the lake and flows south into Paradise Lake. Christiana Creek flows through a wetland on the west end of Paradise Lake and flows south through Painter/Juno Lakes and across the Indiana border where it flows into the Saint Joseph River. The Donnell Lake watershed is relatively small draining 2,420 acres. The land cover in the watershed is a mix of agriculture (38%), forest (28%), wetland (17%) and urban (15%) with small amounts of water (1%) and grassland (<1%; Figure 2). The surficial geology of the watershed is primarily glacial outwash sand and gravel and post glacial alluvium with ice contact outwash sand and gravel in the upper watershed. Donnell Lake has a main basin to the east and a narrow secondary basin to the west (Figure 3). The eastern basin is the deepest reaching 63 feet in depth and the western basin reaches 40 feet. The basins are separated by a point reaching north from the southern shore and a Michigan Department of Natural Resources (DNR) boating access site is located on the point. The substrate is primarily marl with some sand. The shoreline drops off relatively quickly with limited littoral habitat. There is an island in the eastern basin, and a shoal located between the island and the east shoreline of the lake. Donnell Lake supports a typical warmwater fishery including Bluegill, Largemouth Bass, and Northern Pike. Cisco were also historically present in Donnell Lake. Walleye have been introduced through stocking providing additional fishing opportunities.

### **Fishery Resource**

#### **History**

The first record of fisheries surveys on Donnell Lake was a gill net survey performed by the Michigan Fish Commission in 1887. Lake Whitefish had been stocked a single time in 1877 (Table 1). The survey did not find any Lake Whitefish, but it did document the presence of Ciscos with above average growth rates. Smallmouth Bass and Yellow Perch were additional species caught. Large quantities of shiners were observed and the fish were reported as “well fed”. Warmwater fish were periodically stocked from 1933 through 1945. This included stocking of Largemouth Bass, Bluegill, and Yellow Perch. The stocking of these warmwater species in lakes was discontinued in Michigan after research documented stocking was not required to maintain fisheries (Cooper 1948). Walleye stocking was recommended in the future. Donnell Lake was mapped for depth in 1947. The substrate was reported as primarily marl, and the maximum depth was reported as 63 feet. Fishing was reported as popular on the lake in summer with good catches of Bluegill, bass, and Northern Pike and the winter fishery focused on Black Crappie and Yellow Perch.

A partial fish survey was conducted on May 21, 1954. The gear used and details of the survey were not reported. Species observed were Northern Pike, Yellow Perch, Black Crappie, Largemouth Bass, Bluegill and Rock Bass. Brook Silversides were documented as the dominant forage fish and the

presence of gar, Bowfin, and Common Carp was noted. Growth rates for Bluegill were well above average (index score +2.4). Fishing was reported to range from poor to good and black spot (small harmless parasite) was noted on Yellow Perch.

The first intensive survey of Donnell Lake was conducted in 1956. A total of 22 gill net sets were conducted from Sept 4-7, 1956. A limnology profile was collected on September 5, 1956. The water surface was 76 degrees F and dropped to 68 degrees F at 20 feet. The water column was oxygenated down to 25 feet where it dropped below 3 ppm. Latta (1995) reported that Ciscoes require water temperatures of 68 F or lower and dissolved oxygen concentrations of at least 3 ppm. Using these standards, only 5 feet of cool oxygenated water was present for Ciscoes. No Ciscoes were captured during the survey. A total of 169 fish were captured in the gill nets representing a typical warmwater fishery. Yellow Perch was the most common species collected (n = 65) ranging from 5.8 to 12.2 inches. A total of 19 Bluegill were caught ranging from 4.9 to 9.3 inches. Only 12 Largemouth Bass were captured and they were small ranging from 7.4 to 11.4 inches. Longnose Gar (n = 11) were caught with the largest being 42.5 inches. Other species included Northern Pike, Smallmouth Bass, Warmouth, Green Sunfish, Pumpkinseed, Black Crappie, White Sucker, Lake Chubsucker, Brown Bullhead, Yellow Bullhead, Bowfin and Golden Shiner. The seine haul documented an abundance of different prey species. Brook Silverside (n = 106) and Bluntnose Minnow (n = 106) were the most common minnows with Blacknose Shiner, Blackchin Shiner, Johnny Darter, Iowa Darter, Blackstripe Topminnow, and Tadpole Madtom present in lower numbers. Game fish were determined to be growing well. It was also noted that fishing had been reported as poor despite the survey data showing that strong game fish populations were present. Anglers reported particularly poor fishing in summer months.

Walleye were first stocked as fry in 1975 (n = 500,000) and spring fingerlings in 1976 (n = 50,000). A fall electrofishing survey was conducted on October 21, 1975 (2 hours of effort) to evaluate the success of the stocking. No Walleye were captured in the survey. Bluegill were common (n = 362) with good numbers of 6- to 8-inch fish (n = 115) and some large 8- to 10-inch fish (n = 16) captured. Bluegill growth rates were above average. A total of 180 Largemouth Bass were captured that were mostly small with 97% being between 4 and 12 inches and only two fish over 14 inches. Despite the small size structure, growth rates were above average. A total of 110 Yellow Perch were captured that were small with most fish ranging from 2 to 8 inches with only one 10-inch and one 12-inch fish caught. Green Sunfish and Rock Bass were two of the most prevalent species caught with 158 and 99 being captured respectively. Six Northern Pike were collected that averaged 18.8 inches in length. Other species present in low numbers included Pumpkinseed, Black Crappie, bullhead (spp), Lake Chubsucker, Grass Pickerel, Bowfin, and White Sucker. Forage species were prevalent with Brook Silverside and Bluntnose Minnow reported as abundant and Logperch, Common Shiner, and Golden Shiner reported as common. The fishery was reported to be in good balance. It was noted that large fish were scarce for some species, but growth was above average.

Another Walleye stocking evaluation was conducted using spring electrofishing on May 17, 1978. The entire shoreline was surveyed, and no Walleye were caught. Data for other fish species was not collected.

A limnology profile was collected on August 22, 1985. Water temperature was 72 degrees F at the surface down to 15 feet. Temperature dropped below 68 degrees between 18 and 21 feet and the water column remained oxygenated (>3ppm) down to 30 feet.

The first comprehensive fish community survey on Donnell Lake was conducted in 1992 (Dexter 1996). The survey was completed on June 1-3, and June 30, 1992. The survey involved four trap nets,

four experimental gill nets, and two mini fyke nets all set for two nights each (June 1-3). An electrofishing survey was conducted on the shoreline (1 hour of effort) on June 30, 1992. Vegetation observed in the survey was reported as sparse with primarily Chara present. Bluegill catch rates were high with 1,790 being caught. These fish ranged from 2 to 10 inches and averaged 5.8 inches. Ten age classes were captured and recruitment of older age classes was reported as inconsistent. Despite large Bluegill being present in good numbers, size structure was rated as average in trap nets and poor/average in electrofishing by the Schneider index (described in Methods section). Largemouth Bass were extremely abundant (n = 351) but averaged only 6.3 inches with only 5% of fish being over 12 inches. Yellow Perch were captured from seven age classes with good recruitment. Their growth was reported as above average with fish up to 12 inches present. Fourteen Northern Pike were caught with good recruitment reported. Over 60% of the fish caught were of legal size for harvest (>24 inches). The fish community was reported as producing a quality fishing experience. Management objectives were to continue managing Donnell Lake as a quality warmwater fishery. The report noted that ground and surface water quality were continuing concerns that needed to be addressed by following a developed watershed management plan. Water quality issues documented include manure runoff from farm fields, the high intensity of pig production, and contamination from septic system releases. Shoreline development and increased boat traffic also were identified as major threats to the lake ecosystem.

A limnology profile was performed on September 4, 1992, as part of the fish survey. The summer of 1992 was unusually cold due to the Mount Pinatubo eruption. The temperature in Donnell Lake was at or below 68 F throughout the entire water column. Oxygen dropped below 3 ppm at 23 feet. Thus, Cisco habitat was present from the surface to 23 feet. Despite habitat being present during this survey, no Ciscoes were captured. The population was reported as possibly being extirpated, as suggested in a review by Latta (1995). Management recommendations included that a fall survey be conducted to target Ciscoes to determine if they were still present in Donnell Lake.

Recent survey efforts have focused on the Cisco population. A limnological profile was conducted on Donnell Lake on August 31, 2016, to determine if water quality in Donnell Lake could still support Ciscoes (Diana 2017). The water in Donnell Lake was below 68 degrees at 22 feet of depth and dissolved oxygen was 3.04 ppm. Dissolved oxygen dropped to below 3 ppm at 23 feet resulting in a 1-foot layer of very marginal habitat for Ciscoes during late summer. This layer was extremely thin and the dissolved oxygen concentration was barely above the critical minimum. It was determined that the Cisco population may not be supported or are at least limited by available habitat.

Gill netting surveys were conducted for two nights on November 27 and 28, 2017 targeting Ciscoes (Diana 2017). Five experimental gill nets were set on the first night and seven on the second for a total of 12 net nights. A total of 29 fish were captured from ten different species. Northern Pike were caught in the highest number with 12 total fish that averaged 21 inches and ranged from 10 to 35 inches. No Ciscoes were collected during the gill netting survey. Due to the marginal water quality measurements, limited Cisco habitat, and repeated surveys with no Cisco captures, it was determined that it is unlikely that Ciscoes remain in Donnell Lake.

Limnological sampling was conducted again on Donnell Lake on August 31, 2023 (Gunderman 2023). The water temperature did not drop to 68 F until 21 feet, and the dissolved oxygen concentration at this depth was 2.4 ppm. No depths had suitable water temperatures and dissolved oxygen concentrations for Ciscoes. This survey provided further evidence that Ciscoes are likely extirpated from Donnell Lake.

The Donnell Lake Conservation Club has raised funds for periodic stocking of fish in recent years. Yellow Perch were stocked in 2008 and 2022 to supplement the population and Walleye were stocked in 2017 and 2021 to create a fishery. There has been documentation of leach parasites in Largemouth Bass mouths, bacterial infection outbreaks in Largemouth Bass, and small-scale winter fish kills on Donnell Lake. These are common occurrences in fish populations in Michigan lakes. Chemical treatment of vegetation is conducted on Donnell Lake primarily targeting invasive species. Eurasian Watermilfoil and Starry Stonewort are present and treatment is targeted at controlling these species (and to a lesser extent Curlyleaf Pondweed). Hybrid strains of milfoil have been documented in Donnell Lake, which complicates targeted treatment as these hybrids often are more resistant to herbicides than pure Eurasian Watermilfoil.

### Current Status of the Fish Community

#### *Methods*

Donnell Lake was surveyed in 2024 as a DNR discretionary survey. Methods followed those of the DNR Status and Trends program (Wehrly et al. In Revision). Netting efforts took place during May 13-16, 2024. Two gill net sets were conducted overnight for one night for a total of two net nights. Three large-mesh fyke nets were set for three overnight sets for a total of nine net nights. Two small-mesh fyke nets were set for two nights for a total of 4 net nights. Four 25-foot seine hauls were conducted to enumerate minnow and prey species. Three 10-minute electrofishing transects were performed on May 16, 2024, for a total of 30 minutes of electrofishing. All fish were identified, counted, and measured for total length, and aging structures were collected from 10 fish in each inch class for Largemouth Bass, Smallmouth Bass, Northern Pike, Walleye, Bluegill, and Black Capping. Weights for all fish species were calculated using the length-weight regression equations compiled by Schneider et al. (2000b). Limnological sampling was conducted on August 8, 2024, and included a temperature and oxygen profile and a shoreline development and woody cover survey. Temperature and dissolved oxygen concentrations were recorded at 1-foot increments at the deepest spot in the lake.

The relative stock density for each fish species was assessed using catch per unit effort (CPUE) calculated as the number of fish caught per net night (gill, fyke, and trap nets), per hour of electrofishing (boomshocker), or per seine haul. The CPUE data from this survey were compared to a summary of CPUE data from lakes surveyed in the Status and Trends Program from 2001 through 2021 on a statewide and regional level for the Southern Lake Michigan Management Unit (SLMMU). Weighted age compositions using length and age keys for each game fish species were calculated as described by Schneider (2000b). A growth index for each age class was calculated by subtracting the state average mean length from the mean length-at-age from the 2024 Donnell Lake survey. Growth indices for age classes represented by a minimum of five fish were averaged to provide a mean index of fish growth (Schneider et al. 2000a). Growth index scores between +1 and -1 for fish other than Bluegill are considered similar to the state average while scores less than -1 and greater than +1 are considered below or above the state average, respectively. Bluegill growth index scores between +0.5 and -0.5 are considered similar to the state average while scores less than -0.5 and greater than +0.5 are considered below or above the state average, respectively. Bluegill size structure was rated using an index based on the mean length and the proportion of fish >6 inches, >7 inches, and >8 inches collected using specific gear types (Schneider 2000a, Schneider 1990).

#### *Results*

A total of 1,215 fish were collected in the 2024 fish survey (Table 2). A total of 27 species were observed. Bluegill was the most abundant species (n = 436) making up 36% of the total catch by numbers. Bluegill CPUE was 11.7 fish per net night in large-mesh fyke nets and 29.3 fish per net

night in trap nets. These catch rates were below the 25<sup>th</sup> percentile for lakes surveyed in SLMMU (fyke = 22.1; trap = 30.79 fish per net night), but close to the median for statewide lakes (fyke = 13.4; trap = 21.3 fish per net night). This indicates a moderate density of fish. Bluegill ranged from 1 to 9 inches. Thirty-six percent of the Bluegill captured in large-mesh fyke and trap nets were 8 inches or larger with nine fish over 9 inches caught (Figure 4). The Schneider index ranked the Bluegill size structure from fyke/trap nets as excellent (5.8). Bluegill growth rates were above average with an index score of +0.7 (Table 3). Bluegill age 1 through age 3 had a similar mean length at age compared to statewide surveys, but older age classes were almost all over an inch longer than average in Donnell Lake (Figure 5). Pumpkinseed (n = 71), Hybrid Sunfish (n = 28), and Rock Bass (n = 23) were also collected and exhibited good size structures. Pumpkinseed were large averaging 7.7 inches. Very few Yellow Perch and Black Crappie were captured in the survey (n = 14 and 6 respectively). Yellow Perch that were captured ranged from 3 to 10 inches in length and only four of these fish were over 8 inches. The CPUE was 1.0 Yellow Perch per net night in gill nets which is below the 25<sup>th</sup> percentile of 1.6 for SLMMU and 1.5 fish per net night for statewide lakes. The CPUE of Yellow Perch in electrofishing was 22.0 fish hour of electrofishing. Which is above the 25<sup>th</sup> percentile for SLMMU (15.6 fish per net night) but below the 25<sup>th</sup> percentile for statewide surveys (24.0 fish per net night).

Largemouth Bass were the primary predators in Donnell Lake. A total of 115 Largemouth Bass were captured ranging from 2 to 16 inches. Only 6.1% of Largemouth Bass were above the 14-inch legal length limit (Figure 6). The CPUE of Largemouth Bass from electrofishing samples was 192 fish per hour. This is higher than the 75<sup>th</sup> percentile of surveys conducted on SLMMU lakes (147 fish per hour) and statewide lakes (103.2). Mean lengths at age for Largemouth Bass in Donnell Lake were similar to the statewide averages for ages 1 through 4 (Figure 7). However, mean length at age dropped below the statewide average at age 5 and fish did not reach the legal size limit until age 7. This growth pattern resulted in an abundance of fish centered around 12 inches in length. A total of 73% of Largemouth Bass caught were age 4 and 5, which averaged 11.9 and 12.3 inches respectively. Four Smallmouth Bass were captured in the survey that ranged from 3 to 15 inches.

A total of nine Northern Pike were captured. These fish ranged from 20 to 37 inches. Eight of these fish (89%) were over the 24-inch legal size limit. A total of 44% of Northern Pike caught were 35 inches or larger. In late spring or summer, Northern Pike are best surveyed using gill nets. The CPUE of Northern Pike in gill nets was 3 fish per net night. This catch rate is close to the median for SLMMU and statewide lakes (2.5 fish per net night for both). Insufficient numbers of Northern Pike were collected to calculate a growth index score. The fish that were collected ranged from age 3 to age 10 representing six age classes (missing age 5 and 6). The individuals captured were larger than the statewide average for most year classes. The limited growth data, coupled with the large size of fish in the 2024 sample, suggests that Donnell Lake pike are likely experiencing above average growth rates.

A total of 9 Walleye from past stocking efforts were captured. These fish ranged from 16 to 24 inches. One Walleye was from the 2021 year class, and the remainder were age 7 fish that originated from the 2017 fall fingerling stocking conducted by the Donnell Lake Conservation Club. The 2017 year class averaged 22.5 inches in 2024 which is 1.9 inches larger than the statewide average of 20.6 inches.

Several minnow and other prey species were captured in the 2024 fish survey on Donnell Lake. Blacknose Shiner (n = 78), Blackchin Shiner (n = 71), Brook Silverside (n = 41), and Bluntnose Minnow (n = 41) were the most common species. Minnows are abundant in the system and likely contribute to predator growth rates. Predators made up 64% of the total biomass captured in the survey. This percentage is above the range of 20-50% recommended by Schneider (2000a). Largemouth Bass, Northern Pike, Walleye, and Smallmouth Bass were the sport fish predators present and composed 39% of the biomass. Longnose Gar (n = 30), Spotted Gar (n = 8), and Bowfin (n = 5)

are native non-game predators that made up 25% of the biomass. The Longnose Gar were large averaging 31 inches and ranging from 14 – 37 inches. Bowfin were also large, ranging from 20 – 26 inches.

A limnology survey was completed on August 8, 2024 at the deepest point on Donnell Lake. The surface temperature was 78.7 degrees F and remained near this temperature to 15 feet of depth (Figure 8). Temperature dropped to below 68 degrees F at 21 feet. The water column was oxygenated from the surface down to 22 feet where it dropped below 3 ppm. This resulted in less than 1 foot of habitat for Ciscoes.

A total of 358 turtles were also captured during the DNR fisheries survey. The most common species was Map Turtle (n = 240), followed by Musk Turtle (54), Painted Turtle (23), Eastern Spiny Softshell Turtle (n = 21), and Eastern Snapping Turtle (n = 20).

### **Analysis and Discussion**

The Bluegill population in Donnell Lake has moderate density with excellent growth. As a result, size structure is excellent and larger fish are available to catch. Catch rates were low for SLMMU lakes but were close to the statewide median. Many SLMMU lakes have dense populations that struggle from low growth. The reduced density likely allows for the good growth observed as competition for resources is not high. Catch rates may have also been reduced because of netting efficiency due to the steep drop-offs in Donnell Lake. Trap and fyke nets were observed to have numerous large Bluegill and sunfish in the throats of the traps. These fish are not included in the catch for the gear. The steepness of the drop off may have reduced the efficiency of the gear by limiting passage from the throat to the pot of the net. Regardless, catch rates were not low enough to be a concern and resulted in good growth of older fish. Growth rates were average for young fish and were consistent to age 5. Bluegill growth in most Michigan populations decreases when fish mature, resulting in reduced growth rate starting at age 3 or 4. When big fish are present in a population, Bluegill mature at an older age resulting in more energy being allocated to growing larger in size (Drake et al. 1997; Jennings et al. 1997; Hoxmeier et al. 2009). Larger fish are present in Donnell Lake and may cause a delay in maturation. Fish were not collected and dissected to confirm maturation status in the 2024 survey. Another cause for high growth through older age classes could be an abundance of prey. Past surveys noted the abundance of swimming mayflies and wigglers at Donnell Lake providing excellent prey resources for Bluegill and other sunfish. Anglers report large mayfly hatches on Donnell Lake and observe Bluegill feeding extensively on the hatch.

Yellow Perch and Black Crappie were not captured in significant numbers in the 2024 fish survey on Donnell Lake. These species are not targeted well by May surveys, but we would expect higher catch rates if there was significant contribution to the fishery. Past surveys note an abundance of catchable-sized Yellow Perch. Yellow Perch are generally targeted by gill nets and total catch was influenced by the decision to discontinue gill nets sets to limit Northern Pike mortality. The Yellow Perch that were captured were acceptable size for harvest. It is difficult to determine if private stocking has enhanced the fishery but numbers of Yellow Perch were low. Walleye and Northern Pike are likely preying heavily on Yellow Perch as well documented throughout their range. Northern Pike feed extensively on Yellow Perch in systems where they cohabit (Diana 1979; Frost 1954) and have been shown to selectively feed on them (Frost 1954). Walleye prey heavily on Yellow Perch and as a result their populations are often coupled (Forney 1980, Post & Rudstam 1992). When Walleye and Northern Pike are both present, Northern Pike will feed on larger Yellow Perch while Walleye focus on smaller

sizes (Forney 1977). The abundance of these predators likely depress the Yellow Perch population in Donnell Lake.

Fisheries surveys have repeatedly indicated that the Largemouth Bass populations have always exhibited small size structure in Donnell Lake. The 2024 fish survey documented similar reduced size structure. Very few fish over 14 inches were present. Fish did not reach the 14-inch size limit until they were 7 years old and no fish older than age 7 were observed. High abundance of Largemouth Bass could result in low growth due to competition for resources, especially for abundant younger age classes. However, growth of young fish was average indicating this competition is likely not limiting long-term growth. Minnow resources are abundant in Donnell Lake and likely provide adequate prey for these smaller fish. Adult Largemouth Bass may have increased competition for optimal-sized forage as larger-bodied prey were not abundant in the survey (e.g. suckers, Yellow Perch, and larger minnows). The limited number of legal-sized Largemouth Bass and the short life span could also be due to high levels of harvest. A lower minimum size limit could be utilized to allow harvest of smaller fish and potentially allow for increased growth. Slot limits also are implemented to harvest smaller-sized fish, allowing a release in competition for prey and protecting fish in the slot until they grow to a more acceptable size (Anderson 1976; Eder 1984, Wilde 1997). These regulation types could be considered to improve the size structure of Largemouth Bass in the Donnell Lake. Under the existing 14-inch minimum size limit, there are few fish available for legal harvest in Donnell Lake. Reducing the minimum size limit to 10 inches would allow for some harvest to occur and could result in increased growth of adult Largemouth Bass. Similar size limits have been implemented on Woodard Lake, Pleasant, Big Crooked (Diana 2015), Little Crooked, Stone, and Corey lakes in SLMMU and Spider and Arbutus lakes in Grand Traverse County with promising results (see Hettinger 2015a and 2015b). However, harvest regulations for Largemouth Bass are ineffective for managing size structure if exploitation is low (Wilde 1997, Allen et al. 2008). Largemouth bass are more likely released upon capture than many other species of fish and the level of catch-and-release has increased over time due to changing angler behaviors (Quinn 1996, Noble 2002, Allen et al. 2008, Myers et al. 2008, Isermann et al. 2013). Slot or reduced size limits can be particularly ineffective if anglers do not harvest smaller fish either due to catch-and-release practices or if the fish are considered too small to be utilized (Novinger 1990). This is especially problematic when implementing regulations that rely on harvest of smaller Largemouth Bass in order to improve size structure. Regulation changes would need to be coupled with outreach to promote harvest of smaller-sized fish and regulation compliance. Regulation changes are not warranted on Donnell Lake at this time. The reduced growth for older age classes suggests habitat may be limiting and habitat projects may be more effective at increasing size structure than harvest regulations.

Largemouth Bass and Black Crappie populations also may be impacted by the lack of habitat in Donnell Lake. Donnell Lake drops off quickly and much of the shoreline is developed. Woody habitat can be limited in lakes with extensive shoreline development as few trees are available to recruit as habitat and fallen trees are often removed from the lake. In addition, vegetation densities are relatively low excluding some areas of Eurasian Watermilfoil infestations. Shoreline habitat was not quantitatively assessed in the 2024 survey, but lack of nearshore fish cover was evident. Lack of habitat limits recruitment, survival, and growth of fish species that are dependent on nearshore cover. Both Largemouth Bass and Bluegill survival and growth decreases when vegetation is absent or densities are reduced (Wiley et al. 1984, Savino et al. 1992). Largemouth Bass recruitment also has been shown to decline when vegetation coverage is low (Durocher et al. 1984, Miranda and Pugh 1997). Vegetation and woody habitat increases survival of young-of-year Largemouth Bass by providing refuge from predation and access to quality prey. Lack of cover renders adult Largemouth

Bass more vulnerable to angling exploitation, potentially resulting in high harvest rates and few quality-sized fish. Black Crappie heavily utilize offshore woody cover during summer months when lakes are stratified. Growth rates of Largemouth Bass, Black Crappie, and Bluegill could be improved in Donnell Lake by improving nearshore habitat. Wood additions through offshore fish cribs and nearshore fish sticks could be considered to improve fish habitat in Donnell Lake.

The Northern Pike fishery in Donnell Lake is excellent. It is clear from the high catch rates in the gill nets that pike are abundant in Donnell Lake, and large fish up to 37 inches were captured in the survey. Additional Northern Pike would have been collected, but the gill nets were removed from the lake after the first night to prevent mortality of these popular game fish. Donnell Lake has limited wetland habitat for spawning, however there is good connectivity to adjacent lakes where wetlands are prevalent. Preserving existing wetland spawning habitat and the river connections to adjacent systems are important for Northern Pike recruitment in Donnell Lake.

Anglers have reported odd color patterns in Northern Pike captured in Donnell Lake. Fish with these patterns are often referred to as leopard pike. It is unclear what causes the patterning, but it seems to be exhibited more strongly in specific populations. The pattern is considered a color variant of Northern Pike and no distinct behavioral or genetic differences between leopard pike and “normal” pike have been documented, but there has been no significant research into the topic. This is a unique coloration that gives some additional character to the fishery in Donnell Lake.

Walleye were captured in the survey indicating survival from recent stocking efforts. The survey time period and methods were not ideal for evaluating Walleye populations. Capturing nine fish despite these limitations is an indication that stocking efforts were successful and there are larger fish available for anglers. Growth rates for Walleye were well above average. Walleye catch was reduced because of the limited number of gill net sets. Smaller Walleye from the 2021 stocking also may not have fully recruited to the gear resulting in a lower catch compared to 2017 fish. Walleye appear to be surviving well, in Donnell Lake. The limnology suggests there is suitable habitat for Walleye. Minnow prey is abundant, but larger offshore prey may be less abundant.

The predator-prey ratio was very high in the 2024 survey, and the observed growth rates for Northern Pike and Walleye may not be sustainable. Minnow prey is abundant, but catch rates for larger prey (e.g., Bluegill and Yellow Perch) were low. Largemouth Bass adults continue to exhibit low abundance of larger fish with somewhat reduced growth rate. There is also an abundance of native non game predators such as Longnose Gar and Bowfin. These species primarily feed on minnows and small sunfish. Northern Pike and stocked Walleye that feed on larger bodied prey appear to be growing well. Predation from Northern Pike and Walleye could be limiting Yellow Perch populations (Nielsen 1980, Rudstam et al. 1996, Liao et al. 2002). Walleye predation is not required to thin Bluegill as Bluegill are not excessively abundant and growth rates are above average. Predation is likely one reason the Bluegill size structure has shifted to larger fish compared to past surveys. Private Walleye stocking could continue, but DNR recommends not exceeding periodic stocking at low levels that can maintain a fishery without significantly increasing predator load. Production of DNR produced Walleye is limited and it is not recommended to use the limited supply in suboptimal locations.

Turtles were abundant in Donnell Lake and high numbers were captured in nets. Unfortunately, there was some turtle mortality from individuals getting trapped in deeper set nets. Turtle mortality could be minimized in future surveys by ensuring that the pots of fyke nets or trap nets are in water that is shallow enough to allow the turtles to come to the surface and breathe. The mortality was limited and turtle numbers on Donnell Lake was high and should not be impacted. No threatened or endangered

turtle species were captured or observed. Shoreline projects should continue to consider turtle passage to allow these populations to thrive. Seawalls block turtle migrations from the lake to the upland where nesting occurs. Providing access through ramps can benefit nesting success. Basking habitat is also important for maintaining populations.

Ciscoes were first reported in Donnell Lake in 1887, and Latta (1995) reported that the last Cisco record was in 1947. Donnell Lake was open for Cisco netting historically (reports for 1947 – 1951 in DNR files). No Ciscoes were captured in fish community surveys in 1956 and 1992, and the population in Donnell Lake was listed as extirpated in 1995 (Latta 1995). The limnology surveys in 2017, 2023, and 2024 all indicated that habitat for Ciscoes was marginal or non-existent. The habitat layer was extremely thin and the dissolved oxygen concentration were barely above the critical minimum. No Ciscoes were captured during the gill netting survey in 2017 or in the 2024 survey. Given the water quality results and repeated surveys with no Cisco captures, it is unlikely that Ciscoes remain in Donnell Lake.

### Management Direction

**Improve the fish habitat** in Donnell Lake. Largemouth Bass populations continue to be depressed with few large fish present and Black Crappie and Yellow Perch are present in low density. Nearshore and woody habitat are likely limiting recruitment and growth of these species in Donnell Lake. The DNR will continue to work with the Donnell Lake Conservation Club on habitat restoration projects. The Donnell Lake Conservation Club has initiated project planning to install fish cribs, woody habitat, and fish sticks. The DNR will continue to support these efforts and assist in planning, permitting, and installation of habitat structures.

**Protect wetland habitat and connectivity** between Donnell Lake and other local lakes. The wetlands surrounding these lakes and interconnected streams provide spawning habitat for Northern Pike and Yellow Perch and nursery habitat for a wide variety of fish species. Fish likely move between the lakes in the area on a seasonal basis. The DNR will continue to review Michigan Department of Environment, Great Lakes, and Energy permit applications for potential impacts to nearshore habitat on Donnell Lake and recommend modifications and practices that will preserve habitat and ensure continued fish passage.

**Promote a healthy predator-prey balance** in Donnell Lake. Past Walleye stocking has created additional fishing opportunities, but the relative biomass of predators in Donnell Lake is well above the target range. Reducing Walleye stocking should allow Yellow Perch to become more established. Private Walleye stocking can be permitted at low densities and frequency if maintaining the fishery is a priority. DNR recommends stocking at a reduced density and frequency than the standard recommendation of 4 fish per acre every other year. Stocking of Walleye can be permitted every third year to maintain a fishery and prevent overabundance of predators. DNR recommends a reduced density of 3 fish per acre as well. If fish can only be purchased in greater numbers (e.g. minimum order of 1,000 fish) the stocking frequency should be adjusted accordingly so that the average stocking rate does not exceed 1 fish per acre per year. A lower stocking rate will reduce potential impacts to growth for other predators and excessive predation of prey fish in Donnell Lake.

## References

- Allen, M. S., C. J. Walters, R. Myers. 2008. Temporal trends in Largemouth Bass mortality, with fisheries implications. *North American Journal of Fisheries Management* 28:418-427.
- Anderson, R. O. 1976. Management of small warm water impoundments. *Fisheries* 1:5-7, 26-28.
- Cooper, G. P. 1948. Fish stocking policies in Michigan. Michigan Department of Natural Resources, Fisheries Research Report 1167, Ann Arbor.
- Diana, M. J. 2015. Crooked and Little Crooked Lakes. Michigan Department of Natural Resources, Document in the Fish Collection System 10572.
- Diana, M. J. 2017. Donnell Lake. Michigan Department of Natural Resources, Document in the Fish Collection System 11647.
- Dexter, J. L. 1996. Donnell Lake. Michigan Department of Natural Resources. Status of the Fisheries Report 96-8, Lansing.
- Diana, J. S. 1979. The feeding pattern and daily ration of a top carnivore, the Northern Pike (*Esox Lucius*). *Canadian Journal of Zoology* 57:2121-2127.
- Drake, M.T., Claussen, J.E., Philipp, D.P. and Pereira, D.L., 1997. A comparison of bluegill reproductive strategies and growth among lakes with different fishing intensities. *North American Journal of Fisheries Management*, 17(2), pp.496-507.
- Durocher, P. P., W. C. Provine, and J. E. Kraai. 1984. Relationship between abundance of Largemouth Bass and submerged vegetation in Texas reservoirs. *North American Journal of Fisheries Management* 4:84-88.
- Eder, S. 1984. Effectiveness of an imposed slot limit of 12.0-14.9 inches on Largemouth Bass. *North American Journal of Fisheries Management* 4:469-478.
- Forney, J. L. 1977. Evidence of inter- and intraspecific competition as factors regulating Walleye. *Journal of Fisheries Research Board of Canada* 34:1812-1820.
- Forney, J. L. 1980: Evolution of a management strategy for the Walleye in Oneida Lake, New York. *New York Fish and Game Journal* 27: 105–141.
- Frost, W. E. 1954. The food of pike, *Esox lucius* L. in Windermere. *Journal of Animal Ecology* 23:339-360.
- Gunderman, B. 2023. Donnell Lake. Michigan Department of Natural Resources, Document in the Fish Collection System 13828.
- Hettinger, H. L. 2015a. Arbutus Lake. Michigan Department of Natural Resources. Fish Collection System Document 10576.

- Hettinger, H. L. 2015b. Spider Lake. Michigan Department of Natural Resources. Fish Collection System Document 10577.
- Hoxmeier, R.J.H., Aday, D.D. and Wahl, D.H., 2009. Examining interpopulation variation in bluegill growth rates and size structure: effects of harvest, maturation, and environmental variables. *Transactions of the American Fisheries Society*, 138: 423-432.
- Jennings, M. J., J. E. Claussen, and D. P. Philipp. 1997. Effect of population size structure on reproductive investment of male bluegill. *North American Journal of Fisheries Management* 17:516-524.
- Isermann, D. A., Maxwell, J. B. and McNerny, M. C. 2013. Temporal and regional trends in black bass release rates in Minnesota. *North American journal of Fisheries management* 33:344-350.
- Latta, W. C. 1995. Distribution and abundance of Lake Herring (*Coregonus artedi*) in Michigan. Michigan Department of Natural Resources, Fisheries Research Report 2014, Ann Arbor.
- Liao, H., C. L. Pierce, and J. G. Larscheid. 2002. Diet dynamics of the adult piscivorous fish community in Spirit Lake, Iowa, USA 1995-1997. *Ecology of Freshwater Fish* 11:178-189.
- Miranda, L.E. and L. L. Pugh. 1997. Relationship between vegetation coverage and abundance, size, and diet of juvenile Largemouth Bass during winter. *North American Journal of Fisheries Management* 17:601-610.
- Myers, R., J. Taylor, M. S. Allen, and T. F. Bonvechio. 2008. Temporal trends in voluntary release of Largemouth Bass. *North American Journal of Fisheries Management* 28:428-433.
- Nielsen, L. A. 1980. Effect of Walleye (*Stizostedion vitreum vitreum*) predation on juvenile mortality and recruitment of Yellow Perch (*Perca flavescens*) in Oneida Lake, New York. *Canadian Journal of Fisheries and Aquatic Sciences* 37:11-19.
- Noble, R. L. 2002. Reflections on 25 years of progress in black bass management. Pages 419– 432 in D. P. Philipp and M. S. Ridgeway, editors. *Black bass: biology, conservation, and management*. American Fisheries Society, Symposium 31, Bethesda, Maryland.
- Novinger, G. D. 1990. Slot length limits for Largemouth Bass in small private impoundments. *North American Journal of Fisheries Management* 10:330-337.
- Post, J. R. & Rudstam, L. G. 1992: Fisheries management and the interactive dynamics of Walleye and perch populations. — In: Kitchell, J. F. (ed.), *Food web management: a case study of Lake Mendota*: 381–406. Springer Verlag, NY.
- Quinn, S. 1996. Trends in regulatory and voluntary catch-and-release fishing. Pages 152-162 in Miranda, L. E., and D. R. DeVries, editors. *Multidimensional approaches to reservoir fisheries management*. American Fisheries Society, Symposium 16, Bethesda, Maryland.
- Rudstam, L. G., D. M. Green, J. L. Forney, D. L. Stang, and J. T. Evans. 1996. Evidence of interactions between Walleye and Yellow perch in New York State lakes. *Annales Zoologici Fennici* 33:443-449.

- Savino, J. F., E. A. Marschall, and R. A. Stein. 1992. Bluegill growth as modified by plant density: an exploration of underlying mechanisms. *Oecologia* 89:153-160.
- Schneider, J. C. 1990. Classifying Bluegill populations from lake survey data. Michigan Department of Natural Resources, Fisheries Technical Report 90-10, Ann Arbor.
- Schneider, J. C. 2000a. Interpreting fish population and community indices. Chapter 21 in Schneider, James C. (ed) 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.
- Schneider, J. C. 2000b. Weighted average length and weighted age composition. Chapter 15 in Schneider, James C. (ed) 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.
- Schneider, J. C., P. W. Laarman, and H. Gowing. 2000a. Age and growth methods and state averages. Chapter 9 in Schneider, James C. (ed) 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.
- Schneider, J. C., P. W. Laarman, and H. Gowing. 2000b. Length-weight relationships. Chapter 17 in Schneider, James C. (ed) 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.
- Smith, N. J., K. E. Webster, L. K. Rodriguez, K. S. Cheruvilil, and P. A. Soranno. 2021. LAGOS-US LOCUS v1.0: Data module of location, identifiers, and physical characteristics of lakes and their watersheds in the conterminous U.S. ver 1. Environmental Data Initiative. <https://doi.org/10.6073/pasta/e5c2fb8d77467d3f03de4667ac2173ca> (Accessed 2023-11-8).
- Wehrly, K. E., G. S. Carter, and J. E. Breck. In revision. Chapter XX: Inland Lake Status and Trends Program sampling protocols. Michigan Department of Natural Resources, Fisheries Special Report, Ann Arbor.
- Wilde, G. R. 1997. Largemouth Bass fishery responses to length limits. *Fisheries* 22(6):14–23.
- Wiley, M. J., R. W. Gorden, S. W. Waite, and T. Powless. 1984. The relationship between aquatic macrophytes and sport fish production in Illinois Ponds: a simple model. *North American Journal of Fisheries Management* 4:111-119.

**Tables and Figures**

Table 1. Fish stocking history for Donnell Lake.

Species	Year	Number	Length (inches)/Age	Operation
Lake Whitefish	1877	20,000	Swim-up Fry	DNR
Bluegill	1933	7,000	4 month	DNR
Largemouth Bass	1933	1,000	5 month	DNR
Bluegill	1934	15,000	5 month	DNR
Largemouth Bass	1934	2,500	5 month	DNR
Bluegill	1935	20,000	4 month	DNR
Largemouth Bass	1935	1,000	3 month	DNR
Bluegill	1936	10,000	4 month	DNR
Largemouth Bass	1936	750	4 month	DNR
Bluegill	1937	25,000	4 month	DNR
Bluegill	1938	75,000	4 month	DNR
Largemouth Bass	1938	3,000	6 month	DNR
Yellow Perch	1938	15,000	5 month	DNR
Bluegill	1939	75,000	4 month	DNR
Largemouth Bass	1939	3,000	4 month	DNR
Bluegill	1940	2,000 / 20,000	4 month / yearling	DNR
Bluegill	1940	2,000	Yearling	DNR
Largemouth Bass	1940	2,000	Yearling	DNR
Bluegill	1941	60,000	4 month	DNR
Largemouth Bass	1941	500	4 month	DNR
Yellow Perch	1941	4,000	7 month	DNR
Bluegill	1942	55,000	4 month	DNR
Largemouth Bass	1942	500	4 month	DNR
Bluegill	1943	5,000	4 month	DNR
Largemouth Bass	1943	500	4 month	DNR
Largemouth Bass	1944	2,000	3.5 month	DNR
Bluegill	1945	10,000	4 month	DNR
Largemouth Bass	1945	2,000	3.5 month	DNR
Walleye	1975	500,000	Fingerling	DNR
Walleye	1976	50,000	Fingerling	DNR
Yellow Perch	2008	400	4.5	Private Plant (under permit)
Channel Catfish	2008	500	7	Private Plant (under permit)
Walleye	2017	1,000	7.09	Private Plant (under permit)
Walleye	2021	1,000	7	Private Plant (under permit)
Yellow Perch	2022	1,000	4	Private Plant (under permit)

Table 2. Fish captured during the fish survey conducted on Donnell Lake, May 13-16, 2024.

Species	Number	Mean Length (inches)	Total Weight (lbs)	Length Range (inches)
Banded Killifish	118	5.0	13.1	1 - 9
Black Crappie	6	8.0	1.8	5 - 10
Blackchin Shiner	71	2.5	0.4	1 - 2
Blacknose Shiner	78	2.4	0.4	1 - 2
Bluegill	436	5.0	68.7	1 - 9
Bluntnose Minnow	41	2.4	0.3	1 - 3
Bowfin	5	23.1	22.4	20 - 26
Brook Silverside	41	2.8	-	2 - 3
Brown Bullhead	11	13.0	11.6	10 - 15
Green Sunfish	3	4.2	0.2	3 - 5
Hybrid Sunfish	28	5.7	4.8	2 - 9
Iowa Darter	2	2.0	0.0	1 - 2
Largemouth Bass	115	11.4	97.7	2 - 16
Longnose Gar	30	31.0	86.7	14 - 37
Northern Pike	9	30.5	65.6	20 - 37
Pumpkinseed Sunfish	71	7.7	28.7	3 - 8
Rock Bass	23	6.5	5.8	1 - 8
Sand Shiner	19	2.1	0.1	1 - 2
Smallmouth Bass	4	11.3	4.3	3 - 15
Spotfin Shiner	6	3.3	0.1	2 - 3
Spotted Gar	8	25.5	18.2	22 - 29
Tadpole Madtom	1	1.5	0.0	1 - 1
Walleye	9	21.9	32.4	16 - 24
Warmouth	13	5.1	1.6	3 - 7
White Sucker	1	16.5	1.8	16 - 16
Yellow Bullhead	52	12.0	43.4	7 - 14
Yellow Perch	14	6.2	2.0	3 - 10
Grand Total	1,215	6.9	511.8	1 - 37

Table 3. Age and growth demographics for species caught in the 2024 fish survey on Donnell Lake for which age structures (scales or spines) were collected.

Species	Age	Number	Donnell Average Length (Inches)	State Average Length (inches)	Growth Index
Black Crappie	III	2	7.3	7.5	-
	IV	3	8.9	8.6	
Bluegill	I	116	1.7	1.8	+0.7
	III	74	3.3	3.8	
	III	73	5.4	5	
	IV	65	7.3	5.9	
	V	23	8.4	6.7	
	VI	44	8.4	7.3	
	VII	8	8.7	7.8	
	VIII	1	9.4	8.2	
Largemouth Bass	I	2	3.4	4.2	-0.5
	II	7	6.4	7.1	
	III	19	9.6	9.4	
	IV	35	11.9	11.6	
	V	38	12.4	13.2	
	VI	9	12.4	14.7	
	VII	4	15.0	16.3	
Northern Pike	III	1	20.7	20.8	-
	IV	1	25.8	23.4	
	IX	1	33.4	29.3	
	VII	3	27.7	31.2	
	VIII	1	37.9	-	
	X	1	37.1	-	
Smallmouth Bass	I	1	3.1	3.8	-
	III	1	11.6	10.8	
	V	1	14.1	14.4	
	VI	1	15.4	15.3	
Walleye	III	1	16.3	13.9	+1.9
	VII	8	22.5	20.6	

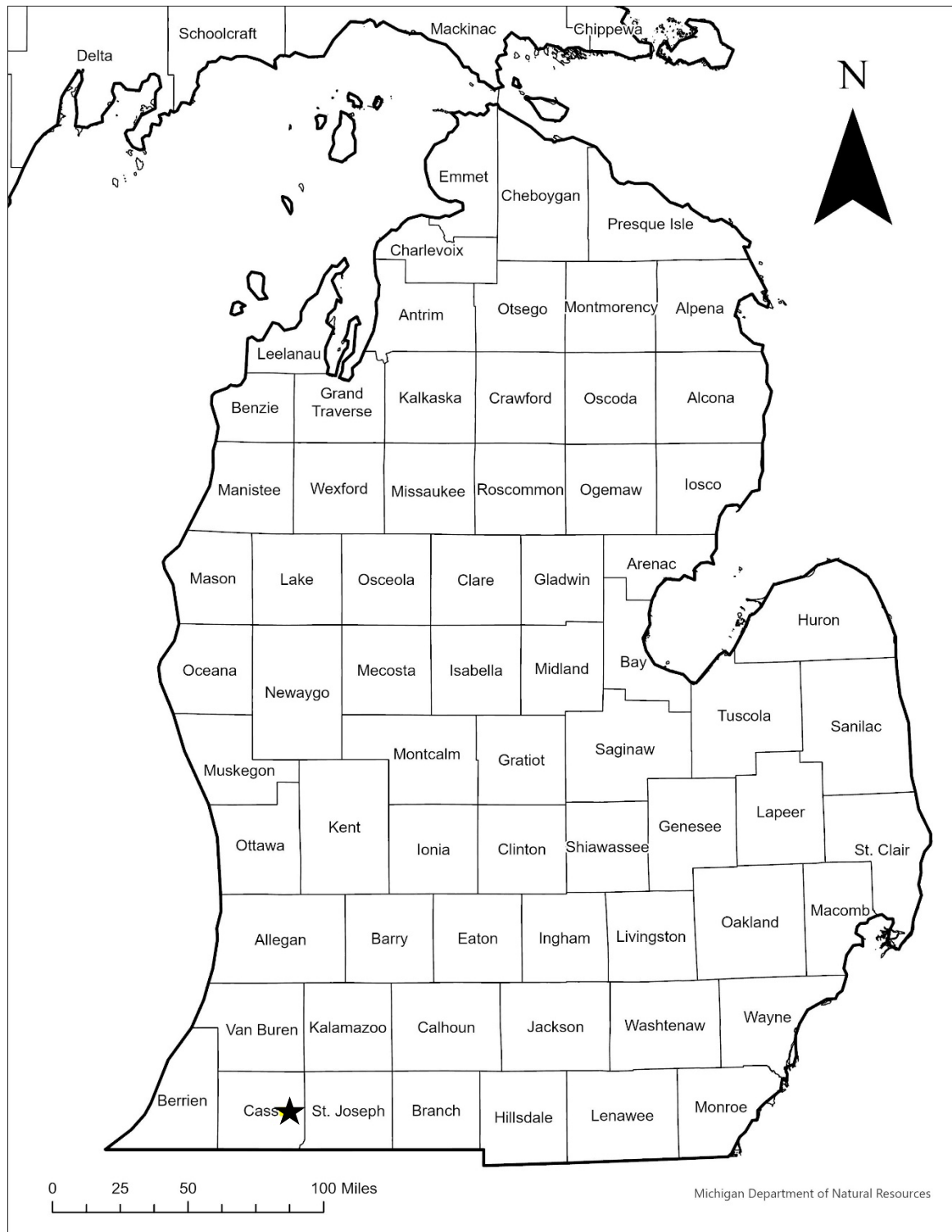


Figure 1. General location of Donnell Lake in Cass County, Michigan. The black star indicates the location of Donnell Lake.

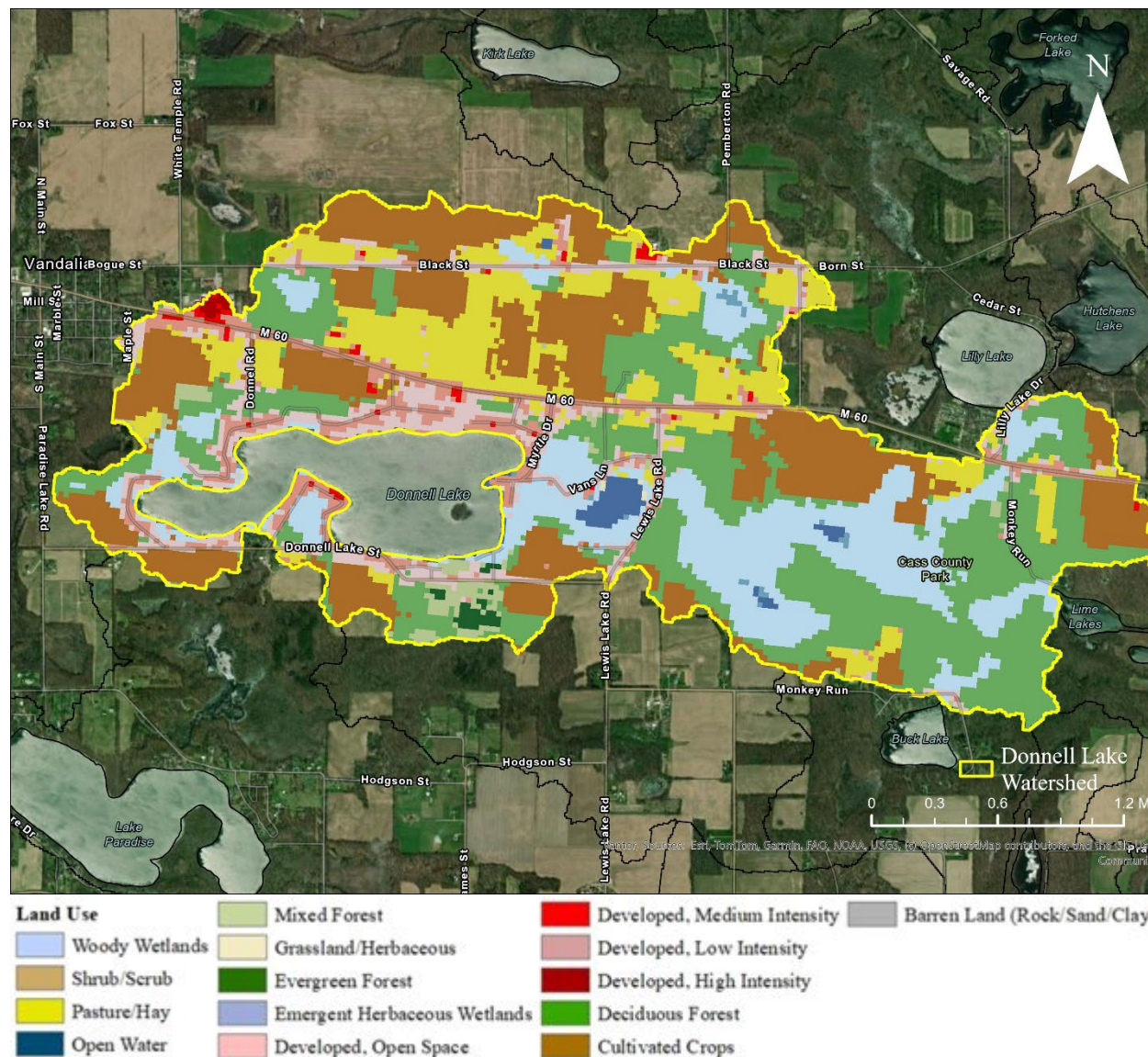


Figure 2. Land use within the Donnell Lake Watershed. Land cover type is based on the 2023 National Land Cover Database (USGS 2024). The Donnell Lake watershed was obtained from LAGOS delineation (Smith et al. 2021).



Figure 3. Bathymetric map of Donnell Lake surveyed by DNR in 1947 and 1956.

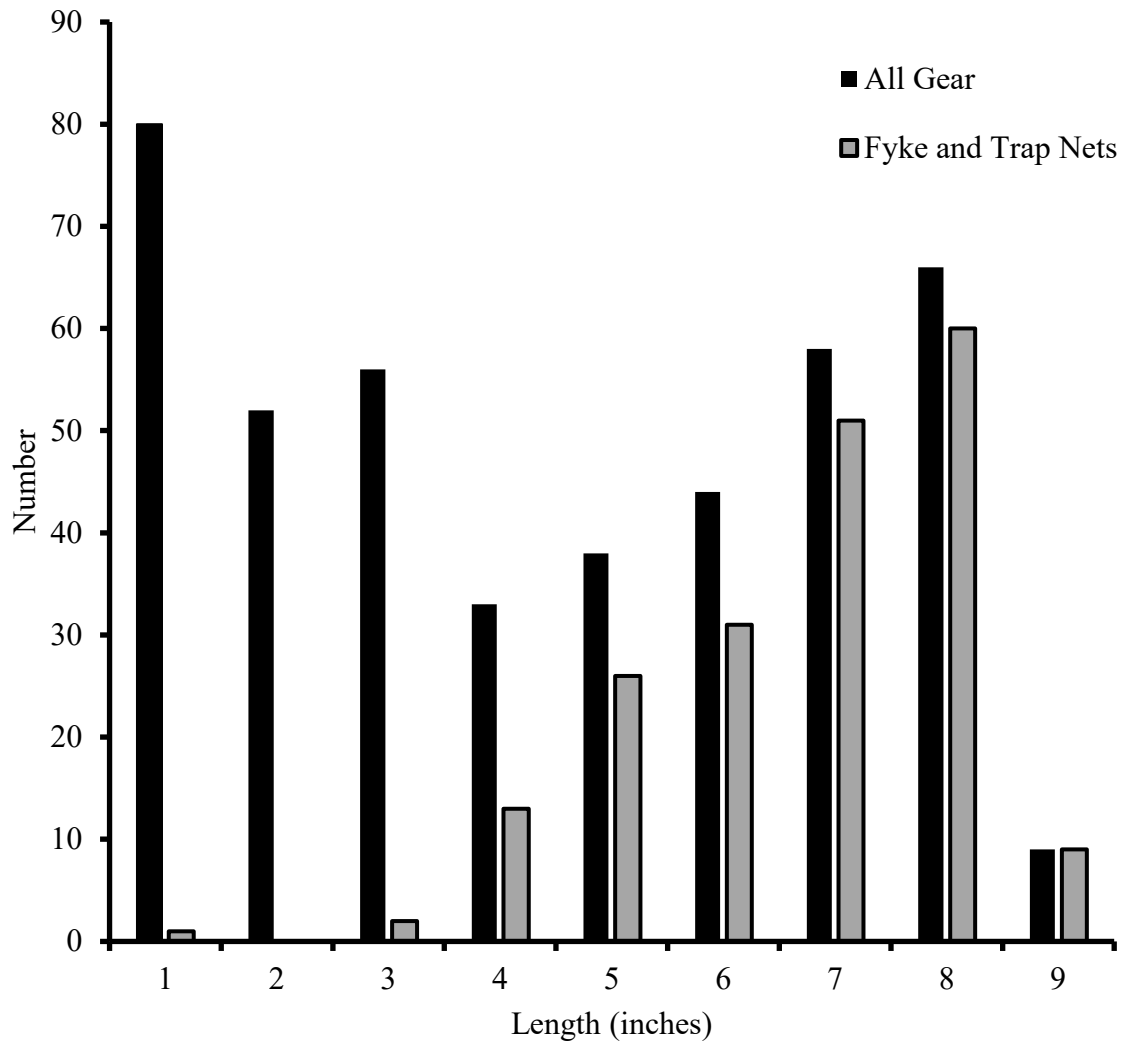


Figure 4. Length frequency distribution for Bluegill captured across all gear types and in fyke and trap nets during the 2024 fish survey on Donnell Lake.

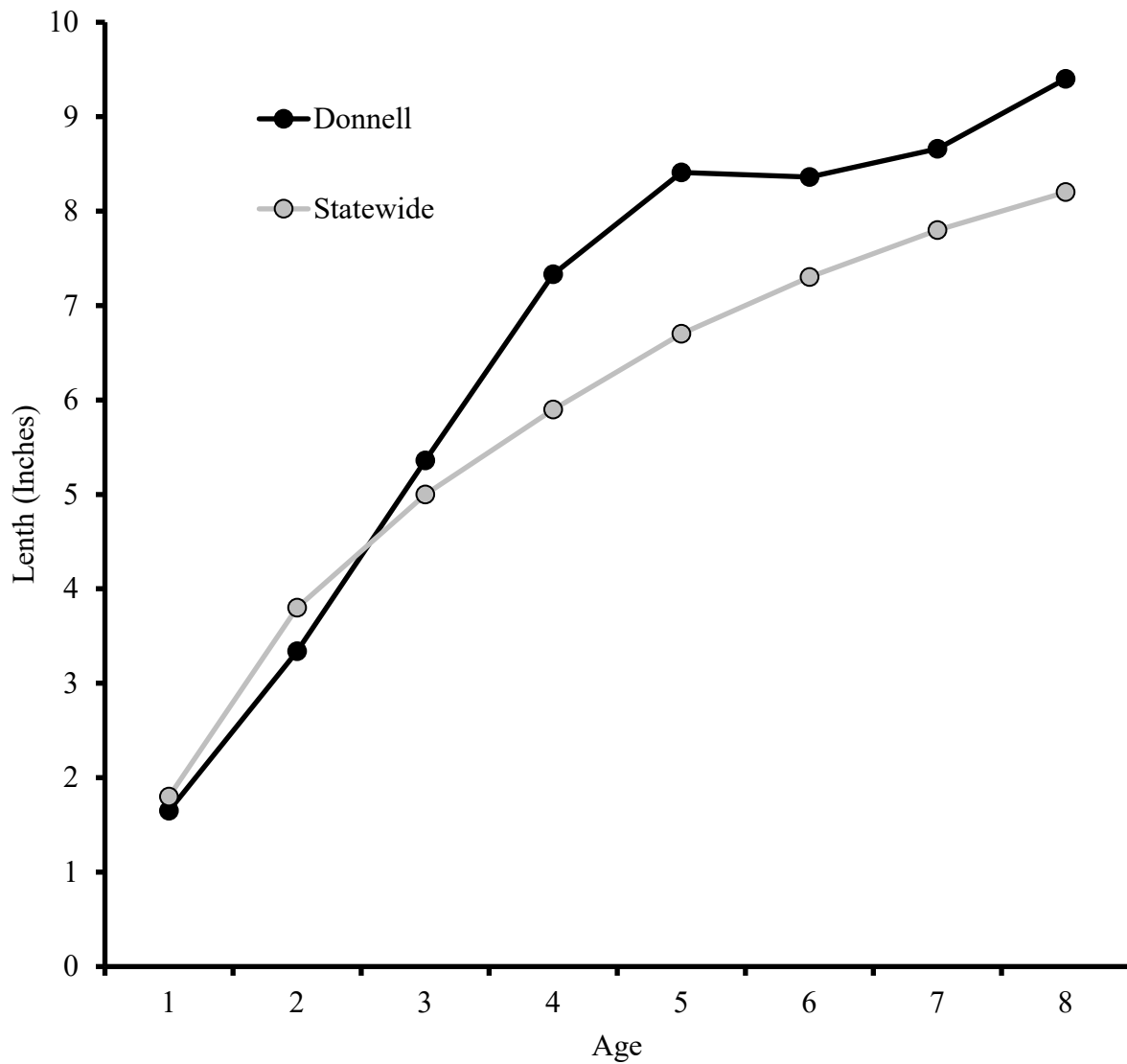


Figure 5. Mean length for Bluegill of each age class captured in the 2024 fish survey on Donnell Lake compared to statewide averages from Schneider et al. (2000a).

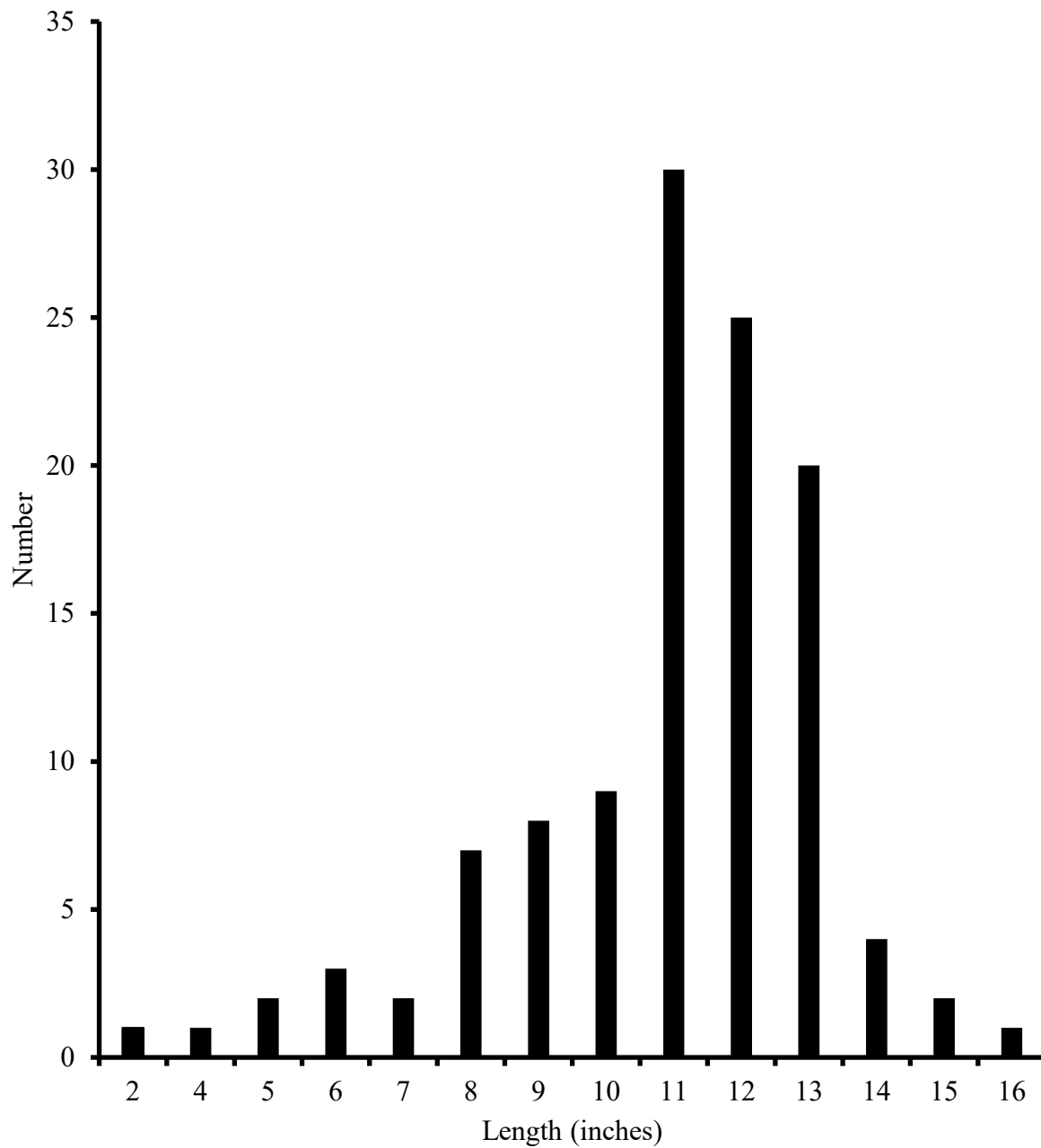


Figure 6. Length frequency of Largemouth Bass captured in the 2024 fish survey conducted on Donnell Lake.

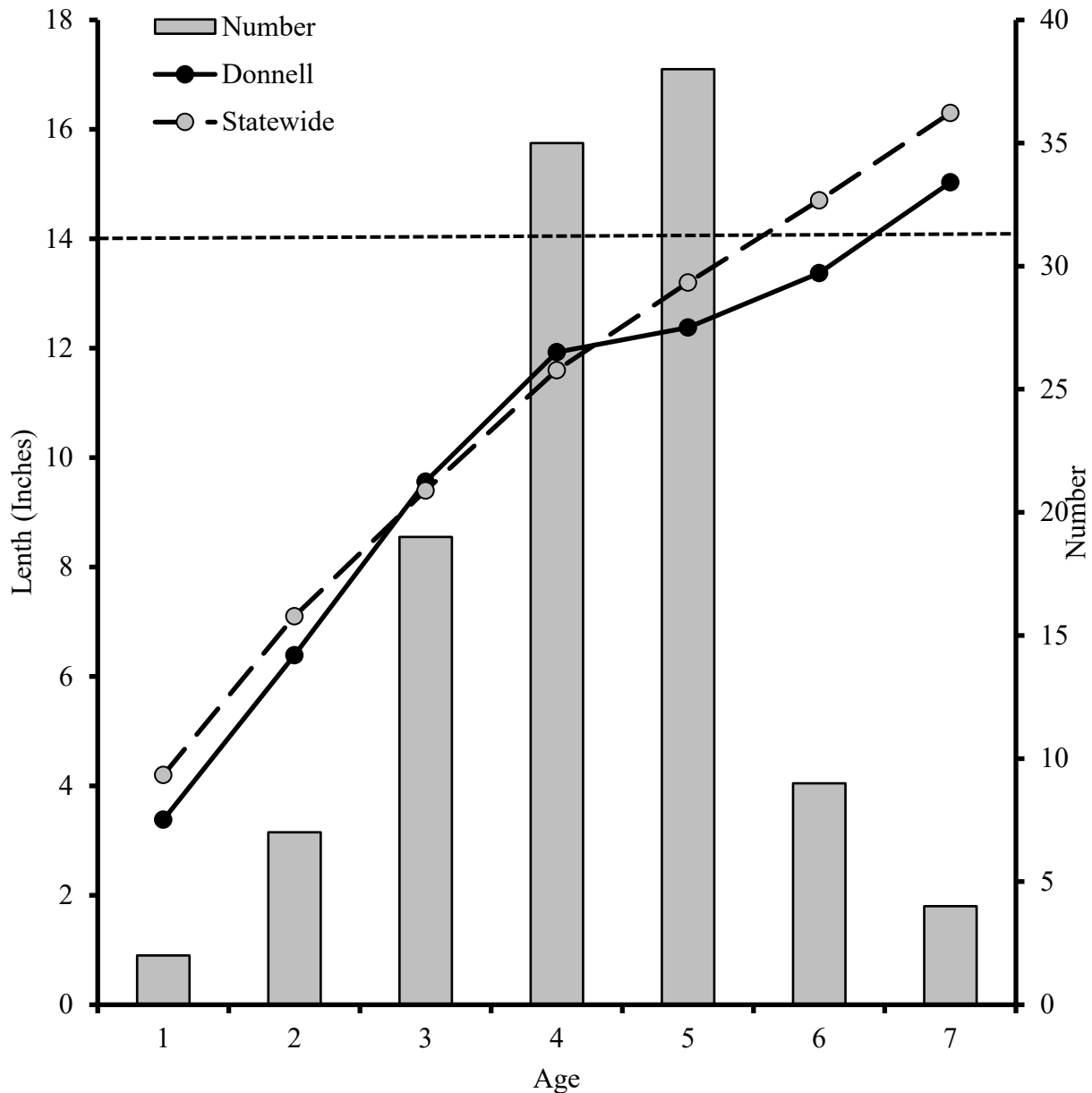


Figure 7. Mean length of Largemouth Bass for each age class collected in the 2024 fish survey on Donnell Lake compared to the statewide average from Schneider et al. (2000a). Bars show the number of fish captured in each age class. The dashed horizontal line represents the 14 inch minimum size limit for Largemouth Bass harvest.

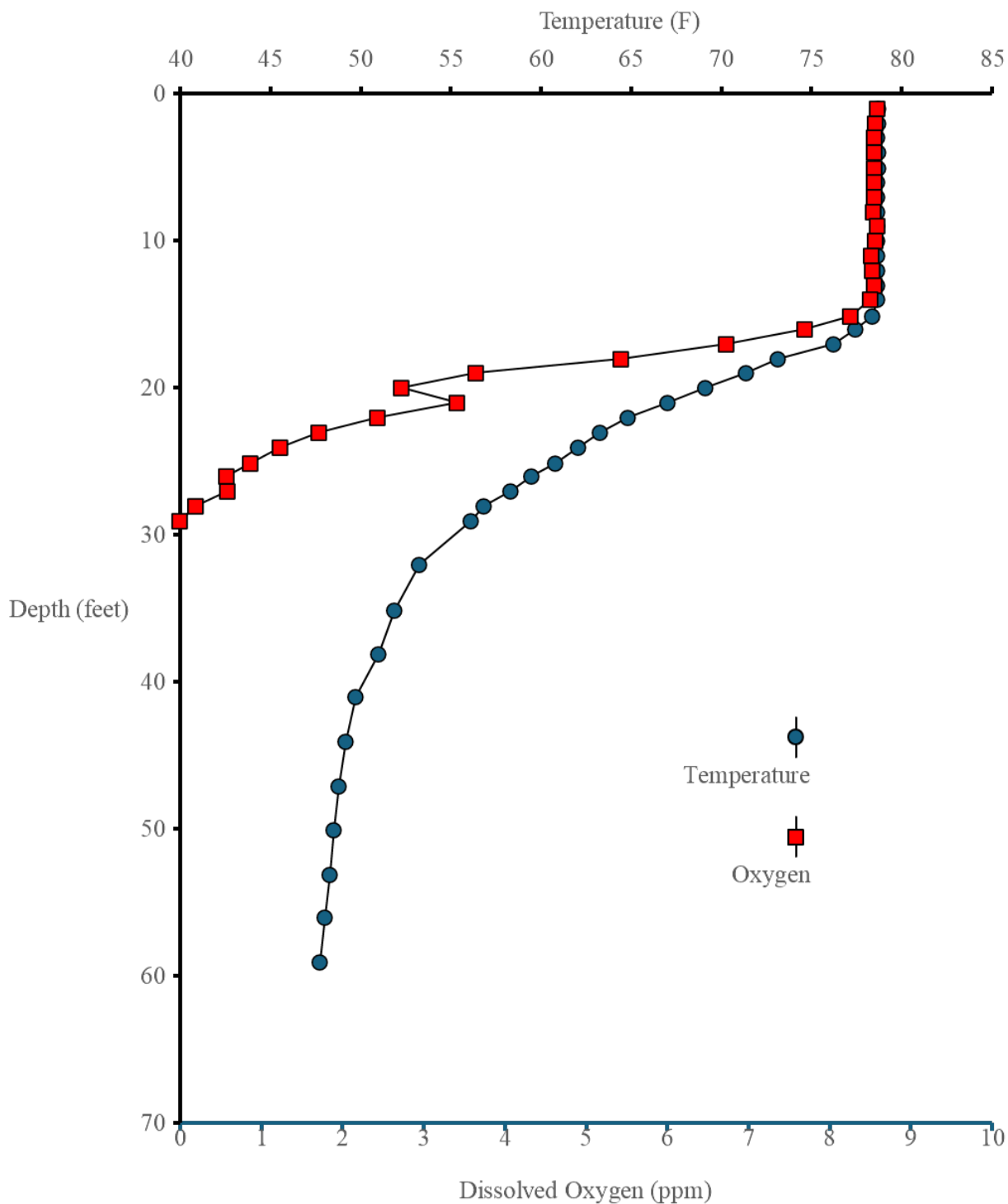


Figure 8. Temperature and dissolved oxygen profile collected at the deepest point on Donnell Lake on August 8, 2024.

**Literature Path**

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