Big Murphy Lake
Schoolcraft, T43N/R17W/Section 08
Manistique River Watershed, Last Surveyed 2023

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Environment

Location
Big Murphy Lake is a 145-acre natural lake located in Inwood Township in western Schoolcraft County in Michigan's Upper Peninsula (Figure 1). The lake lies within the Hiawatha National Forest and is within an hour's drive of both Escanaba and Manistique, Michigan.

Geology and geography
Bedrock formations underlying Big Murphy Lake consist primarily of dolomite limestone with a thin band of shale, formed during the Ordovician Period more than 400 million years ago. Overlying these formations, the surrounding landscape is dominated by glacial outwash deposits, with about 94% consisting of coarse-textured materials and about 6% of untextured materials. Inland lakes with coarse texture materials tend to have greater exchange of cool groundwater when semi-permeable soil types are present. Soil types in this region are typical of glacial outwash deposits and mostly include Rubicon and Kalkaska sand types (USDA 2019) that do have a high drainage capacity.

In summary, these geological characteristics are beneficial to aquatic organisms as they facilitate the exchange of cool groundwater, reducing the prevalence of fish-kills that might occur during the stressful periods of winter and summer. However, fine sands and untextured materials can infiltrate nearshore substrate. Infiltration of fine sand can lead to erosion degrading fish spawning habitat highlighting the importance of erosion control measures within the watershed and along the shoreline of Big Murphy Lake.

Watershed description
The Big Murphy Lake watershed (Figure 2) is part of the much larger Manistique River watershed which drains southward through the City of Manistique before entering Lake Michigan. The lake receives inflow primarily from Leg Creek and an unnamed tributary entering at the northwest and north ends, respectively. Leg Creek is a cold stream with a predicted average July water temperature of 56.7°F, which contributes thermally stable inflows to the lake. Little Murphy Creek is the sole outflow of the lake draining first to Little Murphy Lake and proceeding south to the Indian River before entering Indian Lake followed by the Manistique River.

Chemical and physical characteristics
The most recent assessment of Big Murphy Lake's chemical and physical characteristics dates to the early 1980s. At that time, the lake was considered be of moderate productivity (i.e., mesotrophic). Big Murphy Lake was mapped by the United States Forest Service (USFS) in 1979 and was reported to have a maximum depth of 35 feet. Summer dissolved oxygen concentrations were reportedly sufficient (>4.0 mg/L) to sustain aquatic life until about 21 to 23 feet deep. Big Murphy Lake is oriented along a northwest to southeast axis, with a fetch length of 1.3 miles, which can influence wave action and shoreline processes such as erosion and deposition. The shoreline extends approximately 2.2 miles, with about 38% of the shoreline under public ownership.

Development, public ownership, and access

The Big Murphy Lake watershed (Figure 2) encompasses about 5,000 acres, of which 77% is publicly owned (MGLP 2026) and managed by the USFS. Land cover is predominantly forested, with deciduous and coniferous forest accounting for about 75% of the area (Figure 3), while open water and wetlands make up an additional 22%. Despite the high proportion of public land, access to the lake remains limited. A two-track road (Forest Service Road 2131), accessible from County Road 437, provides entry to the area. However, the existing access point (GPS: 46.12797 -86.46076) is unmarked, steep, and narrow, making it unsuitable for launching most trailered watercraft.

Fishery Resource

History

Fisheries management of Big Murphy Lake began during the 1930s when fish stocking occurred by the Michigan Department of Conservation, which was the predecessor of the Michigan Department of Natural Resources (MDNR). From 1933 to 1944, various life stages of Brown Trout, Walleye, Yellow Perch, Largemouth Bass, and Bluegill were stocked in Big Murphy Lake (Table 1). The status or abundance of these species was unknown prior to stocking. During the 1930s and 1940s, warm- and cool-water species such as Bluegill, Largemouth Bass, Walleye, Smallmouth Bass, and Yellow Perch were stocked in many inland lakes in Michigan with the intent to improve recreational fishing opportunities. However, by the early 1940s stocking of these species had already been largely reduced given their ability to reproduce naturally beyond state hatchery capabilities (Cooper 1948). By 1946, the Michigan Conservation Commission had a policy to curtail stocking of many of these species given the "incontestable evidence that the average planting of these species has involved an insignificant number of fish compared to the number already present" (Cooper 1948, pp. 8).

Following the 1930s and 1940s, there is limited information available with respect to fisheries management in Big Murphy Lake. Some creel census information is available from 1950 to 1962 that suggests Big Murphy Lake was a popular destination for panfish, Northern Pike, and bass. Angler catch rates for Bluegill during this period averaged 2.4 fish per hour, while the catch rates for Northern Pike, Yellow Perch, and Rock Bass averaged about one fish per hour. Favorable fishing reports exist throughout the 1940s and 1950s when catches of 3- to 5-pound bass and 20-pound Northern Pike were not unusual. Additionally, area residences reportedly contain photographs that testify to the recreational fishery that existed during that period. By the late 1970s fisheries management activities increased in Big Murphy Lake to gather baseline information that did not exist previously.

During the early 1980s, and to present day, surveys and management actions were intended to be accomplished through a collaborative working agreement between the USFS and MDNR with staff and resources being shared between agencies to accomplish all goals and tasks. At this time, Big Murphy Lake was reported to provide a poor to fair recreational fishery. And although only a few Northern Pike were caught, there were still 20-pound fish caught indicating the lake's potential. More experienced anglers were reportedly still able to catch bass in the 5-pound size class; however few people utilized the lake for panfish due to the high abundance of 'stunted' fish. Interagency fisheries managers sought to gather additional information about the lake's fish community to guide future management efforts.

A general fish community survey was conducted during the summer of 1980 by the USFS when Northern Pike, Yellow Perch, and bass populations were reported to be low in abundance, with growth being fair or below the state average for those species. The panfish population at that time was reportedly dominated by small, slow-growing Bluegill, Pumpkinseed, and Rock Bass. In contrast, Black Crappie were the highlight of the survey with relatively low catch rates, but with an average size

that was reported as "excellent". Bullhead and Common White Sucker were also captured during the 1980 survey and comprised about 25% of the total biomass. A couple of forage fish were captured including Common Shiner and Bluntnose Minnow which were reported as 'common' during that survey. Lastly, survey staff noted that while the east and north shores contained sufficient shoreline woody habitat, the west shore lacked sufficient habitat due to residential development.

Following the 1980 survey the USFS, in collaboration with MDNR proposed several management actions to improve the recreational fishing in Big Murphy Lake. First, managers recommended that a chemical treatment be conducted to remove approximately 50% of panfish biomass to improve their size structure. Following chemical treatment, managers recommended that Tiger Muskellunge be stocked biennially. Tiger Muskellunge were a popular sportfish at the time and were known to grow quickly. Within three years, Tiger Muskellunge were expected to provide an attractive recreational fishery while preying on panfish, keeping their size structure in-check. Fisheries managers also recommended that nearshore habitat be improved in Big Murphy Lake by placing 50 tree-top cover structures along the 5-to-15-foot depth contour of the lake. Finally, managers recommended providing riparian landowners with information pertaining to the benefits of preserving a natural shoreline and refraining from manipulating timber within 100 feet of the lakeshore.

By the early 1980s lake riparians had expressed concern about the proposed management actions. Some feared the use of Fintrol, a commonly used fish toxicant of the time, would negatively impact waterfowl and other aquatic organisms. Others expressed concern over proposed stocking and lake access improvements, as they feared any improvement to the fishery or lake access would result in an influx of new anglers. After several letters had been exchanged between concerned riparians and staff from both agencies, a public meeting was held, and later a vote through letter was obtained. By December of 1983, managers decided to drop the management proposals since there was significant opposition to chemical treatment and Tiger Muskellunge stocking. However, in 1983 the USFS did install 50 tree-top cover structures to improve nearshore fish habitat in Big Murphy Lake. Fisheries managers at that time tried to gather volunteers to conduct a 'manual' rather than chemical removal of panfish, however there is no documentation that a manual removal of panfish ever occurred.

In 1991 the USFS conducted a general fish community survey of Big Murphy Lake. Panfish including Bluegill, Pumpkinseed, and Rock Bass were noted to be abundant and their growth poor. However, catch rates and growth of Largemouth Bass and Black Crappie were considered excellent. Yellow Perch catch rates were reported to have increased since the early 1980s, however their growth had declined. Managers recommended at that time that a 'thinning' of undersized panfish should occur if there is a desire to improve their average size.

Finally, the USFS conducted a general fish community survey in June of 2011. Overall, 11 different species of fish were captured, and the fish community was reported to be in good condition. Catches of panfish were similar to years past when many fish captured were undersized and growing slightly below the state average. Black Crappie were reported to be in excellent condition with an average size of 13.9 inches. Northern Pike were noted to be growing slightly below the state average, and fish captured averaged 23.8 inches in length. Managers noted that Big Murphy Lake would benefit from the installation of additional tree-top cover structures, however they also observed that regional priorities and staff limitations would make this task difficult to accomplish. Lastly, interaction by USFS staff with lake riparians during the 1991 survey suggested that some felt the lake was 'private' despite there being public walk-in access. Riparians also reported that fishing pressure was limited on Big Murphy Lake.

During the early 2000s, MDNR Fisheries Division initiated a statewide Status and Trends monitoring program to assess fish populations and aquatic habitat in Michigan's inland waters. This program continues today, and the goals of the Status and Trends program are to 1) collect data needed to establish an inventory of inland lake habitat and fish community characteristics, 2) develop reference points for local, regional, and statewide management needs, and 3) evaluate the status and monitor changes in aquatic habitats and fish communities across Michigan.

The Status and Trends program initiated statewide use of standardized survey data collection and procedures as part of its 'random sites' sampling component, which is intended to provide a comprehensive survey of all types of inland lakes in Michigan. In 2023, MDNR Fisheries Division conducted a random survey of Big Murphy Lake following Status and Trends inland lake survey protocols to gather water chemistry, physical habitat, and fish community information. Results from this survey are presented here and prompted the writing of this report.

Current status of the fish community

Methods

From 9 March to 14 August 2023, MDNR Fisheries Division conducted a Status and Trends inland lake survey in accordance with established protocols (Wehrly et al. 2015). The Status and Trends survey consisted of a fish component to assess the status of lake fishes, and a limnological component to evaluate water chemistry, as well as oxythermal and physical habitat.

Status of Lake Habitat

On 9 March and 14 August 2023, limnological surveys were conducted at the deepest basin of Big Murphy Lake to evaluate oxythermal habitat. During the March survey, only water temperature, dissolved oxygen, pH, and specific conductance were collected. During the August survey, the same water quality parameters were collected as the March survey, however, water chemistry samples were also collected to determine alkalinity, concentrations of nutrients (e.g., nitrogen and phosphorus), and chlorophyll-a. Water transparency was also measured during the August survey using a Secchi disk. Water transparency, chlorophyll-a, and total phosphorus concentration were used to calculate the trophic state (Fuller and Jodoin 2016) of Big Murphy Lake which may be used as an index of lake productivity. The Big Murphy Lake littoral zone and lake shore were also visually surveyed in August to quantify physical habitat parameters including residential development, boat dock density, woody habitat density, and the average percent shoreline armored.

Status of Fish Community

MDNR Fisheries Division conducted a fish community survey to assess the status of Big Murphy Lake beginning 5 June 2023. A variety of gear types were used including two small- and five large-mesh fyke nets, one trap net, two experimental gill nets, and one seine. The small- and large-mesh fyke nets were set for a total of four and fourteen net nights, respectively. The trap net was set for three net nights for a total effort of three net nights. Two experimental gill nets were set for two nights for a total of four net nights. Total seine effort was four 25-foot seine hauls completed in nearshore areas.

All fish captured during the survey were identified and total lengths of individual fish were recorded by inch bin (e.g., 7-inch bin = 7.0-7.9 inches). This data was used to compute the average size and range for each gamefish species, as well as length-distribution. Fish weights were calculated using the length-weight regression equation and individual species coefficients listed in Schneider et al. (2000b). The relative abundance for each species was assessed using catch per unit effort (CPUE) calculated as the number of fish captured per unit of effort (e.g., net night, seine haul). The CPUE data from this

survey were compared to the summary regional CPUE data from inland lakes surveyed in the Northern Lake Michigan Management Unit as part of the Status and Trends survey program.

Age structures (10 per inch group) were collected from each gamefish species for age analysis, except Rock Bass. Total lengths for these age and growth specimens were recorded to the nearest tenth of an inch. Scale samples were collected from panfish species including Black Crappie, Bluegill, and Pumpkinseed less than 6.0-inches and bass less than 10.0-inches. Anal fin spines were collected from panfish greater than 6.0-inches, bass greater than 10.0-inches, and all Northern Pike. Weighted age compositions using length and age references for each gamefish species were calculated according to Schneider (2000b). A mean growth index for each age class was calculated by subtracting the state average mean length-at-age from that of the 2023 Big Murphy Lake survey. Only those age classes represented with a minimum of five age samples were used to calculate a mean growth index (Schneider et al. 2000a). Fish growing slower than 1 inch below the state average were considered "below average", while fish growing faster than 1 inch above the state average were considered "above average". Bluegill and Pumpkinseed are the exception where fish growing slower than 0.5 inches or faster than 0.5 inches compared to the state average were considered below or above the state average, respectively. Bluegill and Pumpkinseed size structure was rated using an index based on the mean growth index and the proportion of fish greater than 6, 7, and 8 inches captured using large-mesh fyke nets and trap nets (Schneider 1990, Schneider 2000). Lastly, the mean growth of each gamefish was compared to the regional average length at age. Regional length at age was calculated as the mean length at age for all specimens collected in the Northern Lake Michigan Management Unit during Status and Trends surveys (2002 to present).

To provide general information about the fish community composition in Big Murphy Lake, species captured were grouped into three categories. Black Crappie, Brook Trout, Largemouth Bass, Northern Pike, and Smallmouth Bass were categorized as “piscivores”; Banded Killifish, Bluegill, Bluntnose Minnow, Blacknose Shiner, Common Shiner, Pumpkinseed, Rock Bass, Sand Shiner, and Yellow Perch were categorized as “planktivore-insectivores”; and Brown Bullhead, Common White Sucker, Iowa Darter, Johnny Darter, and Logperch were categorized as “benthivores”. A per acre estimated standing crop was calculated for Big Murphy Lake following Schneider (2000).

Status of Invasive Species

During the 2023 Status and Trends survey, MDNR Fisheries Division staff made note of any aquatic invasive species observed. Additionally, MDNR Fisheries Division staff conducted a desktop review of the Midwest Invasive Species Information Network (MISIN 2026) to assess whether aquatic invasive species had been documented to occur in Big Murphy Lake.

Results

Status of Lake Habitat

Water chemistry –

Alkalinity (102 mg/L CaCO3), Nitrogen (0.771 mg/L), and Phosphorus (0.0403 mg/L) were all reportedly high, compared to the typical range in values for the region (Table 2). The concentration of chlorophyll-a (0.019 mg/L) was moderate compared to the typical range in values for the region (Table 2). Based on water transparency (12.5 feet; Mesotrophic), chlorophyll-a (Oligotrophic) and total phosphorus (Eutrophic) concentration, the trophic state of Big Murphy Lake is somewhat unclear. At the time of sampling in 2023, the lake had a high supply of nutrients, but those nutrients had not resulted in algal blooms and a corresponding decrease in water clarity.

Oxythermal habitat –

During the winter, Big Murphy Lake was unstratified and water temperature ranged from 35.0°F just below the ice to 41.7°F at 33 feet deep (Table 3). Dissolved oxygen ranged from 10.6 mg/L below the ice to 0.5 mg/L at 33 feet deep (Table 3). Low oxygen levels (i.e., hypoxia) existed at depths below 18 feet and there was no evidence of anoxic (i.e., no oxygen) conditions. During the summer, Big Murphy Lake was stratified and water temperature ranged from 70.2°F near the surface to 47.5°F at 33 feet deep (Table 3). From near the water surface to 33 feet deep, the concentration of dissolved oxygen in Big Murphy Lake ranged from 9.0 to 0.0 mg/L (Table 3). Low oxygen levels existed below 19 feet and anoxic conditions existed below 22 feet.

Physical habitat –

Among the physical habitat indicators measured, the number of dwellings and docks per mile of shoreline were rated as moderate compared to the typical range in values for the region (Table 4). The average percent shoreline armored or altered from its natural state was also rated as moderate (Table 4, Figure 4) for the region and the density of woody habitat, or submerged trees per shoreline mile, was rated as high (Table 4, Figure 5).

Status of Fish Community

A total of 15,750 fish weighing 242.8 pounds and representing 19 species were captured during the 2023 survey (Table 5). Piscivores, such as Black Crappie, Brook Trout, Largemouth Bass, Northern Pike, and Smallmouth Bass comprised 1% of the catch by number and 42% of the catch by biomass. Planktivore-Insectivores, such as Banded Killifish, Blacknose Shiner, Bluegill, Bluntnose Minnow, Common Shiner, Pumpkinseed, Rock Bass, Sand Shiner, and Yellow Perch comprised 97% of the catch by number and 39% of the catch by biomass. Benthivores, such as Brown Bullhead, White Sucker, Iowa Darter, Johnny Darter, and Logperch comprised 2% of the catch by number and 19% of the catch by biomass. The estimated standing crop of Big Murphy Lake in 2023 was approximately 36 pounds of fish per acre.

Black Crappie –

A total of 66 Black Crappie were captured in large-mesh fyke and trap nets (Tables 6 and 7). Black Crappie averaged 8.0 inches total length and comprised 0.4% of the catch by number and 9.9% of the catch by biomass. Black Crappie size ranged from 4 to 13 inches long with 26% of the catch meeting or exceeding the 8-inch preferred size for harvest (Table 5, Figure 6). The CPUEs of Black Crappie were high and moderate for large-mesh fyke and trap nets, respectively (Table 8). A total of five age classes of Black Crappie were represented; however, 95% of the fish came from three strong year classes. The mean growth index for age 2-, 3-, and 6-year-olds was -0.3 (Figure 6).

Bluegill –

A total of 774 Bluegill were captured across all gear types except gill nets (Table 6). Bluegill averaged 3.9 inches total length and comprised 4.9% of the catch by number and 3.7% of the catch by biomass. Bluegill size ranged from 1 to 8 inches long with 2% of the catch meeting or exceeding the 6-inch preferred size for harvest (Table 5, Figure 7). The CPUEs of Bluegill were rated as high for seines and small-mesh fyke nets, and moderate for large-mesh fyke and trap nets (Table 8). A total of three age classes were represented and the mean growth index for ages 3-, 4-, and 5-year-olds was -0.9 (Figure 7). The Schneider Index score for Bluegill caught in large-mesh fyke and trap nets was rated as poor.

Largemouth Bass –

A total of 27 Largemouth Bass were captured across all gear types except seines (Table 6). Largemouth Bass averaged 13.1 inches total length and comprised 0.2% of the catch by number and 17.1% of the catch by biomass. Largemouth Bass size ranged from 4 to 17 inches long with 67% of the catch meeting or exceeding the 14-inch minimum size for harvest (Table 5, Figure 8). The CPUEs of Largemouth Bass captured in gill and large-mesh fyke nets were rated moderate, while those captured in small-mesh fyke and trap nets were rated high (Table 8). A total of 11 age classes were represented, and the mean growth index for 2-, 4-, 7-, and 8-year-olds was -0.1 (Figure 8).

Northern Pike –

A total of 14 Northern Pike were captured in large-mesh fyke and trap nets (Table 6). Northern Pike averaged 20.5 inches total length and comprised 0.1% of the catch by number and 12.8% of the catch by biomass. Northern Pike ranged in size from 12 to 25 inches long with 29% of the catch meeting or exceeding the 24-inch minimum size for harvest (Table 5, Figure 9). The CPUEs of Northern Pike were rated low for all gear types used except large-mesh fyke nets which was rated high (Table 8). Too few Northern Pike were captured to make inferences about growth.

Pumpkinseed –

A total of 67 Pumpkinseed were captured across all gear types except gill nets and seines (Table 6). Pumpkinseed averaged 5.2 inches total length and comprised 0.4% of the catch by number and 1.6% of the batch by biomass. Pumpkinseed ranged in size from 1 to 7 inches with 15% of the catch meeting or exceeding the 6-inch preferred size (Table 5, Figure 10). The CPUE ratings for Pumpkinseed ranged from low to high across all gear types used with small-mesh fyke nets rated as high (Table 8). A total of two age classes of Pumpkinseed were represented, and the mean growth index of 3- and 4-year-olds was +0.4 above the state average (Figure 10). The Schneider Index score for Pumpkinseed caught in large-mesh fyke and trap nets was rated as poor.

Rock Bass –

A total of 101 Rock Bass were captured across all gear types except gill nets and seines (Table 6). Rock Bass averaged 4.8 inches total length and comprised 0.6% of the catch by number and 3.5% of the catch by biomass. Rock Bass ranged in size from 1 to 8 inches with 16% of the catch meeting or exceeding the 6-inch preferred size for harvest (Table 5, Figure 11). The CPUEs of Rock Bass captured in large- and small-mesh fyke nets were rated moderate and high, respectively (Table 8). The CPUE of Rock Bass captured in trap nets was rated low (Table 8).

Yellow Perch –

A total of 487 Yellow Perch were captured in all gear types except gill and trap nets (Table 6). Yellow Perch averaged 3.4 inches total length and comprised 3.1% of the catch by number and 1.3% of the catch by biomass. Yellow Perch ranged in size from 1 to 7 inches and there was only one fish captured that met or exceeded the 7-inch minimum preferred size for harvest (Table 5, Figure 12). The CPUE of Yellow Perch ranged from low to high across all gear types, with small-mesh fyke nets reporting a high catch rate (Table 8). An insufficient number of age structures were collected from Yellow Perch to make inferences about growth.

Other Gamefish Species Present –

Brook Trout, Brown Bullhead, and Smallmouth Bass were also captured during the 2023 Big Murphy Lake survey (Table 5). Only a single, 2.5-inch Brook Trout was captured so no inferences could be made about relative abundance or growth. A total of 51 Brown Bullhead were captured between

small- and large-mesh fyke nets. Brown Bullhead averaged 10.7 inches total length and size ranged from 2 to 13 inches (Table 5). The CPUEs of Brown Bullhead captured in small- and large-mesh fyke nets were high and moderate, respectively (Table 8). A total of three Smallmouth Bass were captured in large-mesh fyke nets and their CPUE was moderate for that gear type. Smallmouth Bass averaged 13.8 inches total length and size ranged from 8 to 17 inches (Table 5). Too few Smallmouth Bass were captured to make inferences about size distribution or growth.

Forage Fish Species Present –

A total of nine species categorized as 'forage fish' were captured during the 2023 Big Murphy Lake survey. Seven Banded Killifish were captured; however, they were captured too infrequently to make inferences about relative abundance. Catch rates of Johnny Darter and Logperch were rated as high for seines and small-mesh fyke nets (Table 8). Catch rates of Blacknose Shiner, Bluntnose Minnow, Common Shiner, Iowa Darter, and Sand Shiner were all rated high for small-mesh fyke nets (Table 8). A total of 21 Common White Sucker were captured between gill and large-mesh fyke nets (Table 8). Common White Sucker ranged from 7 to 20 inches long with an average total length of 14.7 inches (Table 5). The CPUE for Common White Sucker was rated moderate for gill and large-mesh fyke nets (Table 8).

Status of Invasive Species

There were no aquatic invasive species documented in Big Murphy Lake during the 2023 Status and Trends survey and there were no occurrences found through a desktop review of the Midwest Invasive Species Information Network.

Analysis and Discussion

Big Murphy Lake exhibits a combination of moderate to high nutrient levels, abundant nearshore woody habitat, and a diverse fish community. More specifically, the Big Murphy Lake fish community supports high biological diversity but also shows imbalance in the fish population size structure and growth for some groups of fishes.

Water transparency and chlorophyll-a information collected from Big Murphy Lake suggests the lake is nutrient poor (e.g., oligotrophic) or unproductive, where managers might expect fish diversity and abundance to be relatively low. However, other water quality parameters such as alkalinity, nitrogen, and phosphorus concentrations suggest the lake is highly productive. It is worth noting that the concentrations of nitrogen and phosphorus in Big Murphy Lake are high for the region and are high compared to other inland lakes across the state of Michigan (Wehrly et al. 2015).

Relatively high phosphorus and nitrogen concentrations can be indicative of lakes that are receiving higher levels of nutrient loading through human-derived inputs such agriculture, lawn fertilizers or leaching septic tanks from riparian residences (Wehrly et al. 2015). Nutrient loading from human-derived inputs can lead to eutrophication causing increased production of phytoplankton and aquatic plants. During the harsh periods of winter and summer, processes related to nutrient loading can reduce dissolved oxygen levels in the water to the point that habitat becomes limited for fish and other aquatic organisms.

Dissolved oxygen levels were last measured in Big Murphy Lake in the 1980s when it was reported that oxygen levels began to limit aquatic organisms at 21 to 23 feet deep. In 2023, oxygen levels were reported to limit aquatic organisms at depths ranging from 18 to 19 feet. So, there has been some loss in terms of the available habitat in the lake, however there is still a reasonable proportion of the water column available to aquatic organisms. That said, this report should be shared with the Department of

Environment, Great Lakes, and Energy so staff can determine whether additional nutrient and oxygen monitoring is warranted.

The density of dwellings and docks, and the extent of shoreline alteration on Big Murphy Lake is moderate compared to other inland lakes in the region. This suggests that while residential development is present, it has not reached levels typically associated with significant habitat loss. Importantly, the density of woody habitat in Big Murphy Lake is rated as high. This is a significant positive feature of the lake as woody habitat is an important component of lakes providing structure for fishes and stabilizing banks and lake sediments. Trees growing along the shoreline that fall into the water are the primary source of woody habitat in most lakes. However, lake riparians often 'clean up' the nearshore areas and remove woody habitat negatively impacting aquatic organisms. Shoreline property owners are encouraged to leave woody habitat in place where it is possible to ensure habitat is available as residential development increases into the future. The presence of abundant submerged woody habitat likely contributes to Big Murphy Lake's current high fish diversity and strong forage base.

The fish community in Big Murphy Lake is highly diverse with a total of 19 different species represented in the recent survey. In the central and eastern region of Michigan's Upper Peninsula, inland lakes tend to support 13 different fish species. This high species richness may be indicative of a healthy and diverse ecosystem capable of supporting multiple trophic levels and various ecological niches. The Banded Killifish was captured in Big Murphy Lake which was surprising given that it has only been documented in less than 2% of lakes sampled in this region. Banded Killifish are an unfamiliar and perhaps underappreciated minnow species in Michigan. Their diet consists largely of aquatic invertebrates (Phillips et al. 2007) and likely includes mosquito larvae. Other fish species, like the Banded Killifish, have been either experimented with (Okyere et al. 2019) or used for biocontrol of mosquitoes (Matias and Adrias 2010). This species could be a new favorite of riparian landowners and anglers during the peak mosquito season, highlighting the benefit of preserving fish diversity and protecting lake habitat for forage species that exist in Big Murphy Lake.

The relative abundance of forage fish captured in various gear types was typically rated high, indicating a strong prey base. This abundant prey base could be a result of moderate development levels, higher nutrient levels, and the high density of woody habitat available in the nearshore areas of the lake. A higher relative abundance of forage fish might explain some of the population characteristics observed for panfish species in Big Murphy Lake.

The relative abundances of panfish species including Black Crappie, Bluegill, Pumpkinseed, Rock Bass, and Yellow Perch were generally rated moderate to high for the various gear types used in this survey. The growth of Bluegill, Pumpkinseed, and young Black Crappie was either comparable to or below the state average suggesting some density-dependent effects, where abundant populations lead to increased competition for food resources. As a result, individuals (especially Bluegill) experience slower growth patterns despite their high relative abundance. These results are not surprising for Big Murphy Lake where panfish populations have consistently showed high abundance and poor growth for decades. Adult Black Crappie are the exception to this rule because minnows and small panfish are forage for them rather than competitors for resources

Big Murphy Lake provides a fair and varied recreational gamefish fishery, highlighted by a solid Largemouth Bass population that occurs in moderate to high relative abundance. There were ten age classes of Largemouth Bass present suggesting strong annual recruitment while growth rates were comparable to the state average. Northern Pike and Smallmouth Bass were present, but at a lower abundance and are likely to provide favorable incidental catches when fishing for other species is slow.

Brown Bullhead are also present in the lake at moderate to high relative abundance providing an additional and sometimes overlooked opportunity, especially for anglers interested in night-time fishing opportunities. Collectively, these species add to the diverse fishing experience in Big Murphy Lake where a consistent, although not exceptional, walk- or carry-in recreational fishery exists.

Management Direction

Habitat Protection

Shoreland and shoreline development can cause poor water quality, erosion, and additional losses to fish habitat. Although residential development is currently rated moderate, nutrient (i.e., phosphorus and nitrogen) levels are reportedly higher than expected. This report will be shared with the Michigan Department of Environment, Great Lakes, and Energy. Following a review of this report, additional monitoring of nutrient and dissolved oxygen levels may be warranted.

Along the shoreline of Big Murphy Lake, residential development is currently at moderate levels, and many natural features (e.g., woody habitat) are still intact. Shoreline property owners are encouraged to implement shoreline and shoreland best management practices to preserve the natural features that exist in the lake. For example, property owners are encouraged to leave fallen trees and logs in place where it is possible to ensure littoral zone habitat remains intact. For more information about how to incorporate best management practices and preserve a natural shoreline, landowners can visit the Michigan Natural Shoreline Partnership website (MNSP 2026).

Fish Community

The Big Murphy Lake fish community is managed as a 'mixed bag' fishery and currently offers attractive, although not exceptional, fishing opportunities in a remote wilderness setting. At this time, there are no fisheries regulation changes needed for Big Murphy Lake and area stakeholders interested in maintaining or improving the fish community are encouraged to focus their efforts on nearshore habitat protection and invasive species prevention.

Invasive Species

Currently, there are no known aquatic invasive species in Big Murphy Lake. That said, both the aquatic invasive Zebra Mussel and invasive Eurasian Watermilfoil exist in the region suggesting Big Murphy Lake, with its high nutrient levels, is vulnerable to future introductions. The MDNR Fisheries Division recommends that representatives from Big Murphy Lake and staff from the Schoolcraft County Conservation District and the Cooperative Invasive Species Management Area (or CISMA) work collaboratively to seek funding to implement programs geared towards outreach and education to prevent future introduction of invasive species. For example, funding for prevention, detection, eradication, and control of aquatic invasive species may be possible through the Michigan Invasive Species Grant Program (MISGP 2026).

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Tables and Figures

Table 1. Historical stocking records for Big Murphy Lake, Schoolcraft County from 1933 to 1944.

Stocking Year	Species	Number Stocked	Life Stage
1933	Brown Trout	13,330	5 month
1933	Walleye	270,000	Swim-up fry
1935	Walleye	180,000	Swim-up fry
1936	Walleye	120,000	Swim-up fry
1936	Yellow Perch	3,000	Adults
1937	Walleye	150,000	Swim-up fry
1938	Walleye	200,000	Swim-up fry
1939	Walleye	450,000	Swim-up fry
1940	Largemouth Bass	1,000	3 month
1940	Smallmouth Bass	500	3 month
1941	Smallmouth Bass	352	Adults
1942	Smallmouth Bass	175	Adults
1943	Largemouth Bass	400	5 month
1944	Bluegill	250	15 month

Table 2. Water chemistry parameters, the typical range (25^{th} to 75^{th} percentile) in values for each parameter, the number (N) of inland lakes in the region sampled in accordance with Status and Trends inland lake survey protocols, Big Murphy Lake, Schoolcraft County survey results, and the rating of Big Murphy Lake compared to the typical regional values.

Water Chemistry Parameter	Typical Range	N	Big Murphy Lake	Rating
Alkalinity (mg/L)	27 to 100	70	102	High
Chlorophyl a (ug/L)	1.6 to 4.0	72	1.86	Moderate
Total Nitrogen (mg/L)	0.420 to 0.674	61	0.771	High
Total Phosphorus (mg/L)	0.008 to 0.021	69	0.0403	High

Table 3. Depth, water temperature, dissolved oxygen, pH, and conductivity measured during the winter (top table) and summer (bottom table) in Big Murphy Lake, Schoolcraft County during the 2023 Status and Trends inland lake survey.

Depth (ft)	Water Temperature (°F)	Dissolved Oxygen (mg/L)	pH	Conductivity (uS/cm)
3	35.0	10.6	7.27	0.186
6	35.5	10.0	7.25	0.190
9	36.8	9.4	7.26	0.193
12	37.5	8.7	7.27	0.195
15	38.3	6.3	7.24	0.199
18	38.9	4.4	7.15	0.204
21	39.7	3.4	7.14	0.206
24	40.2	1.0	7.14	0.213
25	40.2	0.7	7.16	0.214
26	40.3	0.7	7.18	0.214
27	40.5	0.6	7.22	0.217
28	40.6	0.5	7.26	0.221
31	41.3	0.5	7.43	0.265
33	41.7	0.5	7.53	0.280

Depth (ft)	Water Temperature (°F)	Dissolved Oxygen (mg/L)	pH	Conductivity (uS/cm)
3	70.2	8.9	8.60	0.183
6	70.1	9.0	8.77	0.183
9	69.9	8.9	8.77	0.183
12	69.4	8.9	8.76	0.183
13	68.8	8.9	8.72	0.183
14	67.5	9.2	8.63	0.184
15	64.7	9.9	8.55	0.184
16	61.7	9.7	8.44	0.184
17	58.7	9.1	8.29	0.184
18	56.5	7.2	7.78	0.184
19	54.7	5.9	7.71	0.183
20	53.3	2.6	7.51	0.184
21	51.9	0.7	7.33	0.184
22	50.7	0.4	7.27	0.185
25	48.9	0.0	7.20	0.188
28	48.1	0.0	7.18	0.190
31	47.6	0.0	7.15	0.198
33	47.5	0.0	7.15	0.232

Table 4. Physical habitat parameters, the typical range (25th to 75th percentile), the number (N) of lakes surveyed in the Northern Lake Michigan Management Unit, the measured value at Big Murphy Lake, and the rating for Big Murphy Lake compared to other inland lakes in the region.

Physical Habitat Parameter	Typical Range	N	Big Murphy Lake	Rating
Dwellings	1.4 to 20.1	78	11.0	Moderate
Boat Docks	1.5 to 15.7	79	5.5	Moderate
Shoreline Armoring	0.0 to 12.0	79	9.2	Moderate
Large Woody Habitat	25.0 to 205.9	79	262.4	High

Table 5. Species, number captured, total weight, average total length, range in total length, and percent legal or preferred size of fish captured in Big Murphy Lake, Schoolcraft County during the 2023 survey. Preferred size was considered to be 6 inches for Bluegill, Pumpkinseed, and Rock Bass, 7 inches for Yellow Perch, 8 inches for Black Crappie, and ? inches for Brown Bullhead.

Species	Number	Total Weight (lbs.)	Average Total Length (in.)	Range in Total Length (in.)	Percent Legal Size
Banded Killifish	7	0.0	2.5	2 to 3	100
Black Crappie	66	24.1	8.0	4 to 13	26
Bluegill	774	9.1	3.9	1 to 8	2
Bluntnose Minnow	1,335	7.2	2.4	1 to 3	N/A
Blacknose Shiner	122	0.6	2.5	2 to 3	N/A
Brook Trout	1	0.0	2.5	-	0
Brown Bullhead	51	9.2	10.7	2 to 13	20
Common Shiner	226	1.8	3.2	2 to 4	N/A
Iowa Darter	59	0.3	2.4	1 to 3	N/A
Johnny Darter	24	0.1	2.5	1 to 3	N/A
Largemouth Bass	27	41.6	13.1	4 to 17	67
Logperch	183	1.0	2.5	1 to 3	N/A
Northern Pike	14	31.0	20.5	12 to 25	29
Pumpkinseed	67	3.8	5.2	1 to 7	15
Rock Bass	101	8.5	4.8	1 to 8	16
Sand Shiner	12,182	59.9	2.4	1 to 3	N/A
Smallmouth Bass	3	5.0	13.8	8 to 17	67
White Sucker	21	36.6	14.7	7 to 20	N/A
Yellow Perch	487	3.1	3.4	1 to 7	0

Table 6. Total number of fish captured by species and by gear type for Big Murphy Lake, Schoolcraft County during the 2023 Status and Trends survey.

Species	Large Mesh Fyke Net	Gill Net	Small Mesh Fyke Net	Seine	Trap Net	Total
Banded Killifish	0	0	7	0	0	7
Black Crappie	59	0	0	0	7	66
Blacknose Shiner	0	0	122	0	0	122
Bluegill	64	0	685	18	7	774
Bluntnose Minnow	0	0	1,322	13	0	1,335
Brook Trout	0	0	1	0	0	1
Brown Bullhead	10	0	41	0	0	51
Common Shiner	0	0	226	0	0	226
Iowa Darter	0	0	58	1	0	59
Johnny Darter	0	0	16	8	0	24
Largemouth Bass	15	3	2	0	7	27
Logperch	0	0	153	30	0	183
Northern Pike	13	0	0	0	1	14
Pumpkinseed	15	0	50	0	2	67
Rock Bass	59	0	41	0	1	101
Sand Shiner	0	0	12,168	14	0	12,182
Smallmouth Bass	2	0	0	0	1	3
White Sucker	11	10	0	0	0	21
Yellow Perch	1	0	480	6	0	487

Table 7. Catch per unit effort (CPUE) by species and by gear type for fish captured in Big Murphy Lake, Schoolcraft County during the 2023 Status and Trends survey.

Species	Large-Mesh Fyke Net	Gill Net	Small-Mesh Fyke Net	Seine	Trap Net
Banded Killifish	0.00	0.00	1.75	0.00	0.00
Black Crappie	3.93	0.00	0.00	0.00	2.33
Blacknose Shiner	0.00	0.00	30.50	0.00	0.00
Bluegill	4.27	0.00	171.25	4.50	2.33
Bluntnose Minnow	0.00	0.00	330.50	3.25	0.00
Brook Trout	0.00	0.00	0.25	0.00	0.00
Brown Bullhead	0.67	0.00	10.25	0.00	0.00
Common Shiner	0.00	0.00	56.50	0.00	0.00
Iowa Darter	0.00	0.00	14.50	0.25	0.00
Johnny Darter	0.00	0.00	4.00	2.00	0.00
Largemouth Bass	1.00	0.75	0.50	0.00	2.33
Logperch	0.00	0.00	38.25	7.50	0.00
Northern Pike	0.87	0.00	0.00	0.00	0.33
Pumpkinseed	1.00	0.00	12.50	0.00	0.67
Rock Bass	3.93	0.00	10.25	0.00	0.33
Sand Shiner	0.00	0.00	3,042.00	3.50	0.00
Smallmouth Bass	0.13	0.00	0.00	0.00	0.33
White Sucker	0.73	2.50	0.00	0.00	0.00
Yellow Perch	0.07	0.00	120.00	1.50	0.00

Table 8. Typical range (25th percentile to 75th percentile) CPUE values for species captured during Status and Trends inland lake surveys in the Northern Lake Michigan Management Unit (N = 92) compared to Big Murphy Lake.

Species	Gear Type	Typical Range	N	Big Murphy Lake CPUE	Rating
Banded Killifish	Small-Mesh Fyke	-	0	1.75	-
Black Crappie	Large-Mesh Fyke	0.21 to 2.44	43	3.93	High
Black Crappie	Trap Net	0.07 to 3.83	4	2.33	Moderate
Blacknose Shiner	Small-Mesh Fyke	2.33 to 7.75	7	30.50	High
Bluegill	Large-Mesh Fyke	0.90 to 32.82	67	4.27	Moderate
Bluegill	Seine	0.00 to 2.00	33	4.50	High
Bluegill	Small-Mesh Fyke	0.67 to 32.50	59	171.25	High
Bluegill	Trap Net	0.46 to 17.18	10	2.33	Moderate
Bluntnose Minnow	Seine	0.00 to 34.31	36	3.25	Moderate
Bluntnose Minnow	Small-Mesh Fyke	0.50 to 32.88	49	330.50	High
Brook Trout	Small-Mesh Fyke	0.00 to 0.67	2	0.25	Moderate
Brown Bullhead	Large-Mesh Fyke	0.44 to 5.06	31	0.67	Moderate
Brown Bullhead	Small-Mesh Fyke	0.00 to 0.54	14	10.25	High
Common Shiner	Small-Mesh Fyke	0.00 to 6.67	25	56.50	High
Iowa Darter	Seine	0.00 to 0.81	22	0.25	Moderate
Iowa Darter	Small-Mesh Fyke	0.00 to 1.46	22	14.50	High
Johnny Darter	Seine	0.00 to 0.91	21	2.00	High
Johnny Darter	Small-Mesh Fyke	0.00 to 1.38	21	4.00	High
Largemouth Bass	Gill Net	0.00 to 0.81	19	0.75	Moderate
Largemouth Bass	Large-Mesh Fyke	0.06 to 1.93	43	1.00	Moderate
Largemouth Bass	Small-Mesh Fyke	0.00 to 0.46	21	0.50	High
Largemouth Bass	Trap Net	0.25 to 1.22	8	2.33	High
Logperch	Seine	0.00 to 0.35	5	7.50	High
Logperch	Small-Mesh Fyke	0.00 to 7.21	8	38.25	High

Table 8 (Continued). Typical range (25th percentile to 75th percentile) CPUE values for species captured during Status and Trends inland lake surveys in the Northen Lake Michigan Management Unit (N = 92) compared to Big Murphy Lake.

Species	Gear Type	Typical Range	N	Big Murphy Lake CPUE	Rating
Northern Pike	Large-Mesh Fyke	0.74 to 1.68	70	0.87	Moderate
Northern Pike	Trap Net	0.97 to 3.42	11	0.33	Low
Pumpkinseed	Large-Mesh Fyke	0.44 to 5.29	72	1.00	Moderate
Pumpkinseed	Small-Mesh Fyke	0.17 to 3.13	59	12.50	High
Pumpkinseed	Trap Net	0.20 to 3.53	10	0.67	Moderate
Rock Bass	Large-Mesh Fyke	2.21 to 10.63	70	3.93	Moderate
Rock Bass	Small-Mesh Fyke	0.50 to 4.25	62	10.25	High
Rock Bass	Trap Net	1.00 to 4.53	13	0.33	Low
Sand Shiner	Seine	0.33 to 29.15	10	3.50	Low
Sand Shiner	Small-Mesh Fyke	0.25 to 567.13	9	3042.00	High
Smallmouth Bass	Large-Mesh Fyke	0.09 to 1.00	52	0.13	Moderate
Smallmouth Bass	Trap Net	0.15 to 1.37	9	0.33	Moderate
White Sucker	Gill Net	0.50 to 3.75	53	2.50	Moderate
White Sucker	Large-Mesh Fyke	0.17 to 1.79	65	0.73	Moderate
Yellow Perch	Large-Mesh Fyke	0.08 to 1.98	71	0.07	Low
Yellow Perch	Seine	0.00 to 2.25	37	1.50	Moderate
Yellow Perch	Small-Mesh Fyke	0.00 to 10.00	57	120.00	High

Figure 1. Inland depth contour map of Big Murphy Lake located in Schoolcraft County, Michigan.

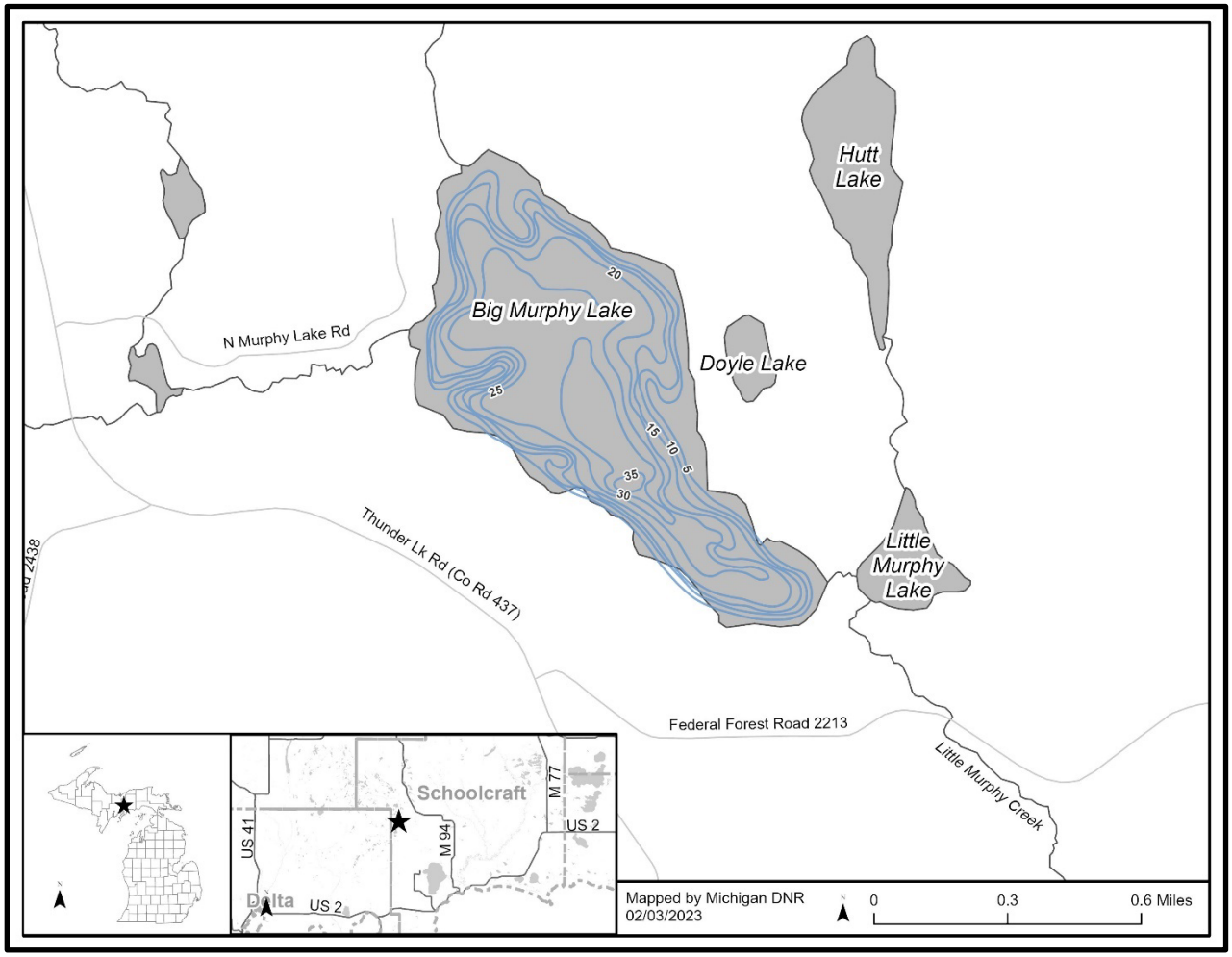


Figure 2. Watershed map for Big Murphy Lake located in Schoolcraft County, Michigan.

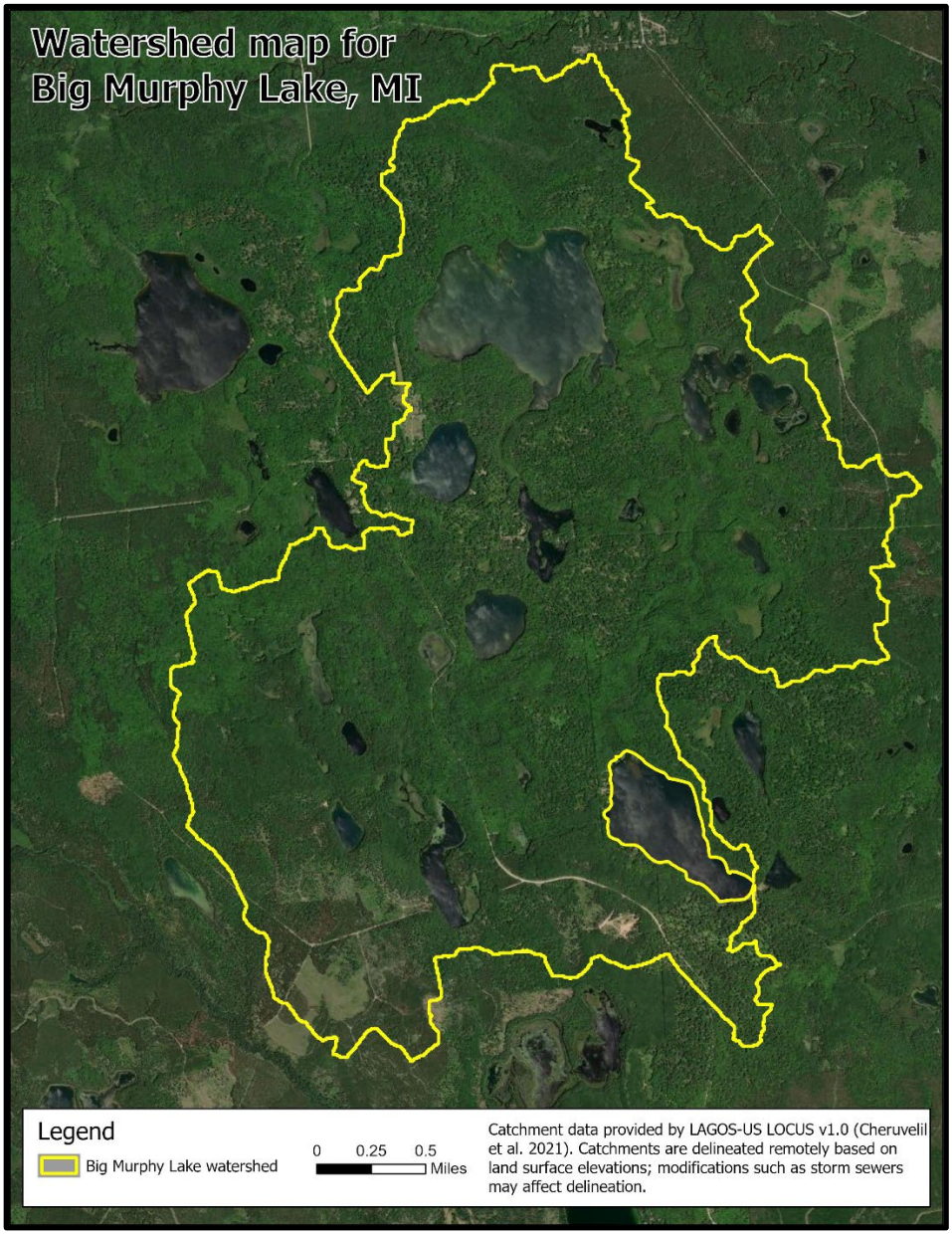


Figure 3. Land use map for the Big Murphy Lake watershed region.

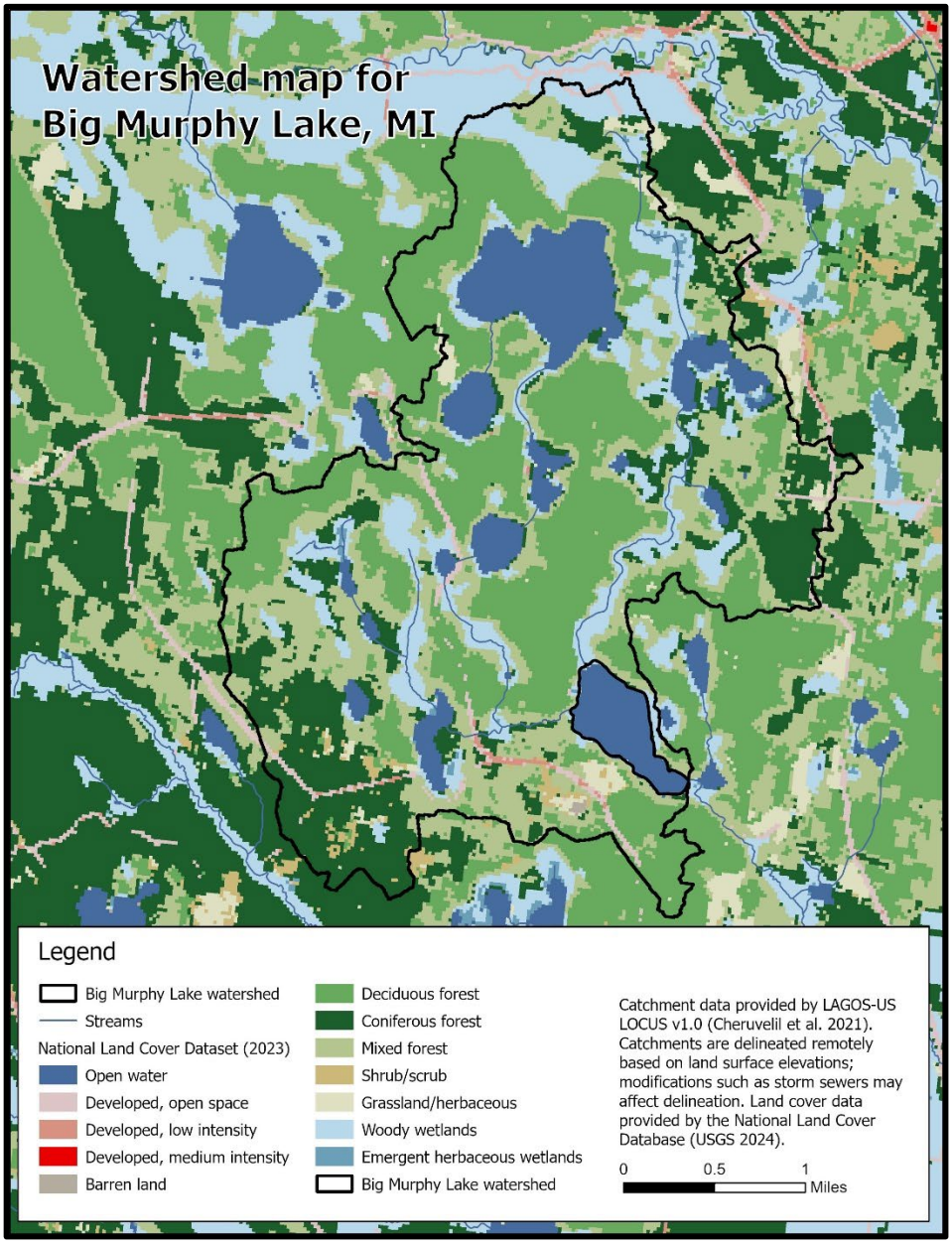


Figure 4. The percent of shoreline in Big Murphy Lake, Schoolcraft County that has been armored or altered from its natural state. The rate of shoreline armoring in Big Murphy Lake is below maximum levels recommended (<25%) by O'Neal & Soulliere (2006) but is 'moderate' compared to other waterbodies in the region.

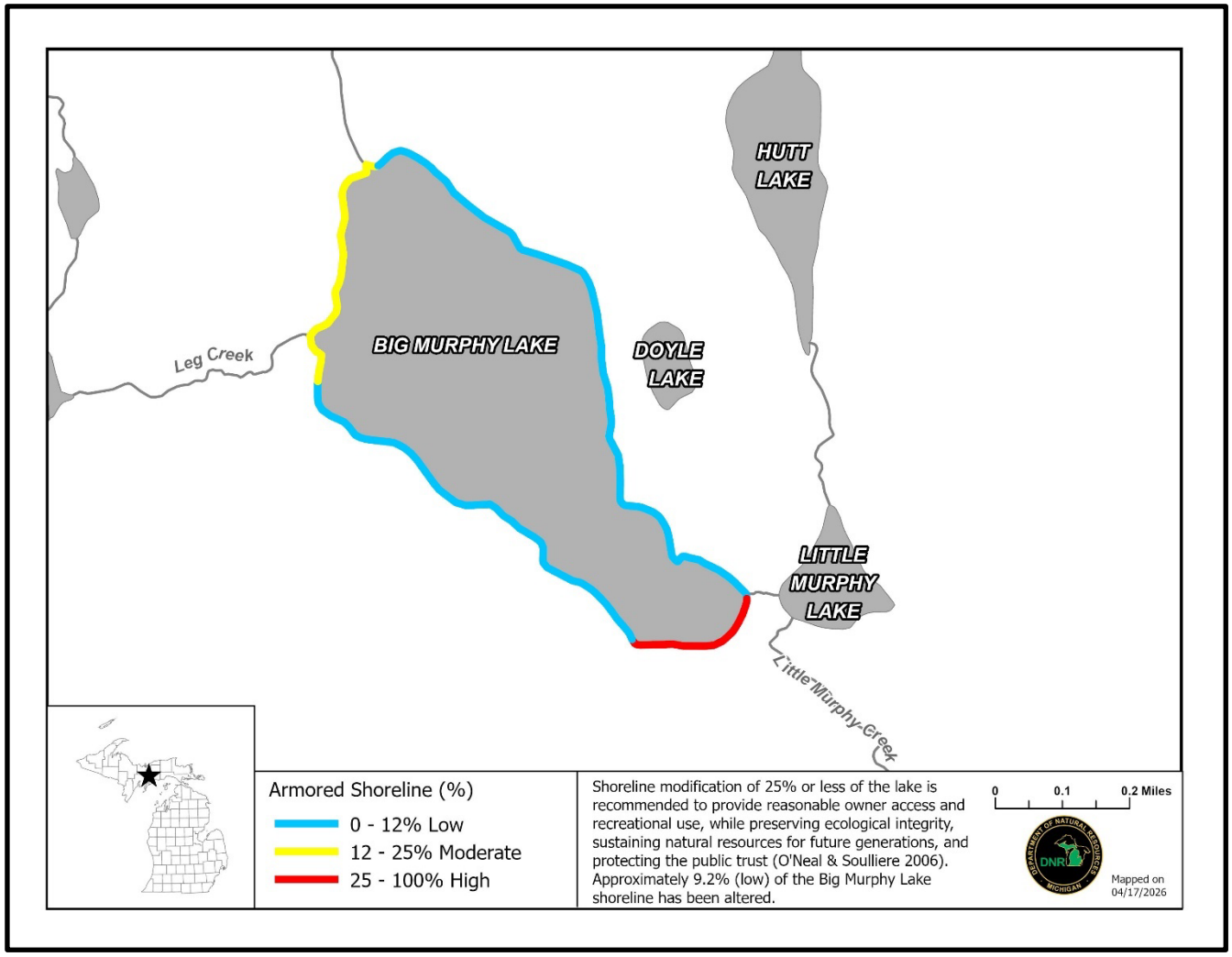


Figure 5. The density of shoreline woody habitat in Big Murphy Lake, Schoolcraft County. The density of woody habitat in Big Murphy Lake is moderate compared to undeveloped lakes in the Midwest region (O'Neal and Soulliere 2006) but is high compared to other waterbodies in the region.

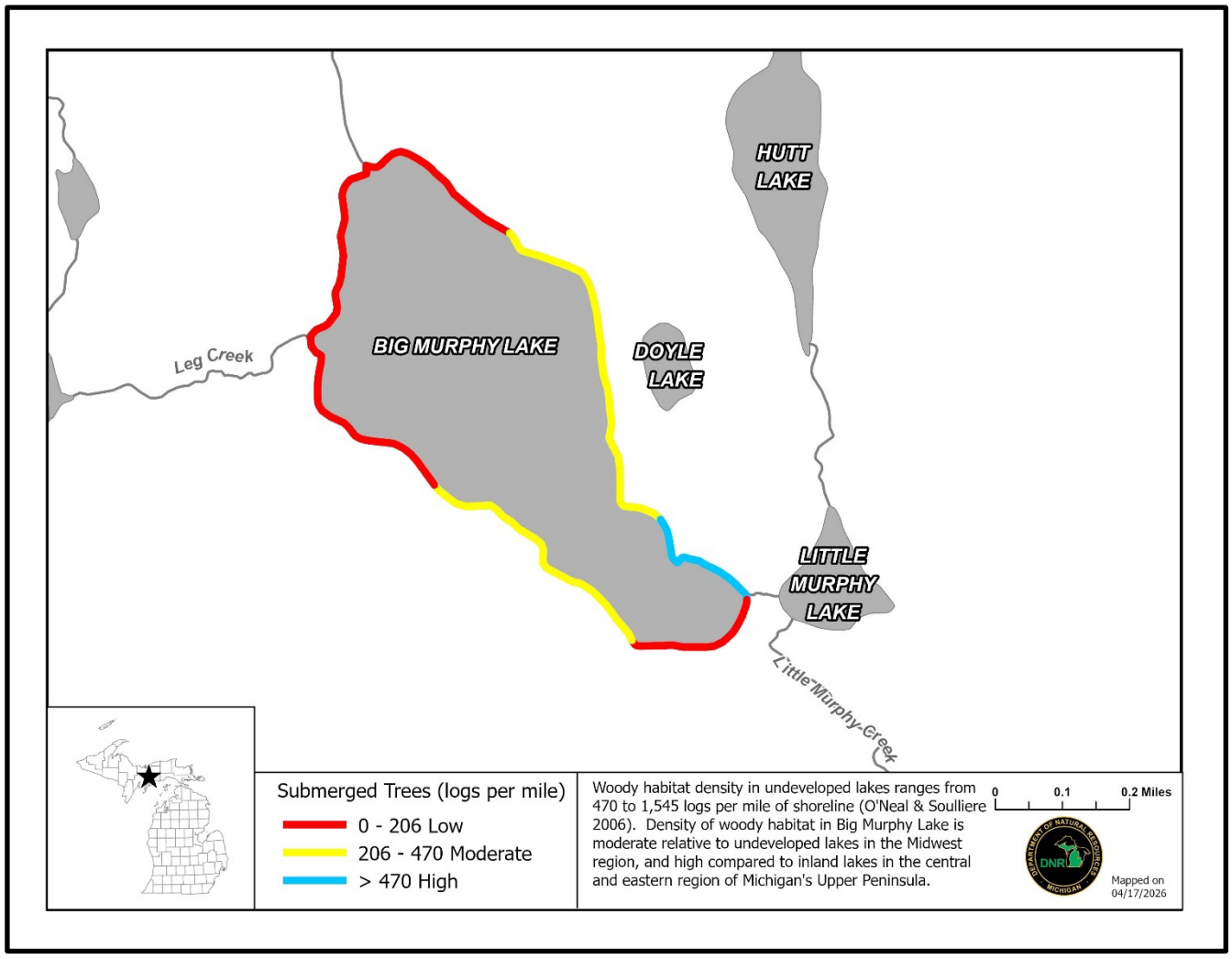


Figure 6. Percent abundance by inch group (top) and the average total length (inches) at age (bottom) of Black Crappie captured in Big Murphy Lake, Schoolcraft County during the 2023 survey.

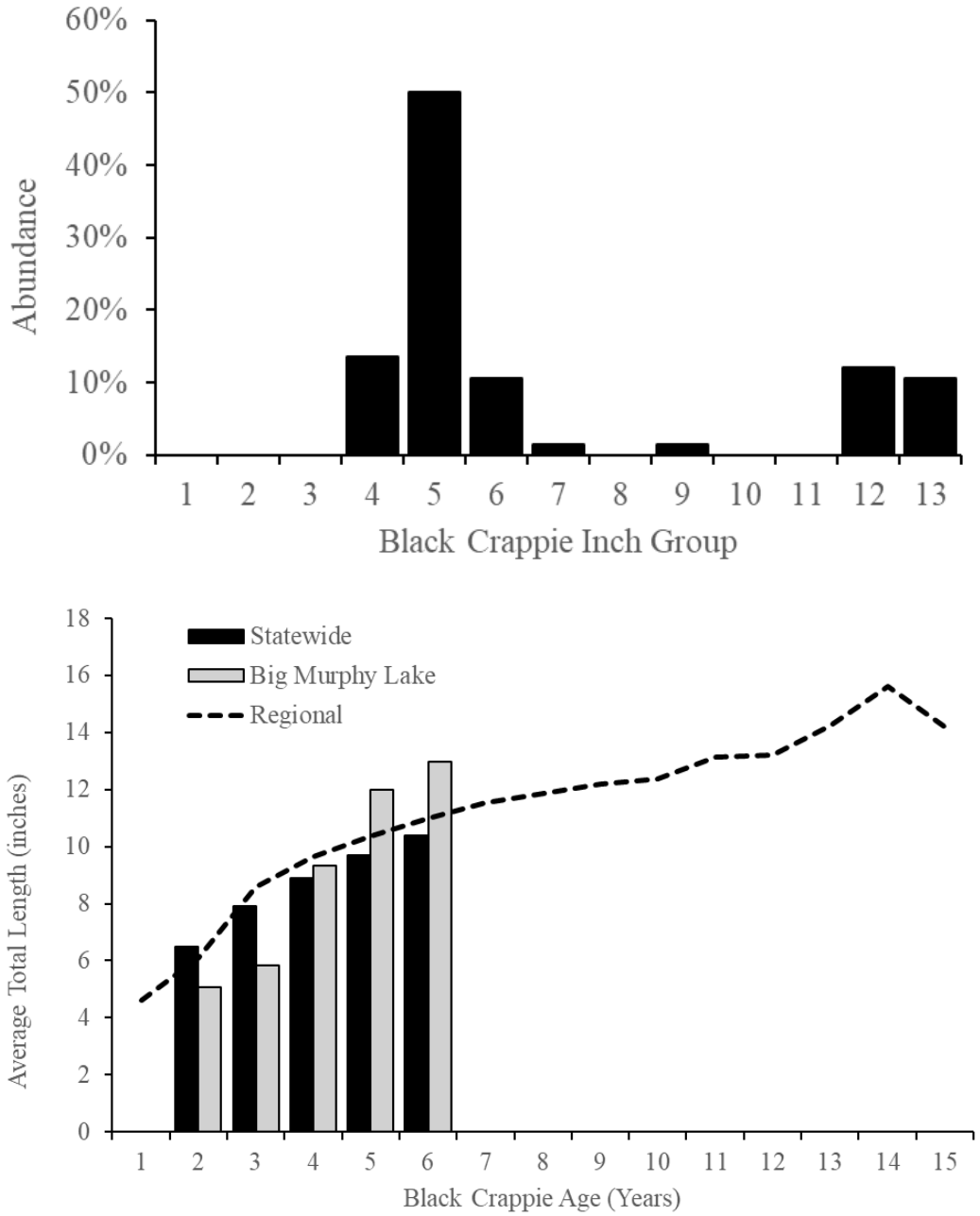


Figure 7. Percent abundance by inch group (top) and the average total length (inches) at age (bottom) of Bluegill captured in Big Murphy Lake, Schoolcraft County during the 2023 survey.

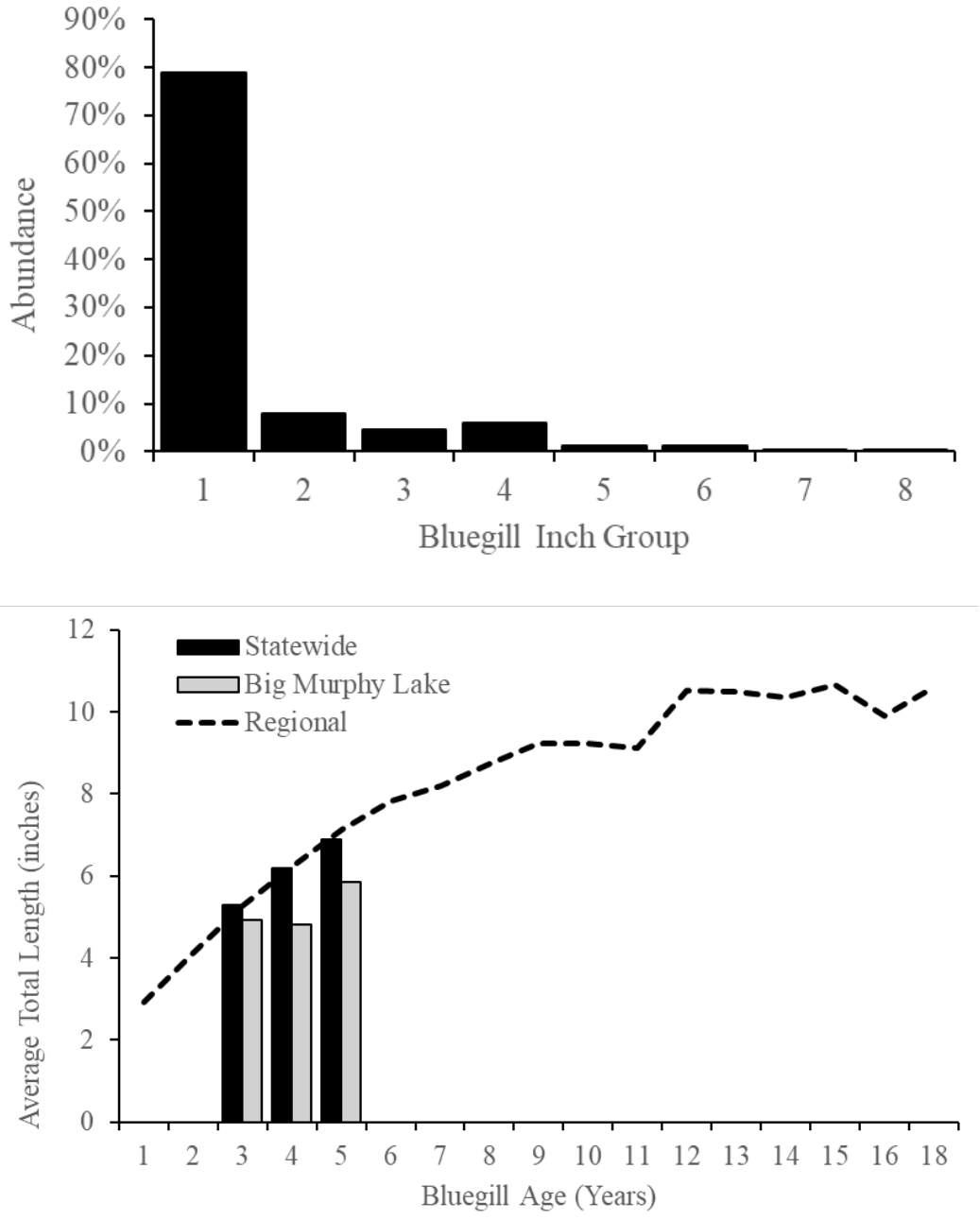


Figure 8. Percent abundance by inch group (top) and the average total length (inches) at age (bottom) of Largemouth Bass captured in Big Murphy Lake, Schoolcraft County during the 2023 survey.

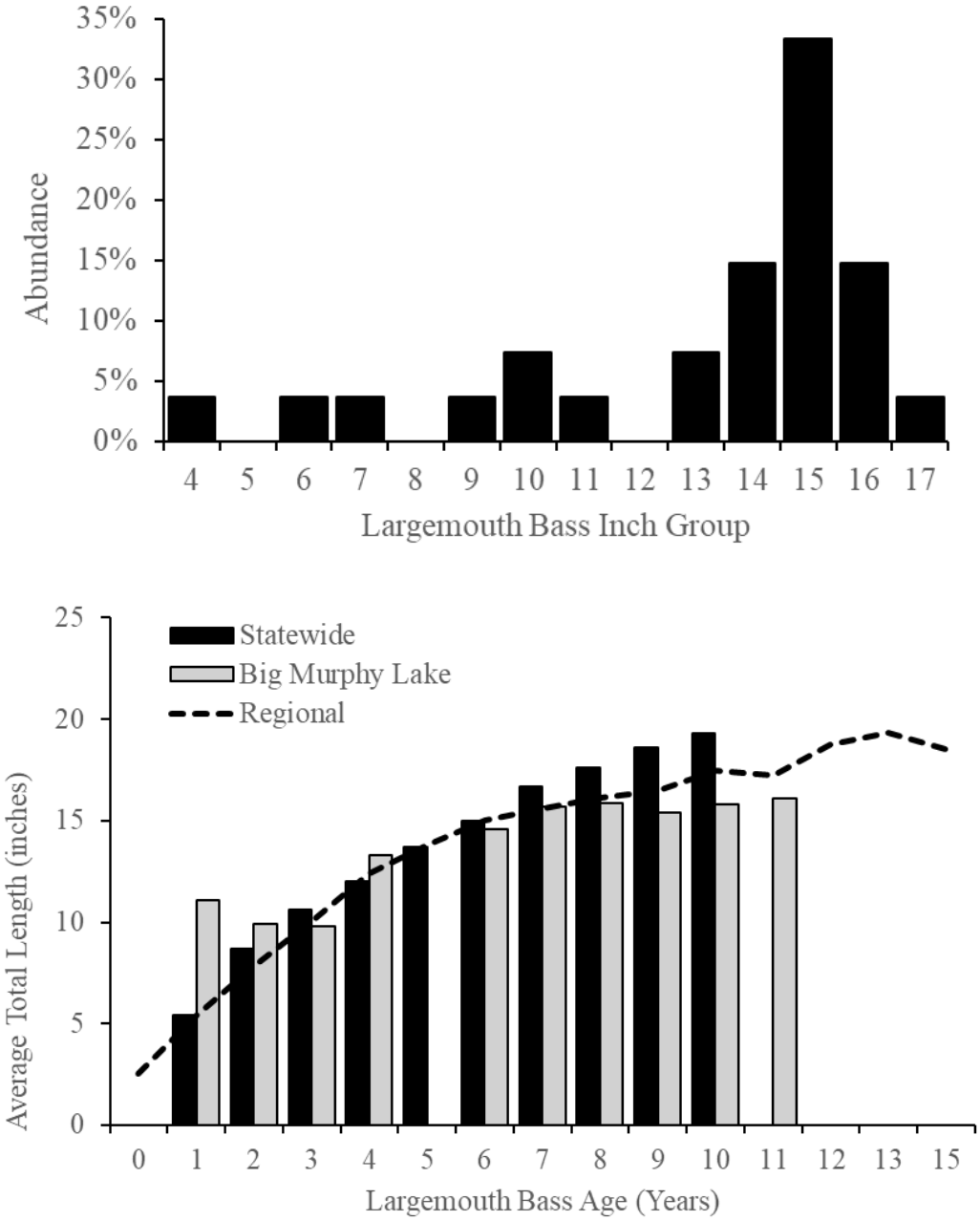


Figure 9. Percent abundance by inch group of Northern Pike captured in Big Murphy Lake, Schoolcraft County during the 2023 survey.

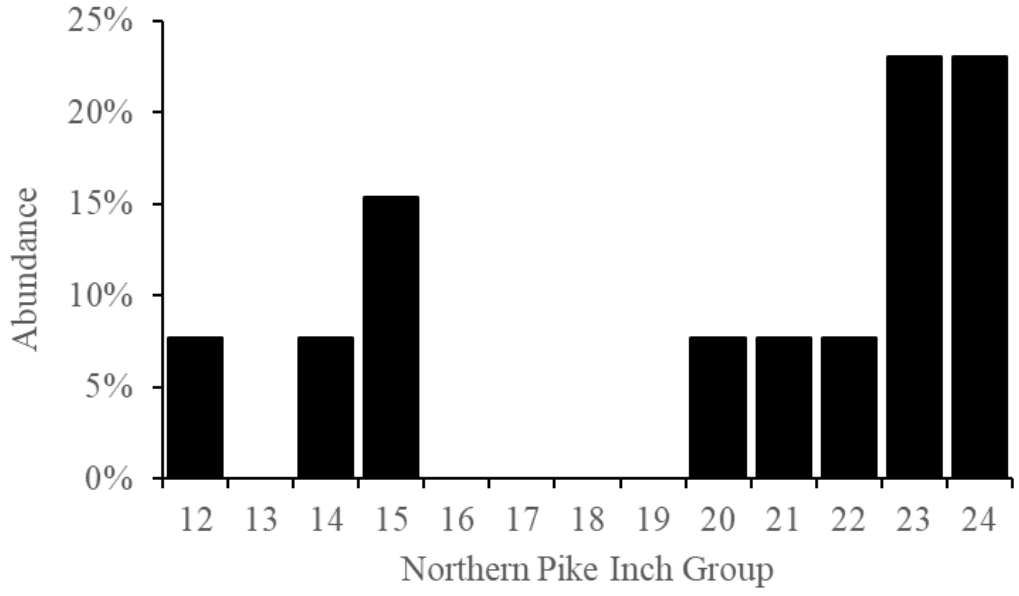


Figure 10. Percent abundance by inch group (top) and the average total length (inches) at age (bottom) of Pumpkinseed captured in Big Murphy Lake, Schoolcraft County during the 2023 survey.

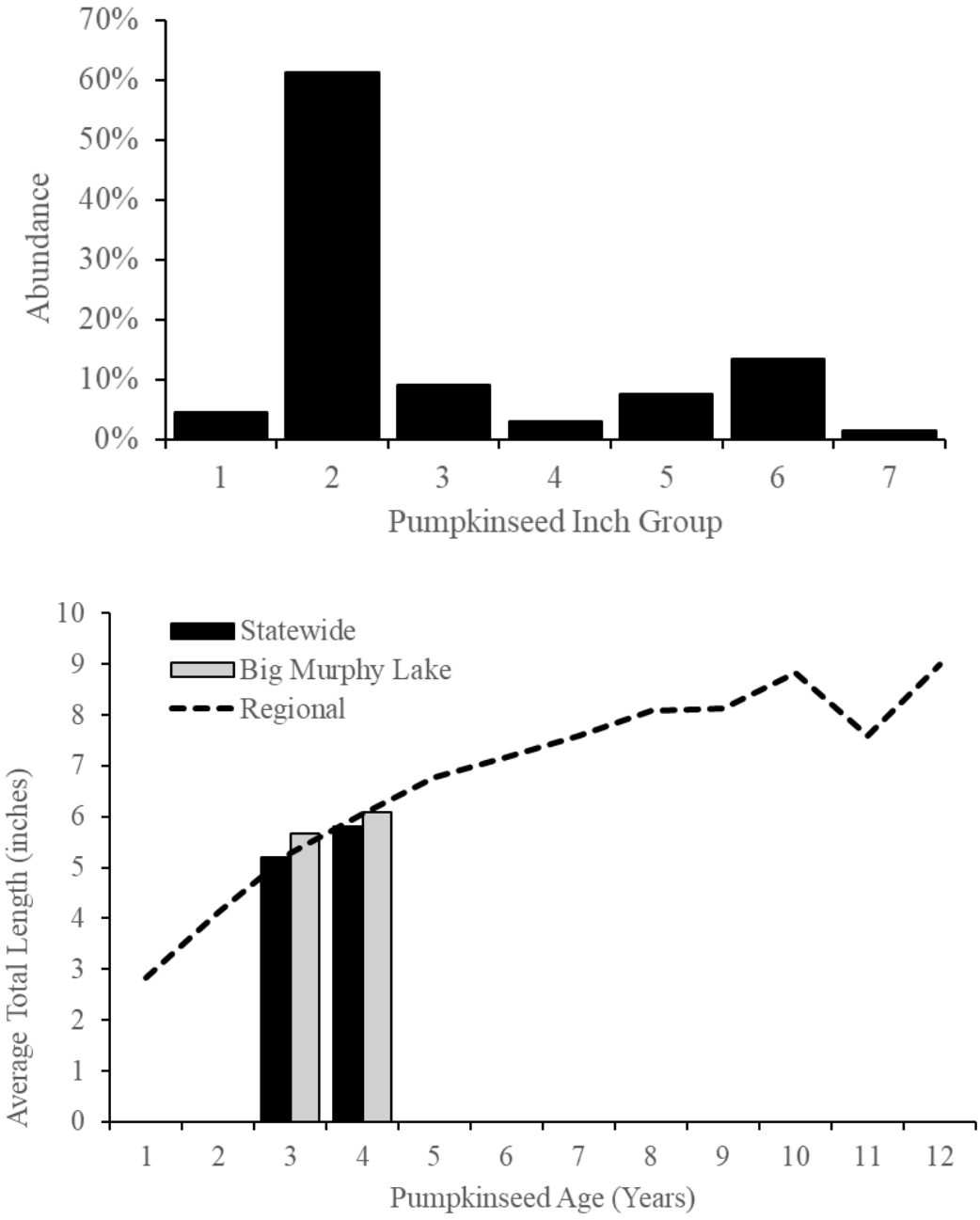


Figure 11. Percent abundance by inch group of Rock Bass captured in Big Murphy Lake, Schoolcraft County during the 2023 survey.

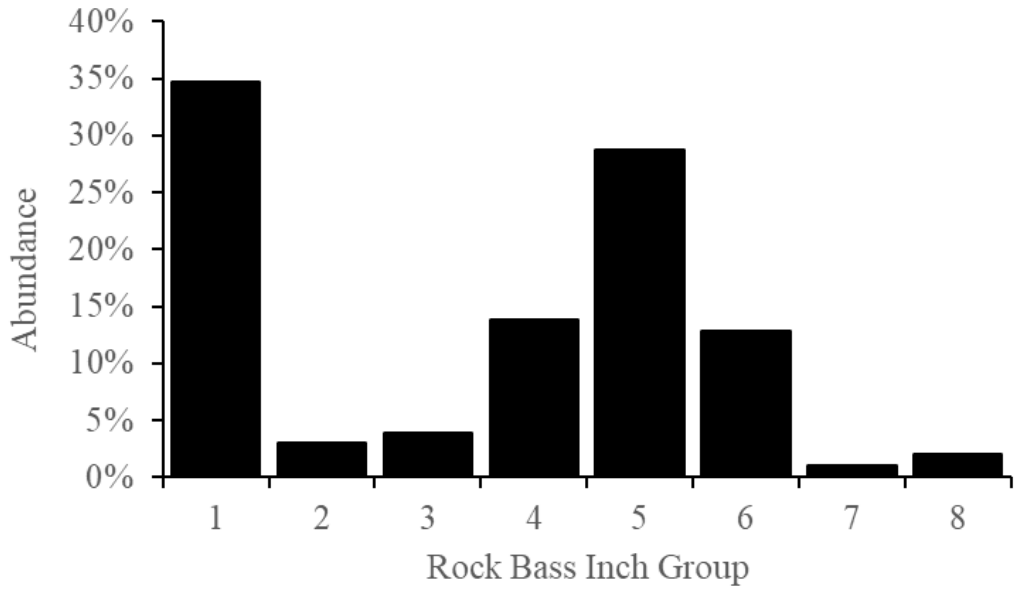
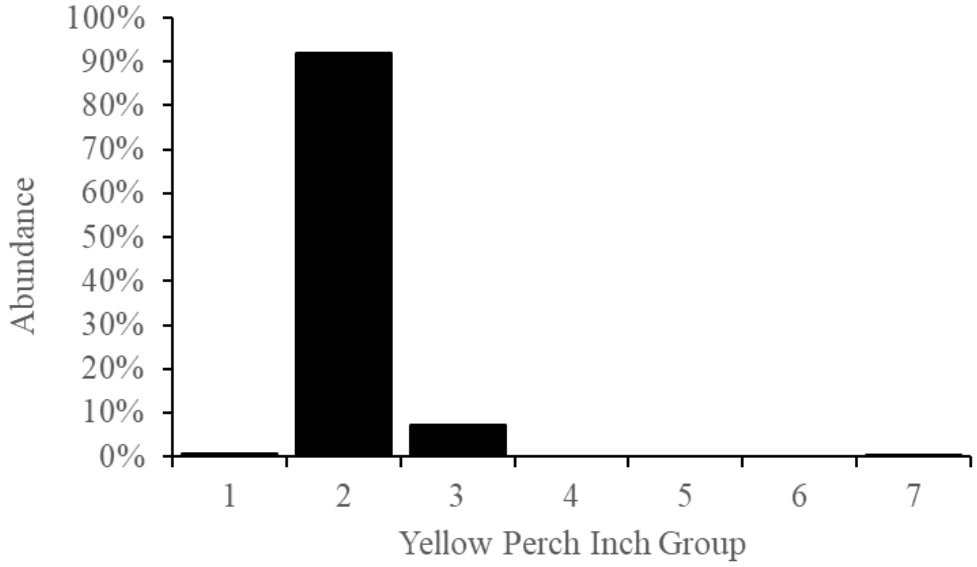


Figure 12. Percent abundance by inch group of Yellow Perch captured in Big Murphy Lake, Schoolcraft County during the 2023 survey.



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