Sixteenmile Lake
(Alger County, T45N/R20W/Sec. 13)
Sturgeon River Watershed, Last Surveyed 2019

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Environment

Location

Sixteenmile Lake is a 443-acre natural lake located in Au Train Township in central Alger County (T45N/R20W/Sec. 13) in Michigan's Upper Peninsula (Figure 1). Chatham (west) and Munising (northeast) are located approximately 10 and 12 miles, respectively, from Sixteenmile Lake along M-94.

Geology and Geography

Geological bedrock formations encompassing Sixteenmile lake include the Prairie Du Chien and Black River groups (MDNR 2001) formed during the early Ordovician period of the Paleozoic Era (USGS 2019). The surrounding landscape is largely forest (83.5%) or wetland (7.6%) with urban, grassland, barren, and water making up less than 10 percent of land cover. The surficial geology of this region is comprised largely of course (75.6%), and medium (18.9%) textured materials with the remaining (5.5%) landscape comprised of untextured materials (e.g., organic material). Course and medium textured materials result in greater amounts of groundwater or springs which helps support aquatic life in waterbodies similar in depth to Sixteenmile Lake. Topsoil is comprised largely of Dawson, Greenwood, and Kalkaska-Cusino soil types (USDA 2017).

Watershed Description

Sixteenmile Lake is a flooded headwater area with a channel that serves as a tributary to the Sturgeon River. The Sturgeon River flows south to Nahma, Michigan where it flows into Big Bay de Noc in the northern region of the Green Bay estuary. There are springs located at the northern portion of the lake and temperature can vary as much as ten degrees from north end (typically cooler) compared to the southern end (typically warmer). Sixteenmile Lake is positioned on a north to south axis and has a shallow range in depth from 1 to 12 feet. Approximately 80 percent of the lake is less than 7 feet in depth and as a result, submersed aquatic vegetation is abundant throughout. Additional features of Sixteenmile Lake include a description of the chemical, physical, and biological parameters.

Chemical and physical characteristics

Water chemistry parameters measured in Sixteenmile Lake on 20 August 2019 included alkalinity, total phosphorus, and total nitrogen and values were reported to be 78.0 mg/L, 0.00171 mg/L, and 0.705 mg/L, respectively. While alkalinity values were high compared to similar sized waterbodies in the region, other parameters reported were comparable to regional and statewide values (Wehrly et al. 2015).

Consistent with when water chemistry samples were collected, a limnological survey was conducted in Sixteenmile Lake, at the deepest point in the lake, to measure dissolved oxygen (mg/L), water transparency (Secchi depth) as well as temperature (F), pH, and conductivity (mS/cm). Dissolved oxygen (mg/L) was measured from 1 to 9 feet deep and ranged from 9.41 to 9.51 mg/L. Therefore,

sufficient oxygen exists during the summer to support aquatic life. That said, shallow depth and abundant flocculant organic material are likely to limit oxygen availability during the winter months ultimately effecting fish populations (e.g., winterkill). Secchi depth was reported to be 9.0 feet. From one to nine feet deep, average values for temperature, pH, and conductivity were reported to be 70.8 °F, 8.7, and 109.3 mS/cm, respectively.

Development, public ownership, and access
On 20 August 2019, the Sixteenmile Lake littoral zone and lakeshore were visually surveyed to quantify physical habitat parameters including residential development (dwellings per mile), boat dock density (docks per mile), average percent shoreline armored, and large woody debris (submerged logs per mile) (Table 1).

Results of this physical habitat survey show that residential development in Sixteenmile Lake is higher but comparable to similar sized waterbodies across the region. The shoreline is sparsely populated with large woody debris with a density of 29.9 submerged logs per shoreline mile. This is relatively low compared to waterbodies across the region suggesting that residential development may be impacting the abundance of woody debris within the nearshore areas of the lake. Although the density of woody habitat is low, the natural shoreline is largely intact. While the natural features of the lake are attractive, interest and use by recreational anglers appears limited due to the shallow nature of the lake. Public access is limited to a small parcel located on the western shore (GPS location: 46.30465 -86.76708). This small parcel includes a sandy sloped bank from which anglers can launch small boats, canoes or kayaks.

History

The first record of fisheries management in Sixteenmile Lake occurred in 1909 when 800 Smallmouth Bass were stocked (Table 2). Following the initial stocking of Smallmouth Bass, additional stocking did not occur until the 1930s. During the 1930s, a total of 1,640,000 Walleye were stocked over an eight-year period to establish a fishery for a highly sought-after gamefish. In addition to Walleye, Yellow Perch (1,000 fall-fingerlings) were stocked in 1934 and 5,000 Age-1 Bluegill were stocked in 1945. Sixteenmile Lake was first mapped by the United States Forest Service in 1937 during a period when cottage owners began to populate the area.

During the 1950s, area residents exchanged office communications with the Michigan Department of Conservation (hereafter referred to as "MDNR") regarding fisheries management of Sixteenmile Lake. For example, the Munising-Alger Conservation Club expressed interest in stocking additional Walleye into the lake. MDNR managers explained that many Walleye were stocked in previous decades, however creel records from 1953 to 1961 failed to show that those stocking events were successful (no captures reported). Club members reported some captures of Walleye during this time, however managers noted that it would be difficult to justify a continuation in stocking this species given the poor to limited success of those historical stocking efforts.

Creel records from the 1950s to 1960s indicated that Northern Pike and Yellow Perch were the dominant species in Sixteenmile Lake and much (97 percent) of the harvest occurred during the winter months. In 1953, the United States Forest Service acquired 5.2 acres near the south end of Sixteenmile Lake. Acquisition of this parcel provided opportunities to improve public access given that more people were inhabiting the area. By 1959, approximately 34 cabins populated the shoreline of the lake

and interest of a more attractive recreational fishery was growing. In 1959, conservation club members noted that `bullheads' were abundant, but numbers had begun to decline beginning in 1952. This mention of fluctuating bullhead numbers will become more relevant decades later (late 1990s).

Following an increase in interest among area anglers, MDNR conducted a general survey of Sixteenmile Lake in the summer of 1961 to gather information about the fish community. Northern Pike, Yellow Perch, and Pumpkinseed Sunfish were captured. At this time, managers concluded that this waterbody was a typical `Northern Pike-Yellow Perch environment'. Waterbodies of this type were noted to support an abundance of these species that typically grow slow and reproduce at a relatively high rate. Given the shallow depth and accumulation of organic material, this lake was highly susceptible to fish kill events, typically in the winter and summer months. Despite these conclusions, additional requests were received by MDNR to stock Walleye. MDNR managers responded by reiterating that the accumulation of organic material and shallow nature of this lake would not provide habitat conditions suitable for Walleye stocking.

In 1965, MDNR managers summarized the current state of Sixteenmile Lake in a letter to an angler as being a large, shallow waterbody prone to winter kill events that are often exacerbated by the abundance of flocculant material in the lake. The scarcity of Walleye after previous year's stocking is likely a result of the lake's conditions not being conducive to support Walleye. Also, a continuation of stocking Walleye of a larger size would be very expensive. Fish toxicants could be used to reduce those species that might prey on Walleye; however, this would have removed all desirable species such as Northern Pike and Yellow Perch and therefore, chemical reclamations were not considered feasible.

During the 1970s additional surveys were conducted as riparians became interested in establishing a set water level by use of a control structure. Fishing during this period was reported to be poor to fair for Northern Pike. In 1975, a general survey was conducted to gather fish community information. Northern Pike, Yellow Perch, Pumpkinseed Sunfish, Common White Sucker, Blacknose Dace, Mimic Shiner, Golden Shiner, and Bluntnose Minnow were captured. Fish captured during this survey were typical to those captured during the survey conducted in 1961 and fishing for Northern Pike during this period was noted to be poor to fair.

By the late 1970s, lake residents stated that lake level was down approximately 8 to 12 inches, and a man-made dam was created near the lake outlet but had washed out. Residents were in the process of establishing a legal lake level in hopes of raising the water level in Sixteenmile Lake. In 1977, a public notice was issued regarding the construction of a water level control structure and was approved in August of that same year. While a permit was granted to construct the water level control structure, there was not a legally established water level during that time.

During the 1980s, several surveys were conducted including general fish community assessments in conjunction with manual removals which were a popular management strategy at that time. In August of 1983, a general survey was conducted, and managers noted that the fish population had changed dramatically since the 1975 survey. In the 1975 no bullhead were captured and only 6 Pumpkinseed Sunfish, 855 Yellow Perch (3% preferred size) and 72 Northern Pike (41% harvestable size) were represented. Results from the early 1983 survey showed that bullhead (Black Bullhead) had become the dominant species and that Northern Pike and Yellow Perch were abundant and undersized. In

1984, MDNR managers drafted a management plan to help `balance' the lake's fish population and improve the sport fishery.

Following the surveys conducted during the early 1980s, MDNR managers noted that stocking efforts would not be successful unless un-desirable or competing species (namely bullhead) were removed prior to stocking. MDNR managers summarized the history of Walleye stocking in the lake and stated that the population decrease was likely due to fluctuating water levels in the lake. MDNR managers also noted that once the existing fish population was put into `balance', Walleye could be stocked regularly in the future.

Prior to the management plan being drafted, anglers targeted Northern Pike and Yellow Perch (mostly through the ice). However, by the early 1980s, the lake had become dominated by Black Bullhead that comprised 82 percent of the lake biomass. Sunfish were still abundant but small. Northern Pike were less abundant and were also small. The radical change in the fish community was noted to be at the expense of the recreational sport fishery. The following actions were proposed in the 1984 management plan as ways to improve the fish community; 1) chemical reclamation, 2) manual removal of all species except Yellow Perch, Pumpkinseed Sunfish, and minnows, 3) stock Tiger Muskellunge in alternate years, and 4) stock Largemouth Bass consecutively for three years.

A chemical reclamation using Rotenone (1.0 ppm) was proposed, however removing the desired species (namely, Northern Pike and Yellow Perch) would also occur so this was not favorable. Also, the cost of the reclamation was estimated to be near 10,000 dollars (25,713 in 2021 dollars). Springs located in the northern arm of the lake would make an effective treatment difficult. Therefore, due to the potential loss of desirable species, costs and treatment logistics, chemical reclamation was not conducted.

Since chemical reclamation was not feasible, manual removals were prescribed to be conducted during the winter of 1984 through the spring of 1985. Tiger Muskellunge were selected to be stocked as an alternative to Northern Pike because they are a hybrid and do not reproduce, so their abundance is predetermined by stocking rate, and they may provide control of the Northern Pike population. Tiger Muskellunge were also expected to grow faster than Northern Pike providing more opportunity for larger sized gamefish. Largemouth Bass were introduced with the intention of utilizing the small and abundant sunfish populations resulting in an improved size structure of those species. This management plan was to remain in effect until 1990 until each action item was implemented.

Manual removal of Black Bullhead (13,677 pounds) and Northern Pike (3,188 pounds) had occurred by 1985. Following manual removals, area residents expressed concerns to MDNR that dead fish left on the ice may begin to smell post-ice melt. At that time, fish removed during surveys were left on the ice to be utilized by area wildlife. To address those concerns, MDNR staff later disposed of dead fish offsite. Following manual removal surveys, Tiger Muskellunge were stocked in 1985, 1987, 1989, and 1991. On average, there were 813 fall-fingerling Tiger Muskellunge stocked each time over those four years. A total of 19,669 and 7,355 spring-fingerling Largemouth Bass were stocked in 1985 and 1990, respectively.

During the mid-1980s, MDNR managers supported the efforts of riparians to maintain lake water levels by constructing a water-level control structure. However, MDNR managers noted that area

residents would need to gather support from all Sixteenmile Lake riparians and work with Lansing officials to complete this process. In 1986, a water level control structure permit was issued to the association that then purchased all the materials needed for construction. In September of 1986, MDNR field staff installed a water level control structure composed of rock and logs. The structure was built in a manner that provided riparians with the ability to adjust the water level as needed. The permit was not intended to establish a `legal lake level', but rather to prevent water levels from dropping below an agreed upon point during the dry, mid-summer months.

By the late 1980s, after additional manual removals were conducted, approximately 18,000 pounds of bullhead had been removed from Sixteenmile Lake. As proposed, the removal was intended to help develop a fishery for Tiger Muskellunge and Largemouth Bass. In 1989, following the completion of all action items in the management plan, a general survey was conducted to obtain additional information about the fish community. More specifically, this survey was conducted to assess the status of the Black Bullhead and Northern Pike populations as well as the success of the Tiger Muskellunge and Largemouth Bass stocking. Species captured during this survey included Northern Pike, Yellow Perch, Black Bullhead, Golden Shiner, Pumpkinseed Sunfish, Common White Sucker, Rock Bass, Largemouth Bass and Tiger Muskellunge.

Despite having removed 18,000 pounds of Black Bullhead, the 1989 survey found that Black Bullhead were again "very numerous", and capture numbers did not "seem to have changed much since 1983". The 1989 survey report concluded that additional removals be conducted in the future. Two Tiger Muskellunge were captured during this survey suggesting that some stocked fish had survived. Northern Pike were noted as being low in abundance and robust in size suggesting that removals may have improved the size structure of that species. Yellow Perch were "more numerous than ever" as noted in the survey report and riparians shared that several Largemouth Bass (2.5 pounds) were captured following stocking.

A recommendation to improve public access was mentioned in the 1989 report and efforts were made to acquire a parcel of land that was owned by Mead Corporation. However, there is no documentation that a parcel of land was ever acquired from Mead Corporation. Following construction of the water level control structure, riparians again communicated their interest of establishing a legal lake level (1989). The request was forwarded to the Department of Environmental Quality Surface Water Quality Supervisor for further review. There is no documentation that a legal water level had been established for Sixteenmile Lake.

By the early 1990s, stocking of Tiger Muskellunge and Largemouth Bass was ceased and angler interest in Sixteenmile Lake fisheries management had increased. In 1995, a law office requested all information regarding fish or lake studies that had occurred. These data were provided to the public as area residents and anglers were interested in reviewing results from previous survey efforts. In 1998, a general fish community survey was conducted. Fish captured included Black Bullhead, Golden Shiner, Northern Pike, Yellow Perch, Common Shiner, Largemouth Bass, Rock Bass, and Pumpkinseed Sunfish. Results from the 1998 survey found that bullhead numbers were at `pre-removal' levels (13 years after removal). Growth rates of all species including Northern Pike, Yellow Perch, and Largemouth Bass were below average. Growth of Pumpkinseed were comparable to the state average, but only younger age classes were represented in the catch. There were no Tiger

Muskellunge captured during the survey, however, anglers mentioned some Tiger Muskellunge were captured but not recently. Public access was noted to be limited at that time.

In 1999, MDNR staff attended a meeting with Sixteenmile Lake riparians. There were approximately 25 to 30 homeowners present. Attendees of the meeting were interested to know what could be done to improve the recreational fishery. MDNR staff provided a history of the fishery and a variety of topics were discussed including 1) declining lake levels and failure of the manmade water level control structure, 2) bullhead removals, 3) and staff limitations. During the discussion it was noted that manual removal of Black Bullhead had created only a temporary improvement in the sport fishery and current staff limitations made additional removal efforts unfeasible. There was a concern expressed that Black Bullhead may have been recently introduced during the 1970s. However, previous reports from anglers and MDNR survey results showed that Black Bullhead had existed at varying densities over a long period of time.

The recommendations that were discussed at the 1999 meeting for future management included 1) the establishment of a legal lake level and re-construction of the water level control structure, 2) encourage angler harvest of Northern Pike to reduce abundance, and 3) MDNR would assess the feasibility of stocking Smallmouth Bass. Following that meeting in 1999, a letter was provided to MDNR staff expressing appreciation for MDNR attendance and the information shared.
During the early 2000s, the Sixteenmile Lake Association members were interested in knowing if stocking of fish could occur in the lake. Area residents explained that there were additional issues associated with the water level control structure, however they had reached out to engineers to improve that structure. In 2002, the lake association was again interested in filing a request to receive all files and survey reports associated with Sixteenmile Lake. Copies of all files were soon provided by MDNR staff.

In 2003, MDNR staff attended a meeting with Sixteenmile Lake riparians. There were approximately 30 to 35 people in attendance. Staff provided a brief management history of the lake and shared fisheries data from previous years. The following information was shared with residents; 1) manual removal of bullhead is labor intensive and the biological benefits are short-lived, 2) the lake is largely private with little access available to the public, and 3) more efficient use of angler dollars would be more appropriate on other lakes given previous years management actions and results.
In 2005 an application was received by the Department of Environmental Quality from a riparian owner requesting to remove shrubs and vegetation from 100 feet of shoreline and to plant grass to the water's edge. This application was denied due to the negative impacts that result from altering natural shorelines as proposed.

In 2017, area residents raised funds to purchase Largemouth Bass and stock Sixteenmile Lake. A total of 80 yearling Largemouth Bass were stocked to help build the population after a suspected winterkill event.

Current Status

Beginning on 17 June 2019, MDNR conducted a survey in accordance with random inland lake Status and Trends survey protocols (Wehrly et al. 2015) to assess the Sixteenmile Lake fish community. A variety of gear types were used including 5 large-mesh fyke nets and 2 small-mesh fyke nets. Four of the large-mesh fyke nets were set for three nights and one large-mesh fyke net was set for two nights

totaling fourteen net nights. Two small-mesh fyke nets were set for three nights each for a total of six net nights. Four seine hauls were completed in nearshore areas. Experimental gill netting and electrofishing surveys could not be conducted in accordance with Status and Trends protocols due to limitations in lake depth and launch access.

Gamefish species including Northern Pike, Pumpkinseed, Rock Bass, and Yellow Perch were measured to the nearest tenth of an inch. Aging structures (10 per inch group) were collected from each gamefish species for age and growth analysis. Scales were collected from panfish species less than 6.0 inches. Anal fin spines were collected from panfish greater than 6.0 inches, and all Northern Pike.

A total of 8,486 fish weighing 1,163 pounds and representing 9 species were captured during the 2019 survey (Table 3). Piscivores, such as Northern Pike and Yellow Perch comprised 1 percent of the catch by number and 5 percent of the catch by biomass. Planktivore-Insectivores such as sunfishes, minnows, and darters comprised 4 percent of the catch by number and 1 percent of the catch by biomass. Benthivores such as Common White Sucker and Black Bullhead comprised 96 percent of the catch by number and 95 percent of the catch by biomass. The total standing crop (Schneider 2000) for Sixteenmile Lake in 2019 was approximately 96 pounds per acre.

Northern Pike - A total of 29 Northern Pike were captured averaging 20.2 inches and comprised 0.3 percent of the catch by number and 4.6 percent of the catch by biomass (Table 3). Northern Pike size ranged from 15.0 to 24.0 inches with 3 percent of the catch meeting or exceeding the minimum size for harvest (24.0 inches). The age distribution of Northern Pike indicated annual recruitment from two- to seven-years-old. The average total length of Northern Pike captured in large-mesh fyke nets was 20.2 inches. The catch per unit effort (CPUE) of Northern Pike in large-mesh fyke nets was 2.07 individuals per net night. Age 3-, 4-, and 5-year-old Northern Pike were all growing significantly below (-3.4 inches) state average. The age at which Northern Pike in Sixteenmile Lake reach legal size is greater than seven-years-old.

Yellow Perch - A total of 37 Yellow Perch averaging 3.4 inches comprised 0.4 percent of the catch by number and less than a percent of the catch by biomass (Table 3). Yellow Perch size ranged from 2.0 to 4.0 inches with none of the catch meeting or exceeding the minimum preferred size for harvest (7 inches). Only a small representative sample (three fish) of age structures were obtained from Yellow Perch. Although limited in sample size, Yellow Perch captured were growing an inch below the state average at two-years-old.

Rock Bass - A total of 19 Rock Bass averaging 6.9 inches comprised 0.2 percent of the catch by number and 0.5 percent by biomass (Table 3). Rock Bass size ranged from 5.0 to 9.0 inches with 89 percent of the catch meeting or exceeding the preferred size for harvest. The age distribution of Rock Bass captured indicated annual recruitment from two- to five-years-old. All age groups of Rock Bass were generally growing above (2.1 inches) the state average.

Pumpkinseed - A total of 5 Pumpkinseed averaging 2.5 inches comprised 0.1 percent of the catch by number and less than a percent by biomass (Table 3). Pumpkinseed size ranged from 1.0 to 3.0 inches with none of the catch meeting the minimum preferred size for harvest.

Other Species - Forage species captured during this survey included Bluntnose Minnow (N = 172), Golden Shiner (N = 100), Common White Sucker (N = 1), and Iowa Darter (N = 2). Collectively, these species represented an insignificant proportion of the total number and biomass. Black Bullhead (94.5 percent) represented a significant proportion of the Sixteenmile Lake fish biomass. A total of 8,121 Black Bullhead were captured with an average size of 6.5 inches and ranging from 5.0 to 11.0 inches.

Analysis and Discussion

Sixteenmile Lake is a medium-sized, shallow, undeveloped lake that contains fish species typical of inland lakes in northern Michigan. Due to the shallow nature of this waterbody and the abundance of aquatic vegetation, production of an attractive recreational fishery will continue to be limited. These conditions are typical of waterbodies serving as headwater sources to streams and rivers in the region (Worchester Lake, MDNR 2019). Opportunities may exist to improve the fishery by encouraging harvest of typically less-desired species (i.e., Black Bullhead) that are currently dominating the fishery.

Species richness, the number of fish species in a lake, of Sixteenmile Lake is low but typical of lakes that occur in the northern region of the state (Wehrly et al. 2015). There were no fish captured that are listed as Species of Greatest Conservation Need and there were no threatened or endangered species captured.

The Northern Pike population in Sixteenmile Lake is slow-growing and of moderate to high density. Michigan's Northern Pike Management Plan can be used to evaluate populations and guide managers towards regulations changes that may improve density and size structure of a population (Smith et al. 2016). For example, a population of Northern Pike is determined to be slow growing when Age 3-, 4-, and 5-year-old fish are growing below the State's 25th percentile. Additionally, a population of Northern Pike is determined to be medium to high-density when CPUE values for fyke net catches exceeds the State's median and 75th percentile catch rate values. Based on the results of this survey, Sixteenmile Lake is determined to have a slow growing, moderate to high density Northern Pike population where only three percent of the fish captured were legal size (i.e., 24 inches or greater). Therefore, a regulation change which serves to reduce over abundance, improve growth rate, while maximizing sustainable harvest would improve conditions for the Northern Pike population in Sixteenmile Lake.

Yellow Perch creel information from the 1950s and 1960s indicated that Sixteenmile Lake historically provided a winter fishery. Based upon the size of Yellow Perch captured during the 2019 survey, it is unlikely that an attractive fishery currently exists for this species. While habitat is not lacking for Yellow Perch reproduction, older age classes of this species may be limited by periodic winter- or summer-kills. Aside from the impacts of fish kills, regulation changes that encourage the harvest of Northern Pike may help to reduce predation of Yellow Perch. Reducing predation may provide opportunity for Yellow Perch to reach a more desirable size for anglers.

A panfish (e.g., Pumpkinseed) and bass fishery does not currently exist in Sixteenmile and based upon historical information may not have ever existed to any significant degree. Similar to Yellow Perch, these species may be limited by the shallow nature of Sixteenmile Lake which makes the lake prone to winter- or summer-kill events. In 2017, area residents and anglers stocked 80, 5-inch Largemouth Bass. However, none of these fish were captured in the 2019 survey suggesting that this stocking

event was largely unsuccessful. Largemouth Bass are not captured as efficiently in impoundment gear, so it is possible that some Largemouth Bass did survive this plant. Largemouth and Smallmouth Bass are most effectively sampled using electrofishing; however, Sixteenmile Lake could not be sampled using an electrofishing unit.

Documentation shows that Black Bullhead have represented a significant proportion of the Sixteenmile Lake biomass at least since the 1950s with some periods (early 1950s) of low abundance reported. Manual removal surveys were performed during the 1980s when nearly 18,000 pounds were removed to balance the fishery. However, in less than a decade, biomass of Black Bullhead was documented to have rebound to pre-removal levels demonstrating this is not an efficient management strategy. Manual removal of undesirable species was historically a common practice used by fisheries managers. However, more recent research suggests removal efforts are unlikely to result in an improvement of intended species (Zorn et al. 2020).

Black Bullhead are documented to spawn during the early spring when water temperatures approach a range in temperature from 50 to 60 °F. Harvest of Black Bullhead in Sixteenmile Lake is permitted year-round and there are no size or possession limits. Bullhead generally are not targeted for harvest as they are not widely regarded as suitable table fare. However, when prepared appropriately, Bullhead can provide a quick and easy meal (Appendix 1 - U.P. Bullhead Stew). Annual spring removal of Black Bullhead via angler harvest may help reduce competition with more desirable species (namely, Yellow Perch and Pumpkinseed). However, significant long-term benefits to the lake fish community are unlikely.

Management Direction

Sixteenmile Lake should be managed as a headwater lake that provides a limited multi-season fishery for Northern Pike and Yellow Perch similar to what existed during the 1950s and 1960s. The lake depth limits this lake's ability to produce an attractive fishery which has been well documented as early as the 1960s. However, some modifications to regulations may be made to improve the fishery. For example, regulation changes for Northern Pike should serve to reduce the biomass of a top predator while improving population size structure. A reduction in biomass of Northern Pike and Black Bullhead should also provide greater opportunity for Yellow Perch and Pumpkinseed to reach a preferred size.

The placement of a water-level control structure on Sixteenmile Lake does not appear to be improving the fishery and may be hindering outmigration of Black Bullhead resulting in an overabundance of that species. Any future proposals for modification of this structure should be carefully considered given that higher water levels have not improved recreational angling opportunity.

1). The current regulation for Northern Pike in Sixteenmile Lake is 24-inch minimum size limit, with a possession limit of 2 fish. This regulation should be changed to the "No minimum size limit with a possession limit of 5 fish (only 1 over 24-inches allowed). This regulation will allow anglers to take advantage of an abundance of slow growing undersized fish, while potentially reducing over-abundance and improving population growth rates.

2). A follow up spring survey using small- and large-mesh fyke nets should be conducted approximately 6 to 10 years after any regulation changes to evaluate changes to the Northern Pike population.

3). Anglers are encouraged to annually harvest Black Bullhead from Sixteenmile Lake during spring to utilize existing fish as a food source.

References

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Figure 1. Map of Sixteenmile Lake, Alger County Michigan. Arrow indicates approximate location of public access site (GPS: 46.30465 -86.76708).

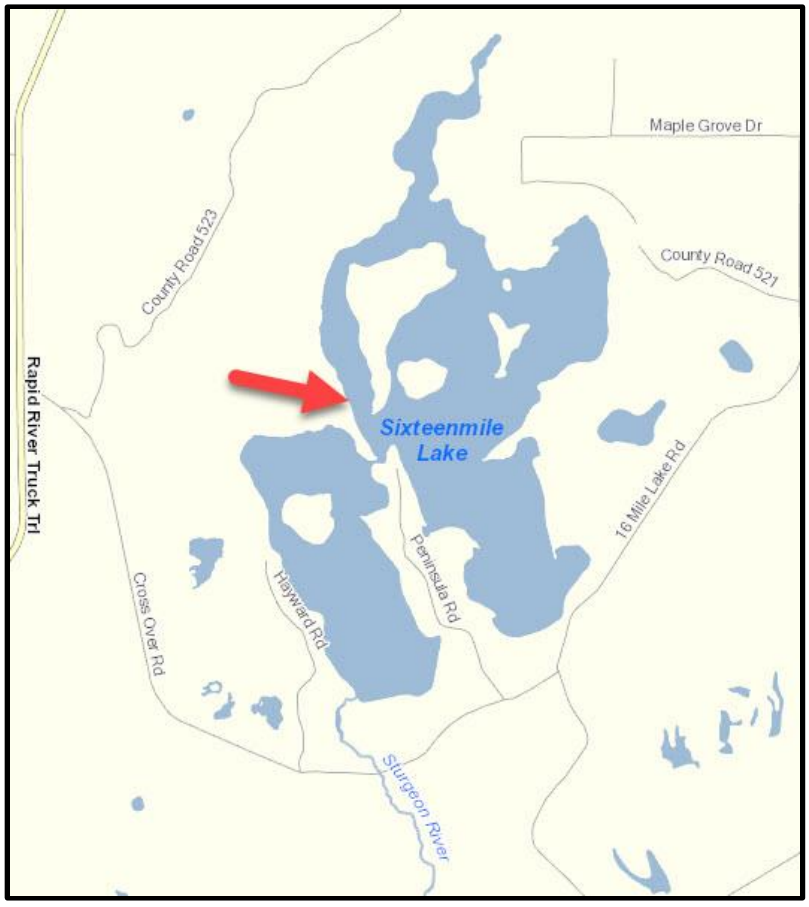

Table 1. Physical indicators including dwelling density (per mile), boat docks (per mile), shoreline armoring (average % armored), and large woody debris (per mile) measured in Sixteenmile Lake, and the regional average (Northern Lake Michigan Management Unit).

Physical Indicator	Sixteenmile Lake	Region
Dwelling Density	8.5	6.0
Boat Docks	8.1	3.4
Shoreline Armoring	2.2	0.7
Large Woody Debris	29.9	341.1

Table 2. Historical stocking record for Sixteenmile Lake (Alger County) by species, year, number (N) stocked, number (N) per acre, and age/size (in.) at stocking.

Species	Year	N Planted	N / Acre	Size at Stocking (in.)
Smallmouth Bass	1909	800	1.8	Fingerling
Walleye	1933	150000	338.6	Swim-up fry
Walleye	1934	120000	270.9	Swim-up fry
Yellow Perch	1934	1000	2.3	8 month
Walleye	1935	150000	338.6	Swim-up fry
Walleye	1936	120000	270.9	Swim-up fry
Walleye	1937	150000	338.6	Swim-up fry
Walleye	1938	200000	451.5	Swim-up fry
Walleye	1939	600000	1354.4	Swim-up fry
Walleye	1940	150000	338.6	Swim-up fry
Bluegill	1945	5000	11.3	15 month
Largemouth Bass	1985	19669	44.4	1.73
Tiger Muskellunge	1985	900	2.0	10.24
Tiger Muskellunge	1987	550	1.2	10.28
Tiger Muskellunge	1989	900	2.0	8.58
Largemouth Bass	1990	7355	16.6	2.01
Tiger Muskellunge	1991	900	2.0	9.21
Largemouth Bass	1991	11000	24.8	3.03
Largemouth Bass	2017	80	0.2	5.17

Table 3. Species, number (N), percent by number (% by N), weight (WGT, in pounds), percent by weight (% by WGT), total length (TL) range in inches (in.), and average total length (Avg.TL) of fish captured during 2019 fisheries survey conducted in Sixteenmile Lake, Alger County. Results include fish capture results from all gear types combined.

Species	N	% N	WGT (lbs.)	% WGT	Range TL (in.)	Avg. TL (in.)
Bluntnose Minnow	172	2	1	0.1	1.0 to 3.0	2.5
Black Bullhead	8,121	95.7	1,098.90	94.5	5.0 to 11.0	6.5
White Sucker	1	0	2.9	0.3	19.0 to 19.0	19.5
Golden Shiner	100	1.2	0.5	0	1.0 to 4.0	2.6
Iowa Darter	2	0	0	0	2.0 to 2.0	2.5
Northern Pike	29	0.3	53.3	4.6	15.0 to 24.0	20.2
Pumpkinseed	5	0.1	0.1	0	1.0 to 3.0	2.5
Rock Bass	19	0.2	5.7	0.5	5.0 to 9.0	6.9
Yellow Perch	37	0.4	0.5	0	2.0 to 4.0	3.4

Appendix 1. Recipe for preparing Bullhead for table fare.

U.P. Bullhead Stew with Butternut Squash (Serves 10) *

Description: Combine all the stew ingredients including ¾ cup water into a large pot. Cook on low for approximately 40 minutes, or until the Bullhead is tender and cooked through. Serve with 2 ½ cups of cooked Basmati rice.

Stew Ingredients:
5 pounds of Bullhead filleted and cut into 2-inch pieces
3 pounds peeled butternut squash, 1-inch cubes
6 medium scallions, cut into ½ inch pieces
2 medium red bell peppers, diced
8 medium garlic cloves, thinly sliced
2 tablespoons grated fresh ginger
4 teaspoons toasted sesame oil
2 tablespoons red curry paste
3 teaspoons kosher salt
2 tablespoons Sriracha sauce
2/3 cup reduced-sodium soy sauce
½ cup fresh lime juice (from about 4 limes)
4 tablespoons chopped fresh cilantro, plus 1 tablespoon for garnish
2 cans unsweetened full-fat coconut milk

*Chemicals can be in fish that you catch or buy from anywhere in the world, but there are always good choices for eating. To get a free copy of the Michigan Department of Health and Human Services EAT SAFE FISH GUIDE, and other helpful information about choosing and eating safe fish, visit Michigan.gov/EatSafeFish or call MDHHS at (800) 648-6942.