Lake Emily
Iron County, T43N R34W Secs 13 & 24
Brule River Watershed, Last Surveyed 2024-25

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Environment

Location
Lake Emily is located approximately 8 miles west of Crystal Falls, in Iron County, Michigan within the Paint River Watershed and is located just north of US Highway 2 (Figure 1). It is located in the Brule River Basin (HUC-8 04030106).

Geology and geography

The immediate surrounding area has a quaternary geology type of peat and muck. The greater area is comprised of coarse-textured glacial till, medium-textured glacial till, and postglacial alluvium.

Watershed description
Lake Emily has a surface area of 325 acres, a maximum depth of 30 feet. The lake is mostly surrounded by wetlands and seepage areas, in particular the southern, western, and northern shorelines, and three unnamed streams enter along the lake's western shoreline. The inlet, known as the Chicagon Slough, is located on the southern end of the lake and connects Lake Emily to Chicagon Lake and has been chronically inundated with beaver activity. The outlet (Chicagon Slough continued) is located on the northern end and drains into the Paint River, a large warm transitional river. The surrounding watershed is a mix of deciduous forest and woody wetlands (Figure 2).

Chemical and physical characteristics
Water chemistry values indicate that the trophic state of Lake Emily is eutrophic, suggesting it receives relatively high inputs of nutrients (i.e. high productivity) as evidenced by the extensive aquatic plant growth.

The lake has an hourglass shape being narrower in the middle (Figures 1 and 2). The shoreline is 3.2 miles in length and the littoral area has consistently been described as having high densities of aquatic vegetation. The lake bottom sediment is mostly sand with a mix of gravel and marl.

Development, public ownership, and access
Homes and cottages are concentrated mainly on the eastern shoreline and to a lesser extent the western shoreline. A hard-surfaced ramp is located near the middle of the eastern shoreline.

The general fish community in Lake Emily is mostly comprised of Pumpkinseed, Yellow Perch, Bluegill, and Rock Bass. Top predators, including Walleye, Northern Muskellunge and Smallmouth Bass are present, but in lower numbers.

Confirmed aquatic and terrestrial invasive species in or near Lake Emily include phragmites, Japanese knotweed, curly-leaf pondweed, narrow-leaved cat-tail, Bells honeysuckle, reed canarygrass, banded mystery snail, and zebra mussels (first observed in 2011). Zebra mussels thus far have not reached high densities compared to what has occurred in Chicagon Lake (very high densities). Heterosporosis, a non-native microscopic spore, was confirmed in 2011 in Yellow Perch. The parasite infects the muscle tissue and gives an appearance of "freezer burn" on the fillet.

Lake Emily has a fish consumption advisory for Black Crappie (any size fish, 2 servings per month), Largemouth Bass (under 18"=2 servings per month, over 18"=6 serving per year), Smallmouth Bass (under 18"=2 servings per month, over 18"=6 serving per year), and Walleye (any size fish, 1 serving per month). The consumption advisory is due to elevated mercury levels which is similar to other waters in the state and due to atmospheric deposition of mercury.

No recent history of fishing tournaments have been registered since mandatory reporting began in 2019.

Fishery Resource

History

Limnology

The Michigan Department of Conservation (hereinafter referred to as the Michigan Department of Natural Resources (MDNR)) recorded the water temperature on September 1st , 1959 and was 74°F at the surface and decreased to 63.5°F at 30 feet. Oxygen levels were 7.5ppm at the surface, 6.3ppm at 15ft, and 0.4ppm at 20 feet.

On August 31, 1977, staff from the MDNR recorded water temperatures, alkalinity, and pH levels on Lake Emily. The surface water temperature was recorded at 68°F and remained relatively the same throughout the water column (64°F at 27 feet). Alkalinity, a measure of a lake's pH buffering capacity, was measured between 140-151 mg/L (methyl orange, MO) indicating suitable levels to buffer acid inputs from the watershed or via atmospheric deposition. The pH was 9 at the surface and 7.4 at a depth of 27 feet. The Secchi disk reading was recorded at 3.5 feet, although this was measured after a rain event that could have influenced the clarity of the water.

On May 14, 1993, a limnology survey was conducted, and MDNR managers collected a variety of water quality parameters including temperature, dissolved oxygen, pH and conductivity from the water surface to the bottom (26 ft.). Water temperature readings were 61.3°F at the surface, 58.5°F at 15 ft., 46.4°F at 20 ft., and 43.2°F at 26 ft. Dissolved oxygen was around 9ppm at the surface to 15 ft., 7ppm at 20 ft., and 0.6 at 26 ft. The pH hovered around 8.5 throughout the water column. Specific conductivity was around 200 µS/cm. The Secchi depth was recorded at 9.5 feet. Development around the shoreline was also estimated to be around 20 percent. Other results included 3 µg/L chlorophyll a, 0.003 mg/L Nitrate + Nitrite, 0.008 mg/L ammonia-N, 0.34 mg/L Total Kjeldahl Nitrogen, and 0.017 mg/L total Phosphorus (all surface samples).

An August 29th , 2002 limnology survey was completed by MDNR that showed temperatures ranging from 71.6°F at a depth of 3 ft, declining steadily with depth to 56.4°F at 27ft. (Table 1). Oxygen levels were 12.6ppm at 3 ft., declined rapidly with depth to 5.8ppm at 12 ft, and less than 1ppm at 21ft (Table 1). The Secchi depth was recorded at 8 ft. (Table 1). Chemical analysis of surface water samples conducted in August 2002 reported the following results: 138 mg/L Alkalinity ($CaCO_3$), 8.5 µg/L chlorophyll a, 0.011 mg/L ammonia-N, <0.01 mg/L Nitrate + Nitrite, 0.6 mg/L Total Kjeldahl Nitrogen, and 0.04 mg/L total Phosphorus. Lake Emily's alkalinity values remain high enough to maintain sufficient buffering capacity against acidification. Chlorophyll a and total Phosphorus levels were elevated, indicating a nutrient-rich state of the lake. The ammonia-N, Nitrate + Nitrite, and Total Kjeldahl Nitrogen levels were low, which indicated little to no pollution from these potential sources (e.g. sewage or fertilizer).

A temperature logger (Onset Hobo Water Temp Pro V2, Model U22-001) was deployed on May 19, 2014, and retrieved on October 15, 2014. The minimum, maximum, and average temperatures recorded between May 19-October 15, 2014, were 47°F, 77°F, and 66°F, respectively.

Limnological parameters were recorded at Lake Emily on September 8, 2015, by the MDNR. Parameters included temperature, oxygen, pH, and conductivity. The surface water temperature was recorded at 75.6°F and declined with depth to 61°F at 30 feet (Table 1). Suitable oxygen levels (>5mg/L) were recorded between 0-8 feet (Table 1). Secchi depth was 5.5 feet. The pH was around 9 from the surface to 6 feet, declined to 8 between 8-10 feet and hovered around 7 for the rest of the water column. Specific conductance was between 248-287 µS/cm throughout the water column.

Limnological parameters were recorded at Lake Emily on August 24, 2022, by the MDNR. Parameters included temperature, oxygen, and conductivity. The pH was not recorded. The water temperature from the surface to a depth of 10 ft. was recorded at 73.8°F and then declined steadily to 56.0°F at 28 feet (Table 1). Suitable oxygen levels (>5mg/L) were recorded between 0-13 feet (Table 1). Secchi depth was 8 feet. Specific conductance was between 269-291 µS/cm throughout the water column. Compared to the 2015 survey, warmer water temperatures and higher oxygen levels were observed deeper into the water column in the August 2022 limnology survey (Table 1). Specific conductivity was relatively the same for both survey years.

Water chemistry values indicate that the trophic state of Lake Emily is eutrophic, suggesting it receives relatively high inputs of nutrients (i.e. high productivity) as evidenced by the extensive aquatic plant growth. Alkalinity and pH levels were relatively consistent during this time period which confirms Lake Emily's ability to buffer acid inputs.

Early Fisheries Management 1927-1978

The first record on file for Lake Emily was in 1927 that described Lake Emily as having a Yellow Perch and Largemouth Bass fishery, beaver activity at the inlet and outlet, and a "very moderate" density of aquatic plants. The first recorded stocking of Lake Emily occurred in 1927 with 50,000 Walleye (Table 2). Between the 1930s-1940s, a variety of fish species were stocked that included Lake Trout, Largemouth Bass, Yellow Perch, Bluegill, Walleye, and Smallmouth Bass (Table 2). By 1947, the fishery was described as having Walleye, Largemouth Bass, Yellow Perch, and some Bluegill. On August 31-September 3, 1959, a fisheries and habitat survey was conducted by the MDNR. The immediate shoreline was described as having sand, gravel, marl, and a high abundance of aquatic vegetation. There were about 20 cottages surrounding the lake. Fish species captured included Walleye, Largemouth Bass, Pumpkinseed, Yellow Perch, White Suckers, and Rock Bass.

In response to poor Walleye fishing reports, the MDNR conducted a fisheries survey from April 25-29, 1970. Fyke nets were deployed as part of the survey methods (12 Net Nights (NN)). One fyke net was deployed at the mouth of Chicagon Creek (Chicagon Slough) which enabled staff to remove 600 pounds of White Suckers, a common practice at the time. Fish species captured and recorded included Walleye (N=25, 17"-24" length range), Northern Pike (N=4, no size reported), White Sucker (N=250, 15"-22" length range), Yellow Perch (noted only as present), and Pumpkinseed (noted only as present). Additionally, 8.5 quarts of Walleye eggs were collected from 11 females. Records do not give details as to why they were collected or their final destination, however managers did note the potential for Lake Emily to be a source for Walleye eggs in the future. In 1971, 250,000 Walleye fry were stocked in Lake Emily.

Fall fingerling Muskellunge were stocked in 1972, 1975, and 1976 (Table 2). In 1978 and 1979, 224 adult Muskellunge were transferred from Iron Lake (Iron County) to Lake Emily. Managers at the time were attempting to establish Lake Emily as a broodstock lake for Northern Muskellunge. There is documentation in the historical files of survey efforts in April-May of 1978 and 1979 that targeted Northern Muskellunge. The documentation appears to be for egg take operations, but it is ultimately

unclear what the purpose was and what became of the eggs collected (no milt was reported as taken). Fisheries crews captured 6 males and 2 females in 1978 and 11 males and 3 females in 1979.

On July 10-13, 1978, a fisheries community survey was completed by staff from the MDNR. Managers noted abundant amounts of aquatic vegetation and nearshore sediment was mostly sand with silt in heavily vegetated areas. Fish species captured included Yellow Perch (N=215, 5”-15” length range, 6.6” average), Walleye (N=2, 22” and 29”), Smallmouth Bass (N=2, 7” and 9”), Largemouth Bass (N=5, 5”-9” length range, 7.3” average), Bluegill (N=15, 5”-10”, 6.9” average), Pumpkinseed (N=190, 3”-7” length range, 4.7” average), Rock Bass (N=153, 3”-9” length range, 5.8” average), White Sucker (N=29, 14”-19” length range, 16.6” average), and Golden Shiner (N=26, 4”-6” length range, 5.5” average). No Muskellunge were captured during the survey efforts however anglers reported great Muskellunge fishing during that summer.

By the late 1970s, the management goal for Lake Emily was to reestablish the Walleye population and maintain the Muskellunge population in order to reduce the perceived excessive numbers of small panfish and white suckers via predation.

Walleye Management 1979-2005

Between 1979-2005, spring fingerling Walleye have been regularly stocked into Lake Emily (Table 2). The Walleye stocked between 1979-1987 were of the Lake Gogebic strain, whereas the Walleye stocked after 1987, were the Little Bay De Noc strain.

In order to evaluate annual Walleye recruitment and stocking efforts, five fall surveys were completed between 1981-2005 (Table 3). Older standards (Ziegler and Schneider 2000) described four of the five years as poor recruitment years (1981,1991,1993, 2005) and one year (1995) as an average year for Walleye recruitment (Table 3). However, user newer qualitative standards based on northern Wisconsin metrics for annual recruitment (Hansen 2012 and Gilbert and Hennessy 2014), one year would be considered a poor recruitment year (2005), two years would be considered low recruitment years (1981,1993), one year was good (1991) and one year was considered very high (1995, Table 3).

On April 21-24, 1988, a spring fishery survey was completed with the intent to assess the adult Walleye population and stocking efforts. Managers determined that the Walleye population was stable with various sizes (Table 4) and multiple age classes present. Stocking was determined to be successful and should continue to supplement the natural reproduction of Walleye in Lake Emily which was thought to be inadequate to sustain itself without supplemental stocking. A yearling Walleye assessment was conducted just a month later on May 25, 1988. Managers maintained their assessment that the Walleye population was doing well and was due to a mix of stocking and natural reproduction. According to managers, Lake Emily had one of the best Walleye populations in the area for numbers and overall size structure.

In the early 2000s, Lake Emily was well known for its Walleye population which anecdotally was thought to have higher fishing pressure from anglers compared to nearby lakes.

Walleye were not stocked from 2007-2010 due to concerns with potential spread of viral hemorrhagic septicemia. Walleye stocking resumed in 2011 with a stocking prescription for three consecutive years of stocking spring fingerlings followed by biennial stocking at a rate of 50 per acre (N=16,000, Table 2).

Walleye Management 2013-2023

In 2013, the MDNR and the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) agreed to active co-management on a set of 15 priority lakes within the 1842 Ceded Territory. Lake Emily is currently one of the priority lakes due to its use by tribal members as a location for spring spearing of

Walleye and its popularity among recreational anglers. Lakes on the priority list are surveyed annually each fall to evaluate Walleye recruitment and at least once every ten years during early spring to evaluate the adult Walleye population. There have been eight fall Walleye recruitment surveys completed between 2013-2023 and with the exception of 2013, all were considered poor year classes according to the older and newer standards (Table 3). The 2013 fall recruitment survey was classified as "low" using the northern Wisconsin metrics. Additional analysis of the 2013 recruitment class included evaluating the contribution of stocked versus naturally reproduced Walleye through the use of marking stocked Walleye with oxytetracycline (OTC). OTC results showed 69% of the fish analyzed were from MDNR stocking efforts and contributed a majority to the fishery.

In May 2018, a spring survey was conducted by GLIFWC in order to evaluate the adult Walleye population. Survey results estimated an adult Walleye density of 4.1 fish/acre and lengths ranged from 12-27 inches (Figure 3, Table 4). In May 2022, the MDNR led a survey to assess the adult Walleye population. Unfortunately, the nets were set too late and the results were ultimately unreliable. In April-May 2023, the MDNR conducted another adult Walleye population survey and the estimate density decreased substantially to 0.7 fish/acre and lengths ranged from 14-27 inches (Figure 3, Table 4). The 2018 length frequency data showed younger and smaller sized Walleye in the population, indicating recruitment was occurring at some level (Figure 3, Table 4). Whereas the length frequency data of the Walleye from the 2023 survey showed a population skewed towards older fish with no recent signs of recruitment (Figure 3, Table 4).

While there has not been a substantial increase in angler complaints in regard to the Walleye population on Lake Emily, the survey data between 2013-2023 shows a continued decline in recruitment, length range, and adult numbers (Tables 3 and 4). In an effort to improve Walleye numbers, a departure from alternate-odd year stocking occurred with an additional stocking event in 2022 (Table 2). In 2023, stocking occurred at twice the prescription rate (i.e., spring fingerlings were stocked at 100/acre instead of 50/acre).

Beginning in 2024, the stocking prescription changed to stocking larger fall fingerling Walleye as the priority life stage at a rate of 5/acre, biennially. This was done to try to increase survival rates of stocked Walleye. If fall fingerling Walleye are not available, then Lake Emily is stocked with spring fingerling at a rate of 50/acre, biennially.

Northern Muskellunge Management 1979-2023

As part of the management goal to maintain a Muskellunge population in Lake Emily, Muskellunge were stocked in 1987,1990, 1991, 1997 and 2001.

The Muskellunge population was considered fair and dependent on stocking until the early 1990s (Tables 5). By 1993, natural reproduction was occurring, and the population was considered to be doing well in numbers and size structure. During this time period, Lake Emily became a popular Muskellunge fishery for anglers to target.

A 2002 survey determined the Muskellunge population was still successfully naturally reproducing, and as time and resources allow, routine surveys should be completed to monitor any changes. Fall and spring surveys conducted between 2013-2023 confirm natural reproduction was consistent enough to provide a reliable Muskellunge fishery for anglers (Tables 5 and 6). Lake Emily's Muskellunge population during this time period was described as having a higher density with a smaller size structure. Anglers were typically able to catch an adult Muskellunge, but they tended to be what anglers considered small (e.g. 30-35 inch range).

Fish Community Survey

In order to better assess the overall fisheries community, which includes panfish and minnow species, surveys are often conducted in early summer. A variety of survey methods are utilized including seines, electrofishing, fyke nets and gillnets. These surveys do not target spawning Walleye or Northern Muskellunge, but rather a variety of all species present in Lake Emily. Consequently, results typically show more panfish and forage species rather than high numbers of predator fish (e.g. Walleye).

On June 3-7, 2002, a Status and Trends survey was completed on Lake Emily. Yellow Perch and Pumpkinseed were the most abundant fish species, followed by Bluntnose Minnows, Rock Bass, and Bluegill. Walleye (N=148) averaged 11.3 inches and ranged from 3-30 inches in length (Table 7). Eleven Walleye age classes were confirmed in the population, indicating a robust population (Table 8). Eight of the year classes coincided with a stocking year. Growth rates were relatively good compared to other waterbodies in the western Upper Peninsula at 0.4 inches below the state average (Table 8).

Current status of the fish community
Surveys were completed by staff from the Northern Lake Michigan Management Unit (NLMMU) on Lake Emily between February 22, 2024-September 23, 2024. Each of the survey's methods and results are described below. An additional summer limnology was conducted on August 19, 2025.

Methods and Results

Winter Limnology Survey
On February 22, 2024, a winter limnology survey was conducted that recorded temperature (°F), oxygen (ppm), pH, and specific conductance (µS/cm). Temperatures increased slightly with depth with 35.0°F at the surface to 40.4°F at 30 feet of depth (Table 9). Oxygen levels were sufficient for fish survival between the surface (13.5ppm) to 24 ft. (4.7ppm). Oxygen levels quickly depleted to 0ppm at 29 feet. (Table 9). The pH levels hovered between 6-7 throughout the water column, which was considered slightly acidic but still conducive for fish survival (Table 9). Specific conductance was between 301-445 µS/cm which is within the normal range of dissolve salts in an inland lake (Table 9).

Status and Trends Survey
A Status and Trends survey was completed from June 3-13, 2024. Surface water temperatures ranged from 66.5-68.3°F. Survey methods included deployment of two small mesh fyke net (4 NN), three (3) large mesh fyke nets (9 NN), four (4) seine hauls, two (2) experimental gillnets (4 NN), three 10-minute electrofishing transects (all fish species), and electrofishing for one (1) hour and seven (7) minutes to survey the remaining shoreline (gamefish only). In addition to the collection of biological data, staff surveyed habitat features including the number of dwellings, docks, submerged logs, and distance of armored shoreline (i.e. riprap and seawalls). The habitat and limnology surveys were completed on July 31 and August 1, 2024, respectively.

A total of 2,982 fish were captured during the Status and Trends survey efforts. Species captured included Black Crappie, Bluegill, Bluntnose Minnow, Common Shiner, Fathead Minnow, Golden Shiner, Horneyhead Chub, Hybrid Sunfish, Largemouth Bass, Northern Muskellunge, Northern Pike, Pumpkinseed, Rock Bass, Smallmouth Bass, Tadpole Madtom, Walleye, and Yellow Perch (Table 10). In terms of the number captured during the survey, Pumpkinseed were the most abundant (comprising 51% of the total catch), Yellow Perch were second at 24%, and Bluegill were third at 7% (Table 10). In terms of biomass captured during the survey, Northern Muskellunge comprised 38% of the catch, followed by Yellow Perch at 22% and Pumpkinseed at 17.5% (Table 10).

Pumpkinseed (N=1,529) were the most abundant species captured during the survey. Pumpkinseed averaged 4.1 inches in length and ranged from 3-5 inches in length with 0% of the catch meeting or

exceeding the acceptable size for harvest of 6 inches (Tables 10,11). Age analysis indicated ages 1-5 present in the population and the mean growth index was considered average at 0.3 inches below the state average (Table 12). Growth for prey fish species is considered average if the mean growth index is within 0.5 inches above or below the state average.

Yellow Perch (N=710) averaged 6.9 inches in length and ranged from 2-10 inches in length with 42% of the catch meeting or exceeding the acceptable size for harvest of 7 inches (Tables 10,11). Age analysis indicated ages 1-10 present in the population and the mean growth index was considered poor at 1.7 inches below the state average (Table 12).

Bluegill (N=213) averaged 5.4 inches in length and ranged from 2-7 inches in length with 5% of the catch meeting or exceeding the acceptable size for harvest of 6 inches (Tables 10,11). Age analysis indicated ages 2-5 present in the population and the mean growth index was considered average at 0.5 inches below the state average (Table 12).

Rock Bass (N=173) averaged 4.8 inches in length and ranged from 3-7 inches in length with 3% of the catch meeting or exceeding the acceptable size for harvest of 6 inches (Tables 10,11). No age analysis was conducted for the collected Rock Bass.

Walleye (N=21) averaged 15.0 inches in length and ranged from 7-24 inches in length with 38% of the catch meeting or exceeding the legal size for harvest of 15 inches (Tables 8,10,11). Age analysis indicated ages 1-3, 7 and 9 present in the population and the mean growth index was considered average at 0.4 inches below the state average (Table 12). Generally speaking, growth for predator fish species is considered average if the mean growth index is within 1.0 inches above or below the state average. However, growth rates for predator fish species in the western Upper Peninsula (U.P.) are even slower compared to state averages, mainly due to climate (i.e. colder for longer periods). For many western U.P. lakes, the mean growth index can be between 1.5-2.0 inches below the state average.

Northern Muskellunge (N=16) averaged 34.4 inches in length and ranged from 30-41 inches in length with 0% of the catch meeting or exceeding the legal size of harvest of 42 inches (Tables 10,11,13). Age analysis indicated ages 5-12 present in the population (Table 12). An insufficient number of samplers were collected therefore a mean growth index was not calculated.

The shoreline habitat survey consisted of 15 1,000-foot segments that totaled 3.2 miles sampled. Lake Emily was found to have 13 docks/mile, 14 dwellings/mile, 380 submerged trees/mile (Figure 4), and 6.7% armored shoreline (Figure 5). The highest density of submerged trees was along the north shoreline (Figure 4). The highest propensity of armored shorelines occurred mainly near the center shoreline on both sides of the lake (Figure 5).

Summer limnology profiles were recorded on August 1, 2024 and August 19, 2025. Temperature, oxygen, pH, Secchi depth, and specific conductivity were recorded for both years. Water chemistry analysis was also performed in 2024 that included Alkalinity ($CaCO_3$), Chlorophyll a, Ammonia-N, Nitrate + Nitrite, Total Kjeldahl Nitrogen, and Total Phosphorus. The 2024 water temperature ranged from 77.4° at the surface to 74.2°F at 13 feet and decreased steadily with depth to 59.8°F at 28 ft. (Table 1). Oxygen levels were around 9ppm from the surface down to 11ft, then declined precipitously to 3.8ppm at 16 ft (Table 1). Oxygen levels reached 0ppm at 18ft. of depth (Table 1). There were suitable oxygen levels for Walleye survival from 0-15 ft. of depth. Specific conductivity was between 259-276 µS/cm throughout the water column which is within the normal range for dissolved salt content for inland lakes. Secchi depth was recorded at 10 ft. The pH was within the suitable range for fish survival between 7-8 throughout the water column. Water chemistry results

were 120 mg/L Alkalinity ($CaCO_3$), 15 µg/L Chlorophyll a, 0.034 mg/L Ammonia-N, 0.004 mg/L Nitrate + Nitrite, 1.03 mg/L Total Kjeldahl Nitrogen, and 0.02 mg/L Total Phosphorus. The Chlorophyll a levels were considered high and indicate increased algal abundance. The 2025 water temperature ranged from 71.4°F at the surface to 68.3°F at 17 feet and decreased steadily with depth to 54.4° at 30 ft. (Table 1). Oxygen levels were around 7ppm from the surface to 11ft, then declining to 3.72ppm at 17 ft. (Table 1). Oxygen levels were less than 1 ppm beginning at a depth of 18 ft. (Table 1). Specific conductivity ranged between 266-327 µS/cm throughout the water column. Secchi depth was recorded at 9 ft. and the pH was between 7-8 throughout the water column.

Fall Recruitment Survey
On September 23, 2024, a fall Walleye recruitment survey was completed by staff electrofishing the entire shoreline of Lake Emily (3.2 miles). The water temperature was 67°F during the survey effort. Only Walleye and Northern Muskellunge were captured and recorded.

Walleye (N=25) averaged 14.1 inches and ranged from 10-26 inches in length with 16% of the catch meeting or exceeding the legal size for harvest of 15 inches (Table 3). Ages 1 and 2 were confirmed as present and a calculated mean growth index of 2 inches above state average, indicating good growth. No age-0 Walleye were confirmed in the survey.

Northern Muskellunge (N=3) averaged 23.8 inches and ranged from 18-33 inches in length with 0% of the catch meeting or exceeding the legal size for harvest of 42 inches. No aging structures were obtained to calculate a mean growth index.

Analysis and Discussion

Comparing Lake Emily to lakes across the State of Michigan, Lake Emily has a higher rate of docks per mile, dwellings per mile and submerged trees per mile (Wehrly et al. 2015). Lake Emily is considered average for percent shoreline armored (6.7% altered shoreline). The surrounding wetlands around Lake Emily likely inhibit shoreline development. However, lakefront property owners should be made aware of the potential impacts that shoreline alteration can have on fish populations. A recent study evaluated shoreline development and Walleye recruitment that showed with an increase in shoreline development there is a decrease in young-of-year Walleye survival (Ziegler et al. 2017). Lakes with a high density of development had a higher dependence on stocking; in particular larger, more expensive fingerlings. Shoreline modification of 25% or less is recommended to provide reasonable owner access and recreational use, while preserving ecological integrity, sustaining natural resources for future generations, and protection the public trust (O'Neal and Soulliere 2006).

Bluegill can play a key role in community structure and overall sport fishing quality in Michigan waters (Schneider 1981). Schneider (1990) suggests indices of Bluegill characteristics can be used to classify populations. The "Schneider Index" uses size scores of length frequency and growth data and relates them to an adjective ranking system ranging from "very poor" to "superior". Using the Schneider Index for classifying Bluegill populations, Lake Emily scored a 1.5 for fyke net metrics and a 2.5 for electrofishing metrics for a combined ranking of "poor". The Bluegill catch-per-unit effort (CPUE) increased by nearly 150% between 2002 and 2024 (Table 14). In 2002, the CPUE for Bluegill captured in large mesh fyke nets was 8.2 per net which is close to average compared to the average CPUE statewide (Table 14, Wehrly et al. 2015). The most recent CPUE calculated in the 2024 survey was 20.4 Bluegill per net which puts the population above average (Table 14).

Pumpkinseed have seen the most substantial increase from 30 per net (2002, Table 14) to 162 fish per net (2024, Table 14). Yellow Perch also have increased during this time period from 28 fish per net to

55 fish per net (Table 14). Black Crappie have declined from 4 fish per net to less than one fish per net during that same time period (Table 14).

Largemouth Bass, Smallmouth Bass, Northern Pike, and White Sucker remain at low densities and changed very little in terms of catch per unit effort (Table 14). Although, technicians did observe White Suckers during the electroshocking runs, so their numbers may be higher than what was captured during the netting survey.

The Northern Muskellunge population is showing possible indications of a decline. In the 2002 Status and Trends survey Northern Muskellunge captured ranged from 11-39 inches (Table 13). Whereas the 2024 Status and Trends survey did not capture any juvenile Northern Muskellunge (Table 13). It should be noted however that there was more survey effort in terms of net nights in 2002 (NN=30) compared to 2024 (NN=9). Their growth rates from the 2024 Status and Trends survey were substantially lower compared to statewide averages, ranging between 3-11 inches below average, indicating competition for forage resources among the population (Table 12). The lack of available forage could be impacting successful natural reproduction. The robust numbers of panfish could be impacting Muskellunge natural reproduction via predation of Muskellunge eggs or newly hatched fry. Lake Emily has had a reputation of having a robust Northern Muskellunge population, so further evaluation of the population should be completed as soon as possible.

The estimated density of 0.7 Walleye/acre from the 2023 population estimate is a substantial decline from the previous estimate of 4.1 Walleye/acre in 2018. Between the 2002 and 2024 Status and Trends surveys, the CPUE decreased by nearly 79% for Walleye captured in fyke nets (Table 14) and 90% for Walleye captured by electrofishing, and representative age classes decreased from 11 to 5 (Table 12). Results from the 2023 and 2024 fall recruitment surveys reveal some level of survival of stocked Walleye and/or natural reproduction; however, the level of recruitment remains very low and doubling the stocking density in 2023 does not appear to have produced a notably better year-class (Tables 2,3). It should be noted that the 2024 fall recruitment survey was conducted prior to the stocking of fall fingerlings. While historical stocking efforts in Lake Emily have maintained a popular Walleye fishery, it appears that changes have occurred that are inhibiting the adult population and reducing survival of young Walleye.

Michigan has a lake classification system that factors in lake habitat characteristics and the fish community (Wehrly et al. 2012). Lake Emily is a Class 3 lake because of its low degree days, low mean temperature, larger surface area, and availability of deeper water. Class 3 lakes are considered to be the most suitable for Walleye and are thought to be able to buffer impacts to climate change (Herbst et al. 2022). This classification system is useful in how it can inform managers of what can be expected in lakes based on a set criteria. However, it does not account for Secchi depth (a measure of water clarity and indirect measurement of production), shoreline development, or density of aquatic vegetation. A recent analysis of Walleye habitat studies in Midwest inland lakes indicated Walleye prefer water clarity (via Secchi depth measurements) to be less than 10 feet (Raabe 2020). Secchi depths have increased slightly over time with the most recent readings at 9-10 feet (Table 1). Lake Emily also has a higher density of docks and homes around the shoreline compared to other lakes across the state. Shoreline development can inhibit Walleye recruitment in Lake Emily if it continues to expand further around the perimeter of the lake.

The density of aquatic vegetation and its impacts to Walleye recruitment success has recently been analyzed for Wisconsin and Minnesota Lakes (Dr. Robert Davis, University of Wisconsin-Madison, Wisconsin American Fisheries Society 2025 Annual Meeting). The results showed Walleye CPUE decreased dramatically once the littoral vegetation density reached 50%, even causing year class

failures in many cases. Less than 10 young-of-year per mile is considered a poor year class in Wisconsin (Dr. Robert Davis, UW-M, WIAFS 2025 Annual Meeting). Lake Emily has a history of abundant aquatic vegetation, but no quantitative studies have analyzed any changes over time. Anecdotally, residents on Lake Emily deploy a boat harvester that collects curly-leaf pondweed and other perceived nuisance aquatic vegetation from the lake. While this does solve temporary boat navigation issues, weed harvesters have shown to spread curly-leaf pondweed even further around the lake just from small plant fragments.

The shoreline development index (SDI) is another important factor when predicting juvenile Walleye numbers in Michigan lakes (Bopp et al. 2023). The SDI is calculated by using measures of lake perimeter, lake surface area, and lake mean depth. The CPUE for juvenile Walleye is expected to be higher when the SDI is less than 2 (less shoreline irregularity). Essentially, the more circular a lake is, the higher the expected juvenile CPUE. The SDI for Lake Emily is 1.3, which indicates Walleye recruitment should be higher.

Walleye prefer water temperatures between 64°F-75°F, oxygen levels ≥5ppm and a Secchi disk reading depth of less than 10 feet (Raabe 2020). The summer limnology results from August 1, 2024, showed the area where Walleye preferred temperatures, suitable oxygen levels and Secchi depth (<10 feet) co-occurred were limited to a bandwidth of 5 feet between 11-15 ft. of depth (Table 1). Lethal oxygen levels were observed beginning at a depth of 17ft, so if Walleye are to survive, they cannot stay in those depths that provide suitable light and temperature conditions for extended periods of time. The 2025 summer limnology results showed similar trends in that suitable oxygen, temperatures, and Secchi depths were between 10-16 feet of depth (Table 1). However, in 2025 oxygen levels were 2ppm lower in the upper portions of the water column compared to previous years (Table 1). It is currently unclear what the cause was of decreased oxygen levels. The 2025 water temperatures were higher at greater depths compared to the 2002 limnology survey (Table 1). For example, at 15 feet in 2002 and 2025, the water temperatures were 67.6°F and 70.7°F, respectively (Table 1). The same trend was observed in 2024, however that survey occurred at the beginning of August instead of the end of August (Table 1). If summer temperatures continue to extend into September or October, Walleye could have even less suitable habitat in the future. Therefore, summer limnology surveys should continue on Lake Emily as time and resources allow.

Certain water quality parameters have changed from the August 29, 2002, sampling and the August 1, 2024, sampling (Table 15). It should be noted the one month discrepancy in sample timing and its timing could influence readings however, the differences are worth discussing. Alkalinity has decreased slightly over time and should be monitored (Table 15). Buffering capacity is an important feature of any lake to counter any atmospheric acid rain inputs. The Chlorophyll a levels nearly doubled from 8.5µg/L to 15 µg/L indicating eutrophic conditions were present and conducive to algae outbreaks. However, Ammonia-N, Nitrate + Nitrite, Total Kjeldahl Nitrogen and total Phosphorus levels were considered to be in low concentrations for both years which could help limit any excessive algae growth (Table 15). Levels did increase for Ammonia-N and Total Kjeldahl Nitrogen, although levels were still considered to be at low concentrations (Table 15).

In the Ceded Territory of Wisconsin, it has been well documented that Walleye populations are in a decline for naturally reproducing, stocked or a combination of both in northern Wisconsin lakes and that harvest rates have remained stable despite those declines (Mrnak et al. 2024). The Wisconsin DNR partners with Tribal Governments to obtain inland lakes creel data that provides essential data on harvest (recreational and tribal). The Michigan DNR does not have a similar inland creel program, therefore it cannot be concluded for certain that overharvest is occurring on Lake Emily. However,

given the trends in northern Wisconsin and similar angling habits in the western Upper Peninsula, it is not out of the realm of possibility that harvest is outpacing Walleye production in Lake Emily.

Lake Emily is currently projected to provide suitable habitat for Walleye through the year 2050, although it is considered to have a high vulnerability to climate change (Midwest Glacial Lakes Partnership). Unfortunately, Lake Emily is exhibiting changing biotic and abiotic conditions that are potentially impacting the Walleye population today. If general warming trends continue, suitable Walleye habitat in Lake Emily could be insufficient to sustain a healthy Walleye population and in turn, an attractive fishery for anglers. The Michigan DNR recognizes the social importance that Walleye have for anglers and has stocked Walleye above the recommended rates in recent years in order to boost survival (Table 2). However, management decisions (e.g. stocking) for Lake Emily are largely constrained by the biological and ecological factors currently present (i.e. amount of suitable habitat, increased panfish population). This is not unique to only Lake Emily or the Upper Peninsula. The State of Wisconsin has seen similar patterns of decline that, so far, have been largely out of managers' control and therefore adopted a new method that will help guide management directions into the future. The Resist-Accept-Direct framework (RAD) is a system designed to categorize lakes together based on similar attributes (temperature, fish community and water clarity) and how they relate to current management strategies and use these categories to adapt for future conditions (Feiner et al. 2022, Dassow et al 2022). Briefly, the "resist" category can be described as managing a lake for historical and current conditions (e.g. stocking). The "accept" category is acknowledging that change is occurring and allow lakes to evolve into a new community naturally (e.g. no stocking). The last is "direct", which is managing for a fishery that is projected to be most suitable in the future (e.g. directly managing for warmwater fisheries rather than coldwater). Utilizing the RAD Framework will help guide fisheries managers into the future, but knowledge of local lake conditions should also be considered in the decision-making process (Dassow et al. 2022).

The current fish community of Lake Emily can be described as follows:

1. A panfish community dominated by Pumpkinseed, Yellow Perch and to a lesser extent Bluegill and Rock Bass.
2. Northern Pike, Largemouth Bass, and Smallmouth Bass are present in low densities.
3. A Northern Muskellunge population that has consistent natural reproduction, a smaller size structure and a higher density compared to other lakes managed for Muskellunge.
4. A diverse minnow community.
5. A Walleye population that is currently in decline with very little natural reproduction, if any, occurring, and minimal stocking success for at least 10 years.
6. During extended warm summers, suitable oxygen and temperature levels may be inhibiting fish survival.

Management Direction

Current

The Michigan DNR Fisheries Division's Northern Lake Michigan Management Unit recommends continuing Walleye stocking at the current rate of 5 fall fingerlings per acre or 50 spring fingerlings per acre every other year. Strong consideration should be given to allow for additional stocking events if resources allow. Fall young-of-year surveys should continue into the foreseeable future. Currently, Lake Emily's stocking prescription is valid through 2034. If stocking efforts do not produce a Walleye

population of at least 1.5 adult per acre, management efforts should switch to the "accept" and "direct" options listed above.

Goals and expectations

1. One of the goals for Lake Emily is to maintain the areas of undeveloped shoreline. Natural shorelines often contribute to large woody debris, thus providing cover that helps protect fish during critical life stages (i.e., predation while young). Conversely woody debris can provide cover for ambush predators such as Northern Muskellunge. Additionally, native aquatic vegetation should be preserved to protect spawning habitat and provide protection for prey fish species.
2. A May survey that evaluates the Northern Muskellunge population in Lake Emily should be conducted as soon as time and resources allow.
3. Another winter limnology should be conducted due to the above average air temperatures observed over the 2024 winter. Air temperatures were in the 50's and there was less than 10" of ice on the lake and little to no snow cover.
4. Lake Emily has seen a shift in the Walleye population that so far has been out of the managers' ability to change (despite increased stocking densities and frequency). Following the RAD Framework, the following are options managers should discuss with Tribal Partners and the angling community:
    a. Resist: Continue stocking at the current rate of 5 fall fingerlings per acre or 50 spring fingerlings per acre every other year,
    b. Accept: Discontinue stocking of Walleye and accept Lake Emily no longer supports a healthy Walleye population either from stocking efforts or natural reproduction,
    c. Direct: Focus on management efforts toward a balanced fishery that prioritizes warmwater fish species, specifically Bluegill and Pumpkinseed.

Obstacles to attainment of goals

A potential obstacle reaching Goal #1 would be lake property owners who wish to develop the land and remove the trees and plants from the water's edge. Riparian owners should also reconsider utilizing a weed harvester on Lake Emily. While a harvester does increase boat navigation in the short term, it's likely to increase the aquatic plant community to even higher densities. The riparian owner's education to the benefits of a natural shoreline is critical in reaching this goal.

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Tables and Figures

Table 1: Limnology results for Lake Emily, Iron County, Michigan taken between 2002-2025 that included water temperature (°F) and oxygen (ppm). Data taken from DNR Fisheries Division records.

Depth (ft.)	August 29, 2002 Temperature (°F)	August 29, 2002 Oxygen (ppm)	September 8, 2015 Temperature (°F)	September 8, 2015 Oxygen (ppm)	August 24, 2022 Temperature (°F)	August 24, 2022 Oxygen (ppm)	August 1, 2024 Temperature (°F)	August 1, 2024 Oxygen (ppm)	August 19, 2025 Temperature (°F)	August 19, 2025 Oxygen (ppm)
0			75.6	9.9	73.8	9.74	77.4	9.1	71.4	7.28
1					73.8	9.74	77.7	9.2	71.5	7.22
2			74.6	10.44	73.8	9.7	77.6	9.24	71.4	7.28
3	71.6	12.56			73.8	9.76	77.3	9.61	71.5	7.23
4			74	10.48	73.8	9.73	76.4	9.75	71.5	7.24
5					73.8	9.72	76.2	9.55	71.5	7.18
6	70.8	9.71	73.9	10.26	73.8	9.66	76	9.56	71.6	7.11
7					73.8	9.78	75.8	9.39	71.6	7.17
8			71.9	7.2	73.8	9.61	75.6	9.31	71.6	7.18
9	69.5	7.72			73.8	9.57	75.7	9.37	71.6	7.21
10			70.4	4.56	73.8	9.15	75.5	9.19	71.7	7.1
11					73.3	7.95	75.3	9.8	71.5	7.04
12	68.6	5.82	67.4	3.1	72.3	7.51	74.9	8.83	71.5	6.91
13					71.5	6.97	74.2	6.16	71.5	6.52
14			65.9	1.98	70.6	4.7	73.9	6.13	71	5.9
15	67.6	4.47			69.7	2.32	73.2	5.3	70.7	5.47
16			64.7	1.14	69.3	1.28	72.5	3.83	70.4	5.93
17					69	0.73	70.8	1.77	68.3	3.72
18	66.2	1.71	64	0	67.8	0	70.1	0	66.7	0.63
19					66.8	0	68.4	0	63.3	0.19
20			63.4	0	65.6	0	67	0	61.4	0.25
21	60.4	0.94			63.3	0	65.5	2.09	59.8	0.08
22			62.9	0	62.6	0	65	0	59.6	0.03
23					61	0	62.9	0	57.4	0.01

Depth (ft.)	August 29, 2002 Temperature (°F)	August 29, 2002 Oxygen (ppm)	September 8, 2015 Temperature (°F)	September 8, 2015 Oxygen (ppm)	August 24, 2022 Temperature (°F)	August 24, 2022 Oxygen (ppm)	August 1, 2024 Temperature (°F)	August 1, 2024 Oxygen (ppm)	August 19, 2025 Temperature (°F)	August 19, 2025 Oxygen (ppm)
24	57.5	0.67	62.5	0	58.7	0	61.8	0	56.9	0.01
25					57.7	0	60.8	0	56	0.01
26	56.7	0.3	62.3	0	56.9	0	60.4	0	55.3	0
27	56.4	0.4			56.6	0	60.2	0	55.1	0
28			61.7	0	56	0	59.8	0	54.9	0
29					55.6	0			54.6	0
30			61	0					54.4	0

August 29, 2002	September 8, 2015	August 24, 2022	August 1, 2024	August 19, 2025
Secchi depth 8 ft.	Secchi depth 5.5 ft.	Secchi depth 8ft.	Secchi depth 10ft.	Secchi depth 9ft.

Table 2: History of stocking in Lake Emily, Iron County, Michigan from 1927-2024. Data taken from DNR, Fisheries Division records.

Species	Year	Number	Life Stage or Average Length (inches)	Rate (# of fish/acre)
Walleye	1927	50,000	unknown	156
Lake trout	1932	4,250	5 month	13
Lake trout	1932	7,000	4 month	22
Lake trout	1933	5,000	4 month	16
Largemouth bass	1934	200	4 month	1
Lake trout	1935	5,400	7 month	17
Yellow perch	1935	3,000	7 month	9
Smallmouth bass	1936	200	4 month	1
Bluegill	1937	4,000	4 month	13
Largemouth bass	1938	300	3 month	1
Largemouth bass	1938	300	4 month	1
Bluegill	1938	8,000	4 month	25
Walleye	1940	400,000	fry	1250
Bluegill	1942	5,000	4 month	16
Smallmouth bass	1943	1,000	4 month	3
Walleye	1971	250,000	fingerlings	781
Muskellunge	1972	963	fingerlings	3
Muskellunge	1975	1,789	fall fingerlings	6
Muskellunge	1976	1,912	spring fingerlings	6
Muskellunge	1978	98	adult	0.3
Muskellunge	05/09/1979	126	32.6	0.4
Walleye	07/21/1979	12,000	2.6	38
Walleye	07/17/1980	16,000	2.0	50
Walleye	07/07/1983	17,840	2.1	56
Walleye	07/03/1985	16,500	1.8	52
Walleye	06/21/1987	9,346	2.0	29
Walleye	06/26/1987	5,827	2.0	18
Muskellunge	07/08/1987	728	4.6	2
Muskellunge	07/15/1987	572	6.2	2
Walleye	06/30/1989	16,000	2.0	50
Muskellunge	10/26/1990	164	11.0	1
Walleye	06/28/1991	20,387	2.0	64
Muskellunge	10/15/1991	29	17.9	0.9
Walleye	06/30/1993	12,000	1.4	38
Walleye	06/22/1995	5,647	2.0	18
Walleye	06/25/1995	652	2.0	2

Species	Year	Number	Life Stage or Average Length (inches)	Rate (# of fish/acre)
Walleye	07/01/1995	8,028	2.0	25
Walleye	07/07/1997	16,064	2.0	50
Muskellunge	09/12/1997	700	10.5	2
Walleye	06/15/1999	15,360	1.4	48
Walleye	06/27/2001	16,000	1.5	50
Muskellunge	10/17/2001	556	12.2	2
Walleye	09/22/2003	16,000	1.5	50
Walleye	07/12/2005	17,500	2.2	55
Walleye	06/22/2011	16,777	1.7	52
Walleye	06/11/2012	13,373	2.0	42
Walleye	07/04/2013	5,000	1.9	16
Walleye	07/09/2013	7,613	2.6	24
Walleye	07/10/2013	3,700	2.0	12
Walleye	06/23/2015	16,000	1.4	50
Walleye	06/21/2017	16,559	1.8	52
Walleye	06/26/2019	17,000	1.6	53
Walleye	06/17/2021	11,477	1.7	36
Walleye	06/18/2021	7,154	1.7	22
Walleye	06/30/2022	14,101	2.4	44
Walleye	06/28/2023	31,950	1.6	100
Walleye	10/08/2024	1,572	4.3	5
Walleye	06/26/2025	15,800	1.7	49

Table 3: Lake Emily, Iron County, Michigan, fall Walleye recruitment survey results including catch per mile for Age-0 and Age-1 Walleye, whether it coincided with a stocking year, total distance of shoreline surveyed, water temperature, and qualitative year class rating based on Hansen 2012 and Gilbert and Hennessy 2014. Data taken from DNR, Fisheries Division records.

Date	Agency	# Wae Age-0	Catch per mile Age-0[1]	# Wae Age-1	Catch per mile Age-1[2]	Stocking Year?	Shoreline Surveyed (mi.)	Water Temperature (°F)	Qualitative Rating (Age-0)
09/29/1981	MDNR	14	8.0	9.0	5.1	No	1.75	52	low
09/12/1991	MDNR	89	27.8	0	0.0	Yes	3.2	67	good
09/28/1993	MDNR	26	8.1	37	11.6	Yes	3.2	-	low
09/11/1995	MDNR	254	79.4	55	17.2	Yes	3.2	-	very high
09/12/2005	GLIFWIC	14	4.4	6	1.9	Yes	3.2	75	poor
09/23/2013	MDNR	29	6.2	12	2.6	Yes	4.7	60	low
10/13/2016	GLIFWIC	0	0	7	2.2	No	3.2	53	poor
10/08/2018	GLIFWIC	0	0	12	3.8	No	3.2	53	poor
09/24/2019	MDNR	9	2.8	3	0.9	Yes	3.2	66	poor
09/29/2020	MDNR	0	0	5	1.6	No	3.2	56	poor
09/21/2021	MDNR	3	0.9	1	0.3	Yes	3.2	60	poor
09/27/2022	MDNR	6	1.9	5	1.6	Yes	3.2	54	poor
10/02/2023	MDNR	9	2.8	11	3.4	Yes	3.2	64	poor
09/23/2024	MDNR	0	0	14	4.4[3]	Yes[4]	3.2	67	poor

[1]Age-0: 5-9 inch Walleye, [2]Age-1: 10-12 inch Walleye, [3]Age-1: Walleye were 11-12 inches for this year, [4]Stocked fall fingerling.

Table 4: Total catch by length range of Walleye collected from Lake Emily, Iron County, Michigan in April 1988, May 2018, and April/May 2023. Data taken from DNR, Fisheries Division records.

Inch	1988	2018	2023
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	1	0	0
12	18	1	0
13	19	13	0
14	22	60	1
15	48	63	8
16	16	40	17
17	18	20	21
18	23	10	17
19	27	11	20
20	21	10	31
21	17	13	13
22	7	7	10
23	2	3	8
24	7	3	9
25	2	4	5
26	1	1	0
27	0	2	2
28	0	0	0

Table 5: Fall survey results ranging from 1981-2024 for Northern Muskellunge (MUS) including number, length range, method, and effort level on Lake Emily, Iron County. Data taken from DNR Fisheries Division records.

Date	MUS	Length Range (in.)	Method	Effort (hrs.)
09/29/1981	2	28-30	Electroshocking	1.7
09/12/1991	8	9-25	Electroshocking	2
09/28/1993	24	8-21	Electroshocking	2.2
09/11/1995	31	7-35	Electroshocking	2.3
09/23/2013	13	26-39	Electroshocking	2.8
10/13/2016	0	-	Electroshocking	1.2
09/29/2020	6	31-36	Electroshocking	1.5
10/02/2023	13	26-45	Electroshocking	1.4
09/23/2024	3	18-33	Electroshocking	1.3

Table 6: Spring survey results ranging from 1988-2022 for Northern Muskellunge (MUS) including number, length range, method, and effort level on Lake Emily, Iron County. Data taken from DNR Fisheries Division records.

Date	MUS	Length Range (in.)	Method	Effort (hrs., NN)
04/21/1988	1	38	Fyke	15
05/25/1988	7	10-13	Electroshocking	2.4
05/12/2003	15	25-40	Fyke	16
05/27/2014	13	26-40	Fyke	17
05/04/2022	56	27-40	E, Fyke	3, 54

Table 7: Total catch by length range of Walleye collected from Lake Emily, Iron County, Michigan in June 2002 and June 2024. Data taken from DNR, Fisheries Division records.

Inch	2002 Walleye	2024 Walleye
0	0	0
1	0	0
2	0	0
3	2	0
4	0	0
5	0	0
6	10	0
7	62	2
8	25	1
9	0	1
10	0	1
11	2	4
12	1	0
13	3	2
14	2	2
15	3	0
16	2	0
17	6	0
18	4	1
19	9	3
20	6	0
21	1	2
22	4	0
23	2	0
24	1	2
25	1	0
26	0	0
27	0	0
28	1	0
29	0	0
30	1	0

Table 8: Weighted mean length (inches) at age and growth relative to the state average for Walleye sampled in June 2002, May 2014 and June 2024 from Lake Emily, Iron County, Michigan. The number of fish aged is in parentheses. Data taken from DNR, Fisheries Division records.

Date of Survey	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Mean growth index[1]
June 2002		7.6 (28)*		13.5 (8)*	16.1 (4)	18.2 (14)*	19.9 (2)	20.8 (11)*	21.1 (3)	21.9 (2)*		22.9 (2)*		24.7 (2)*		28 (1)*	-0.4
May 2014			13.6 (1)*		18.3 (5)					23.0 (2)*	23.4 (6)	26.7 (2)*	24.9 (3)	24.9 (2)*			+1.4
June 2024		8.3 (5)*	11.1 (4)*	13.6 (5)*		19.8 (1)*		24.3 (2)*		26.0 (1)*							-0.4

[1]Mean growth index is the average deviation from the state average length at age.
*Coincides with a stocking year.

Table 9: Winter limnology results taken on Lake Emily, Iron County, Michigan on February 22, 2024, that included temperature (°F), oxygen (ppm), pH, and specific conductance (µS/cm). Data taken from DNR Fisheries Division records.

Depth	Temperature (°F)	Oxygen (ppm)	pH	Specific Conductance (µS/cm)
0	35.0	13.5	7.8	318
3	37.5	13.6	7.5	309
6	39.6	13.1	7.3	312
9	40.0	11.7	7.1	319
12	39.8	9.2	6.9	318
15	39.7	8.8	6.9	322
18	39.1	8.2	6.8	333
21	38.7	7.4	6.7	354
24	38.9	4.7	6.6	368
25	39.1	2.6	6.6	371
26	39.2	2.4	6.5	384
27	39.5	2	6.5	389
28	39.7	1.3	6.4	398
29	40.0	0	6.3	445
30	40.4	0	6.3	442

Table 10: Number, length, and percentages of fishes collected from Lake Emily, Iron County, Michigan in June 2024. Data taken from DNR, Fisheries Division records.

Common Name	Scientific Name	Number	Total weight (lbs.)	Average length (in.)	Percent of catch by number	Percent of catch by weight	Percent legal or acceptable size
Black Crappie	*Pomoxis nigromaculatus*	10	5.0	9.0	0.3	1.1	60(≥7")
Bluegill	*Lepomis macrochirus*	213	24.5	5.4	7.0	5.2	23 (≥6")
Bluntnose Minnow	*Pimephales notatus*	117	0.7	2.6	4.0	0.2	-
Common Shiner	*Luxilus cornutus*	14	1.2	5.6	0.5	0.3	-
Fathead Minnow	*Pimephales promelas*	1	0.0	3.5	0.0	0.0	-
Golden Shiner	*Notemigonus crysoleucas*	85	3.9	4.8	3.0	0.8	-
Horneyhead Chub	*Nocomis biguttatus*	1	0.0	4.5	0.0	0.0	-
Hybrid Sunfish	-	11	1.3	5.3	0.4	0.0	18 (≥6")
Largemouth Bass	*Micropterus salmoides*	5	6.2	11.9	0.2	1.3	20 (≥14")
Northern Muskellunge	*Esox masquinongy*	16	179.4	34.4	0.5	38.4	0 (≥42")
Northern Pike	*Esox lucius*	1	5.2	28.5	0.0	1.1	100 (≥24")
Pumpkinseed	*Lepomis gibbosus*	1529	81.7	4.1	51.0	17.5	0 (≥6")
Rock Bass	*Ambloplites rupestris*	173	14.5	4.8	6.0	3.1	3 (≥6")
Smallmouth Bass	*Micropterus dolomieu*	5	7.9	13.3	0.2	1.7	60 (≥14")
Tadpole Madtom	*Noturus gyrinus*	70	1.7	3.6	2.4	0.4	-
Walleye	*Sander vitreus*	21	32.1	15.0	0.7	6.9	38 (≥15")
Yellow Perch	*Perca flavescens*	710	102.2	6.9	24.0	22.0	42 (≥7")

Table 11: Total catch by length of select fish species collected from Lake Emily, Iron County, Michigan in June 2024. Data taken from DNR Fisheries Division records.

Inch	Black Crappie	Bluegill	Largemouth Bass	Northern Muskellunge	Pumpkinseed	Rock Bass	Smallmouth Bass	Walleye
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	0	**8**	0	0	0	0	0	0
3	0	**2**	**1**	0	**709**	**21**	0	0
4	0	**51**	0	0	**772**	**93**	0	0
5	**1**	**102**	0	0	**48**	**53**	0	0
6	**3**	**45**	0	0	0	**5**	**1**	0
7	0	**5**	0	0	0	**1**	0	**2**
8	**1**	0	0	0	0	0	0	**1**
9	0	0	0	0	0	0	0	**1**
10	**2**	0	0	0	0	0	**1**	**1**
11	**2**	0	**1**	0	0	0	0	**4**
12	**1**	0	0	0	0	0	0	0
13	0	0	**2**	0	0	0	0	**2**
14	0	0	0	0	0	0	0	**2**
15	0	0	0	0	0	0	**2**	0
16	0	0	0	0	0	0	0	0
17	0	0	**1**	0	0	0	0	0
18	0	0	0	0	0	0	**1**	**1**
19	0	0	0	0	0	0	0	**3**
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	**2**
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	**2**
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	**2**	0	0	0	0
31	0	0	0	**2**	0	0	0	0
32	0	0	0	0	0	0	0	0
33	0	0	0	**3**	0	0	0	0
34	0	0	0	**5**	0	0	0	0
35	0	0	0	0	0	0	0	0
36	0	0	0	**1**	0	0	0	0
37	0	0	0	**1**	0	0	0	0

Inch	Black Crappie	Bluegill	Largemouth Bass	Northern Muskellunge	Pumpkinseed	Rock Bass	Smallmouth Bass	Walleye
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	0	**8**	0	0	0	0	0	0
3	0	**2**	**1**	0	**709**	**21**	0	0
4	0	**51**	0	0	**772**	**93**	0	0
5	**1**	**102**	0	0	**48**	**53**	0	0
6	**3**	**45**	0	0	0	**5**	**1**	0
7	0	**5**	0	0	0	**1**	0	**2**
8	**1**	0	0	0	0	0	0	**1**
9	0	0	0	0	0	0	0	**1**
10	**2**	0	0	0	0	0	**1**	**1**
11	**2**	0	**1**	0	0	0	0	**4**
12	**1**	0	0	0	0	0	0	0
13	0	0	**2**	0	0	0	0	**2**
14	0	0	0	0	0	0	0	**2**
38	0	0	0	**1**	0	0	0	0
39	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0
41	0	0	0	**1**	0	0	0	0

Table 12: Weighted mean length (inches) at age and growth relative to the state average for select fishes sampled from Lake Emily, Iron County, Michigan in June 2024. The number of fish aged is in parentheses. Data taken from DNR Fisheries Division records.

Species	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Mean growth index[1]
Black Crappie			8.7 (1)	10.9 (1)	11.7 (1)	11.6 (1)	12.0 (1)						-
Bluegill		4.4 (3)	5.1 (18)	5.7 (8)	6.1 (15)								-0.5
Largemouth Bass			11.6 (1)	13.1 (1)	13.5 (1)	17.2 (1)							-
Northern Muskellunge					31.6 (1)	32.4 (2)	34.5 (2)	32.9 (4)	36.1 (4)	37.4 (1)	41.3 (1)	38.8 (1)	-
Pumpkinseed	3.5 (6)	3.9 (11)	4.5 (7)	4.4 (8)	4.6 (1)								-0.3
Smallmouth Bass			15.0 (1)	13.0 (2)		6.6 (1)	18.5 (1)						-
Walleye	8.3 (1)	11.1 (4)	13.6 (5)				24.3 (2)		26.0 (1)				-0.4
Yellow Perch	3.1 (1)	5.9 (3)	6.2 (18)	6.6 (8)	7.5 (4)	7.6 (11)	7.6 (10)	9.1 (2)	9.4 (1)	10.8 (1)			-1.7

[1]Mean growth index is the average deviation from the state average length at age.

Table 13: Total catch by length range for Northern Muskellunge collected from Lake Emily, Iron County, Michigan in June 2002 and June 2024. Data taken from DNR, Fisheries Division records.

Inch	2002 Northern Muskellunge	2024 Northern Muskellunge
0	0	0
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	**1**	0
12	0	0
13	0	0
14	**1**	0
15	**1**	0
16	0	0
17	0	0
18	0	0
19	0	0
20	**1**	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	0
29	**2**	0
30	**1**	**2**
31	**1**	**2**
32	**1**	0
33	0	**3**
34	0	**5**
35	0	0
36	0	**1**

Inch	2002 Northern Muskellunge	2024 Northern Muskellunge
37	**1**	**1**
38	0	**1**
39	**1**	0
40	0	0
41	0	**1**

Table 14: Catch-per-unit-effort (CPUE, fyke nets) from 2002-2024 for various fish species collected in May or June from Lake Emily, Iron County, Michigan. Qualitative ratings compare Lake Emily CPUE results to statewide averages between 2002-2007 (Wehrly et al. 2015). Data taken from DNR, Fisheries Division records.

Species	June 3-7, 2002 CPUE	June 3-7, 2002 Qualitative Rating	May 27-29, 2014 CPUE	May 27-29, 2014 Qualitative Rating	June 3-6, 2024 CPUE	June 3-6, 2024 Qualitative Rating	Change (2002 to 2024)	% Change (2002 to 2024)
Black Crappie	4.3	Medium-High	0.8	Low	0.7	Low	-3.6	-83.8
Bluegill	8.2	Medium	9.9	Medium	20.4	Medium-High	12.2	147.8
Largemouth Bass	0.3	Low	0.4	Low	0.0	Low	-0.3	-100.0
Northern Muskellunge	0.3	N/A^	0.7	N/A	0.7	N/A^	0.4	162.5
Northern Pike	0.5	Low-Medium	0.6	Low-Medium	0.1	Low	-0.4	-78.6
Pumpkinseed	30.0	High	50.7	High	162.0	High	132.0	440.6
Rock Bass	8.4	Medium-High	6.4	Medium-High	13.1	High	4.7	55.3
Smallmouth Bass	0.03	Low	0.00	Low	0.0	Low	0.0	-100
Walleye	1.5	High	1.1	Medium-High	0.3	Low-Medium	-1.2	-78.0
Yellow Perch	28.4	High	7.2	Medium	55.6	High	27.2	96.0
White Sucker	0.1	Low	0.0	Low	0.0	Low	-0.1	-100
Net Nights	30		20		9			

^ No data to reference in Wehrly et al. 2015

Table 15: Limnology results for Lake Emily, Iron County taken on August 29, 2002, and August 1, 2024. Data taken from Fisheries Division records.

Parameter	August 29, 2002	August 1, 2024
Alkalinity (mg/L)	138	120
Chlorophyll a (µg/L)	8.5	15
Ammonia-N (mg/L)	0.011	0.034
Nitrate + Nitrite (mg/L)	<0.01	0.004
Total Kjeldahl Nitrogen (mg/L)	0.6	1.03
Total Phosphorus (mg/L)	0.04	0.02

Figure 1: Lake map of Lake Emily, Iron County, Michigan.

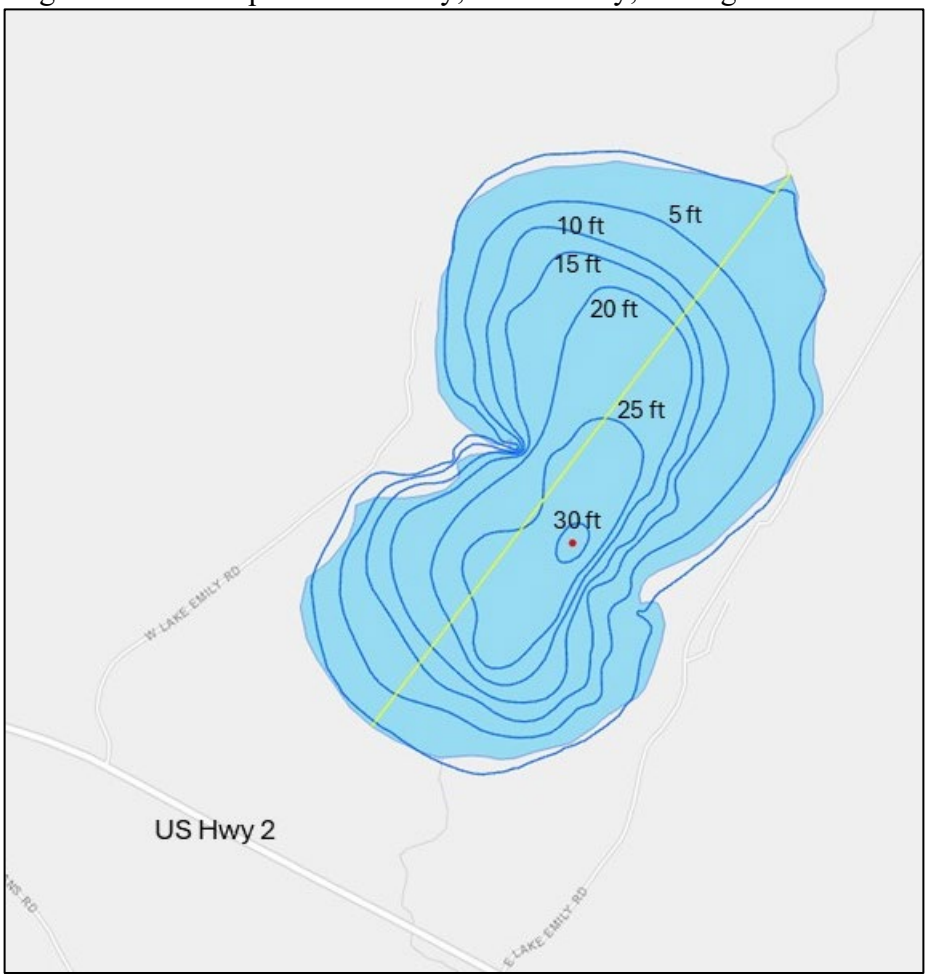


Figure 2: Lakeshed map of Lake Emily, Iron County, Michigan.

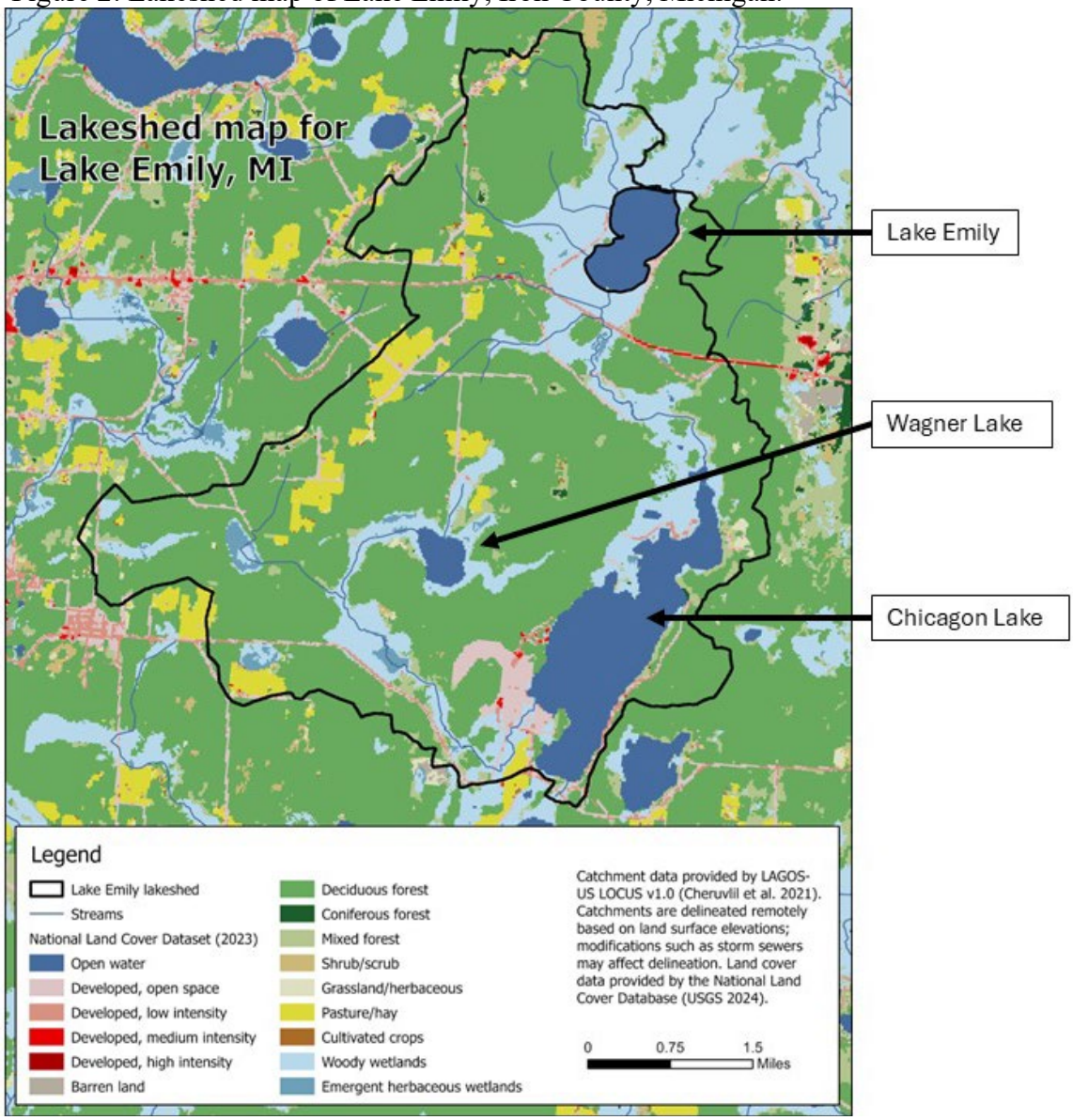


Figure 3: Length frequency of Walleye captured in May 2018 compared to April/May 2023 in Lake Emily, Iron County. Data taken from DNR Fisheries Division records.

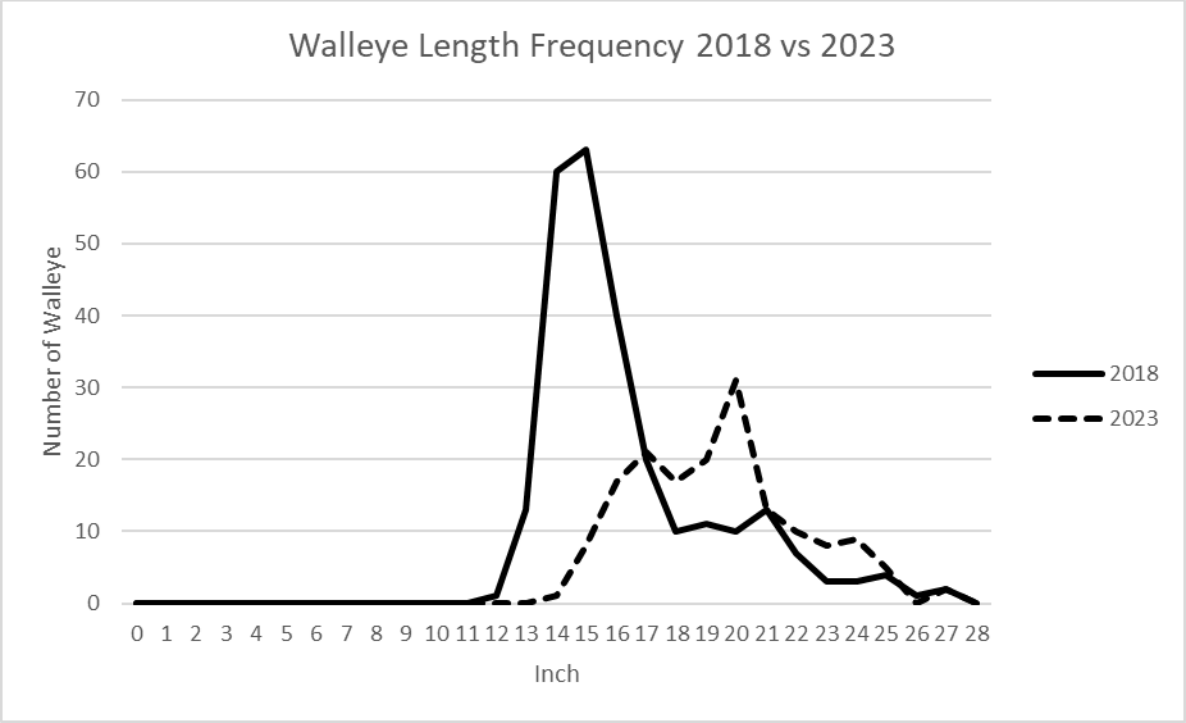


Figure 4: The number of submerged trees counted along the shoreline of Lake Emily, Iron County. Data taken from DNR Fisheries Division records.

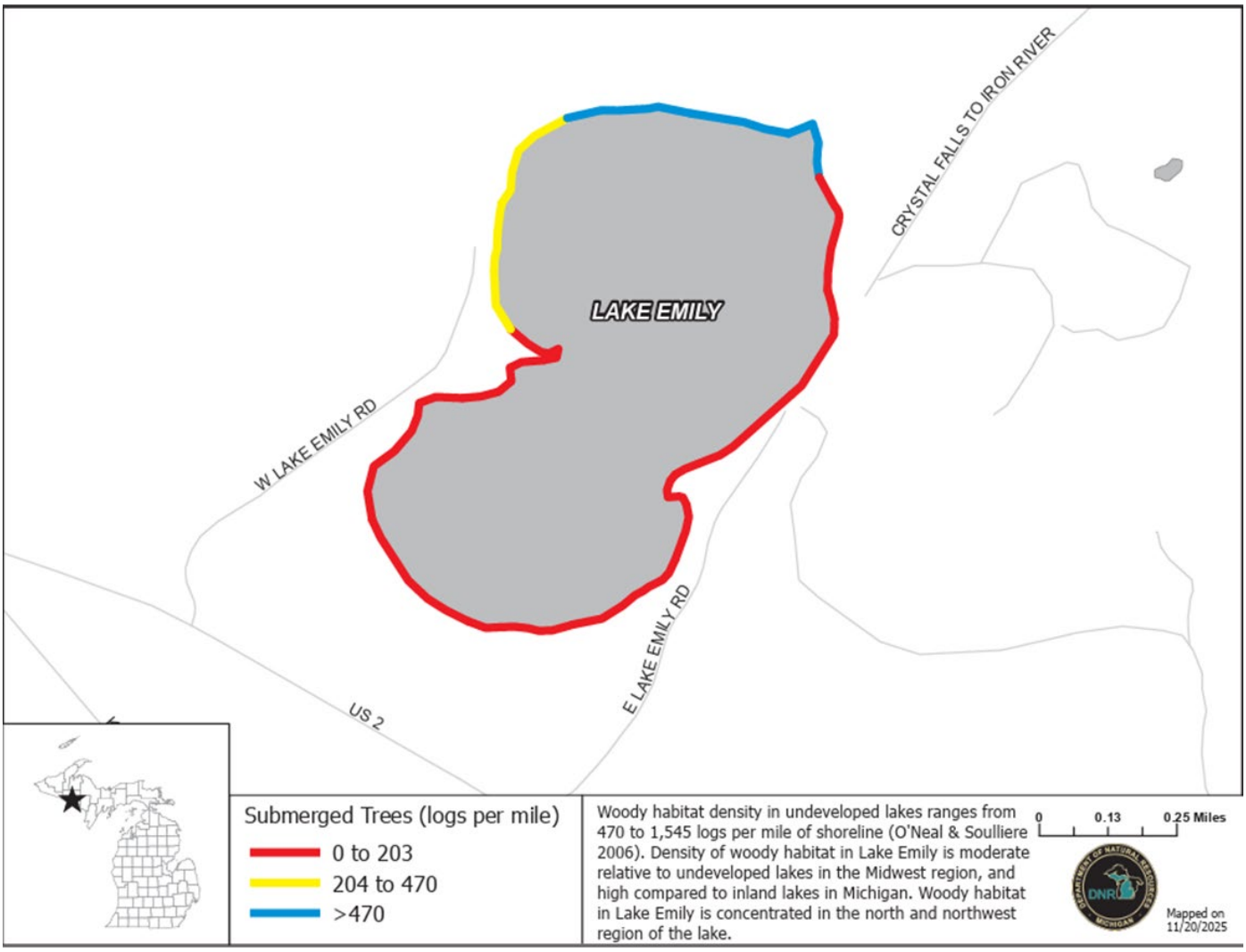
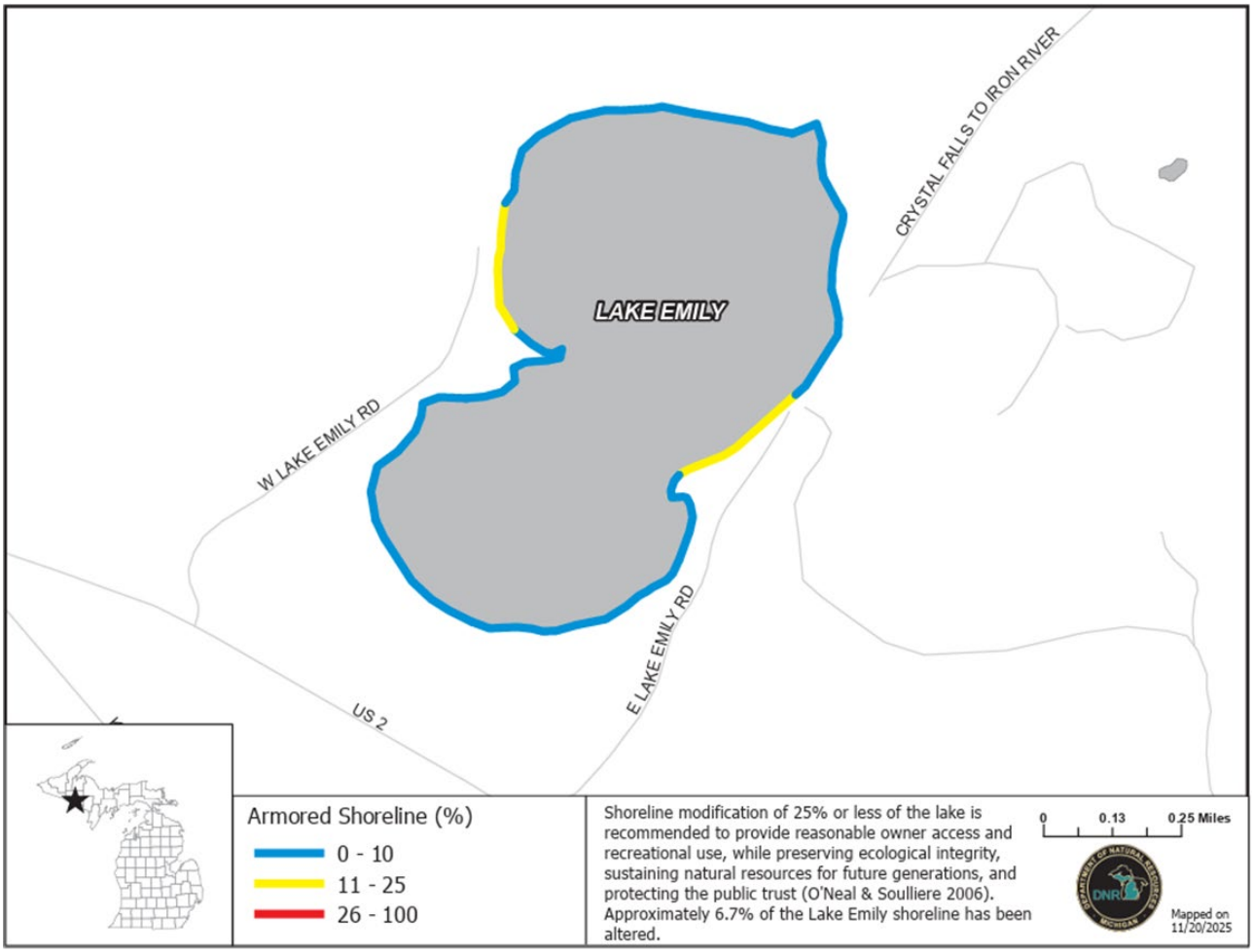


Figure *5*: Shoreline modification percentages around the shoreline of Lake Emily, Iron County. Data taken from DNR Fisheries Division records.



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