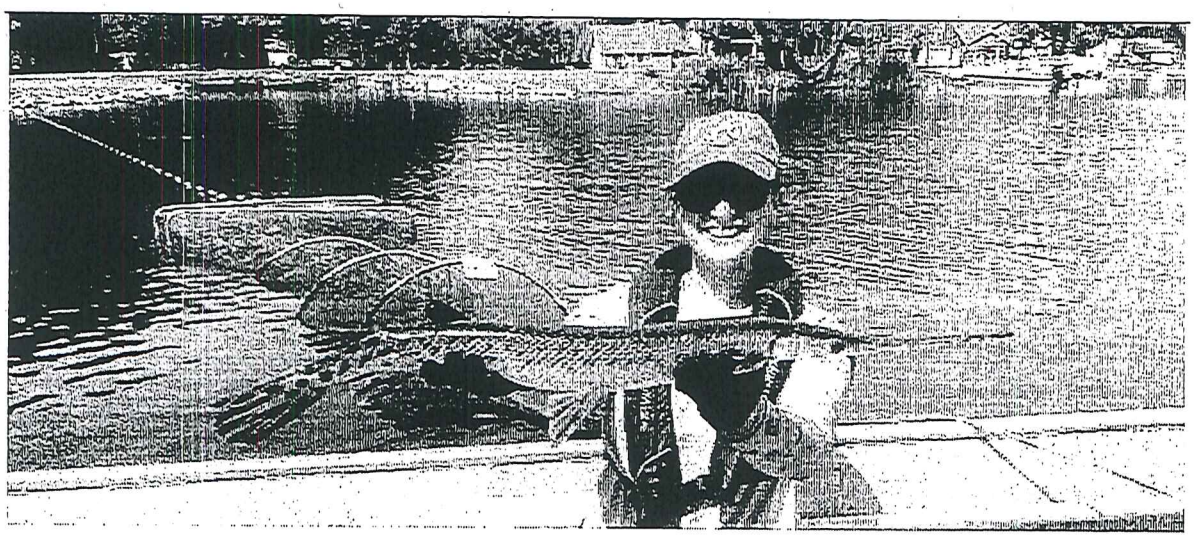
DNR

Michigan DNR Fisheries– Southern Lake Huron Management Unit

Chippewa Lake – 2022 Status and Trends

2022 Status and Trends Lake Report



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On the cover: DNR Fisheries Biologist, April Simmons, with a 35 in Longnose Gar captured in a large-mesh fyke net from Chippewa Lake. Photo Credit: A. Simmons

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Introduction

The Inland Lake Status and Trends Program (LSTP) of the Michigan DNR is a statewide program with annual management unit obligations. The purpose is to conduct standardized fishery and limnological sampling on public inland lakes greater than 10 acres that allows for statewide comparisons over a one-to-two-week period in late spring or early summer (55-80°F). Multiple gear types are used in an effort to randomly sample different habitats and to collect information on a range of species and size classes:

- *Large-mesh fyke net* consist of a lead (4' x 100'), a front frame made up of two rectangles (4' x 6'), and a pot end made up of three hoops (4' diameter) and two throats. The mesh size of 1.5 in captures larger (> 3 in) species that inhabit the littoral zone or move inshore at night. Nets are set overnight perpendicular to the shoreline.
- *Small-mesh fyke net* consist of a lead (3.5' x 50'), a front frame made up of two rectangles (3.5' x 6'), and a pot end made up of three hoops (3' diameter) and two throats. The mesh size of 3/16 in captures small (< 3 in) species that inhabit the littoral zone or move inshore at night. Nets are set overnight perpendicular to the shoreline.
- *Experimental gill nets* consist of five monofilament panels of 1.5, 2.0, 2.5, 3.0, and 4.0-in-stretch mesh, each 25 feet in length. Gill nets should be set in offshore areas and may not be suitable for all lakes biologically or socially.
- *Seine* is 5' tall and 25' long with a mesh size of 3/16 in to capture small (< 3 in) species that inhabit the littoral zone. Seines should be deployed parallel to shore and then formed into a semi-circle by keeping the nearshore end stationary and pulling the offshore end in an arc. The seine can then be pulled toward shore trapping fish between the shoreline and the seine.
- *Boom shocking* is completed at night as catch rates and the number of species encountered tends to be higher than during the day. A minimum of three 10-minutes passes should be made in the littoral zone parallel to the shore. All species of all sizes should be netted.
- *Trap net* consist of a lead (6' x 100'), two wings and heart (3' x 6'), and a pot with a single throat. The mesh size of 1.5 in captures larger (< 3 in) species that inhabit the littoral zone or move inshore at night. Nets are set overnight perpendicular to the shoreline.

Chippewa Lake was surveyed with gillnets and hook and line by the Michigan Fish Commission in September of 1892. The shore was described as 'mostly high' with a sand beach and a hard clay bottom. The surface and bottom water temperatures remained in the low 60s during the weeklong survey. The survey found "Black Bass Smallmouth, Grass Pike, Calico Bass, Rock Bass, Bluegills, perch, sucker, Gar Pike, and Dogfish". Grass Pike is likely referring to Northern Pike not the Grass Pickerel. Dogfish is another common name for Bowfin and Gar Pike is likely a Longnose Gar but possibly a Spotted Gar. It is assumed based on geographical information that the noted Calico Bass is actually a Largemouth Bass. Walleye were stocked in 1889 but were not

collected in the 1892 survey. Interestingly, this survey sheet recommended stocking "eels"; however, there are no records of this occurring.

An early inventory survey was conducted in the summer of 1952 following two decades of warmwater fish stocking efforts (Table 1). The management focus was on investigating Northern Pike movement to their spawning grounds by particularly focusing on the culverts. Some larger culverts were installed as a result. The Mecosta County Rod and Gun Club pike marsh project was developed in 1961. In 1976 and 1980, spring fingerling Walleye and fall fingerling tiger muskellunge (Muskellunge × Northern Pike) were stocked, respectively. A netting survey was conducted in 1987 and growth data was collected for Bluegill, Black Crappie, Yellow Perch, Largemouth Bass, and Northern Pike – all of which were growing below the statewide average. Only four Walleye were captured and aligned with the 1976 stocking event.

The results of the 1987 survey shifted management to focus on establishing a Walleye population to improve the panfish growth rates and create a recreational fishery. Spring fingerling Walleye stocking was initiated in 1988 and has occurred for the most part biennially ranging from 50-100 Walleye/acre. However, follow-up post-stocking surveys showed limited survival of Walleye. In 1988, 12 young-of-the-year Walleye were captured after night shocking the entire shoreline. Another survey was conducted in the spring of 1997 and 19 Walleye were captured with six year classes present growing +3.5 in above the statewide average. Other species were captured and analyzed during the 1997 survey. Bluegill growth was slightly below statewide average with a mean growth index (MGI) of -0.8. Black Crappie and Pumpkinseed sizes and growth improved to slightly since 1987 with an MGI of +0.3 and +0.6, respectively. Northern Pike continued to grow slowly as did Largemouth Bass.

Another Walleye electrofishing evaluation was conducted in 2000. Only one young of the year and 15 yearling and older were captured. In 2003 no young-of-the-year Walleye were captured and only one adult was noted. However, this survey was conducted in slightly warmer temperatures than suggested for a young-of-the-year Walleye stocking evaluation and could explain the low catch rate. The low numbers of young-of-the-year Walleye captured may indicate reduced survival from the past. A more recent Walleye focused survey was conducted in 2019. Twelve Walleye were captured during this survey and total length ranged from 10.0 to 12.0 in. Eight of the twelve Walleye were age 1 and the other four Walleye were age 2. There were stocking events in both 2017 and 2018 that would correlate to these fish.

Overall, the limnological and temperature characteristics of Chippewa Lake favor warm to cool water fish species. According to the 2009 Status and Trends survey Bluegill, Pumpkinseed, Rock Bass, Black Crappie, Northern Pike, Walleye and Largemouth Bass are the prevalent sport fishes. Their relative abundance and average size remained fairly consistent compared with the last survey conducted in 1997, except there was a decrease in Black Crappie captured and an increase in Walleye and Largemouth Bass.

Table 1. Fish stocked by the lake association in Chippewa Lake, Mecosta County, 1980-2020.

Year	Species	Strain	Number	Average Length (in)
1980	Walleye	Hybrid	14,000	8.66
1988	Walleye	Muskegon	10,259	2.01
1990	Walleye	Muskegon	10,156	1.89
1991	Walleye	Muskegon	38,929	1.61
1991	Walleye	Bay De Noc	53,121	1.61
1992	Walleye	Muskegon	148,685	1.18
1993	Walleye	Muskegon	81,320	1.02
1995	Walleye	Muskegon	81,070	1.34
1997	Walleye	Muskegon	77,416	1.36
1998	Walleye	Muskegon	80,401	1.26
2000	Walleye	Muskegon	79,000	1.06
2003	Walleye	Muskegon	41,778	1.10
2006	Walleye	Tittabawassee	39,913	1.60
2008	Walleye	Muskegon	17,855	1.80
2009	Walleye	Muskegon	30,890	1.50
2013	Walleye	Muskegon	89,799	2.18
2015	Walleye	Muskegon	50,737	2.05
2017	Walleye	Muskegon	59,645	1.30
2018	Walleye	Muskegon	101,630	2.24
2019	Walleye	Muskegon	54,998	1.68
2021	Walleye	Muskegon	59,690	1.58
2022	Walleye	Muskegon	43,687	2.72

The objectives of this survey were to 1) identify all fish species present, 2) determine age and growth to evaluate the sport fish community, and 3) collect limnological data including temperature and dissolved oxygen profiles, nutrient concentrations, and shoreline alterations.

Study Area

Chippewa Lake is a 790-acre lake located 9 miles east and 3 miles north of Big Rapids in Mecosta County. The lake is in the uppermost headwaters of the Chippewa River. Its outlet, Chippewa Creek, flows through the Martiny Chain and then becomes the West Branch Chippewa River, eventually flowing into the Tittabawassee River in Midland, then to the Saginaw River and to Saginaw Bay, Lake Huron. The lake has two small inlets, Whaley Creek (from Long Lake) and Wilbur Creek. Chippewa Lake is considered a large shallow-to-medium-depth mesotrophic lake with warm temperature characteristics. The maximum depth of Chippewa Lake

is roughly 39 ft in one spot on the north side of the lake. The average depth is 15 ft. The percentage of shoal habitat in Chippewa lake is roughly 57%. Aquatic vegetation is the dominant form of aquatic habitat in the littoral zone with a common occurrence of *Chara*, and Curly Leaf Pondweed with a 0.6 mi^2 wetland mass on the northern portion of the lake. Reeds and Cattail were common along the shoreline in a few areas. Bottom substrate in the shoals is comprised of sand, fibrous peat, and marl.

Residential development is extensive on Chippewa Lake. The habitat was evaluated during the limnological survey in August 2023. Twenty-seven transects were analyzed covering approximately 2.85 mi of shoreline with canals excluded. There were only 6 submerged trees, 320 small docks, 23 large docks, and 449 dwellings on the lake. Approximately 67% of the shoreline was armored (e.g. seawalls, riprap, etc).

Public access to Chippewa Lake is via a state DNR boat launch located on the northeast end of the lake. It has a double concrete ramp with two courtesy piers that supports approximately 40 vehicles and trailers, and two additional car only spaces.

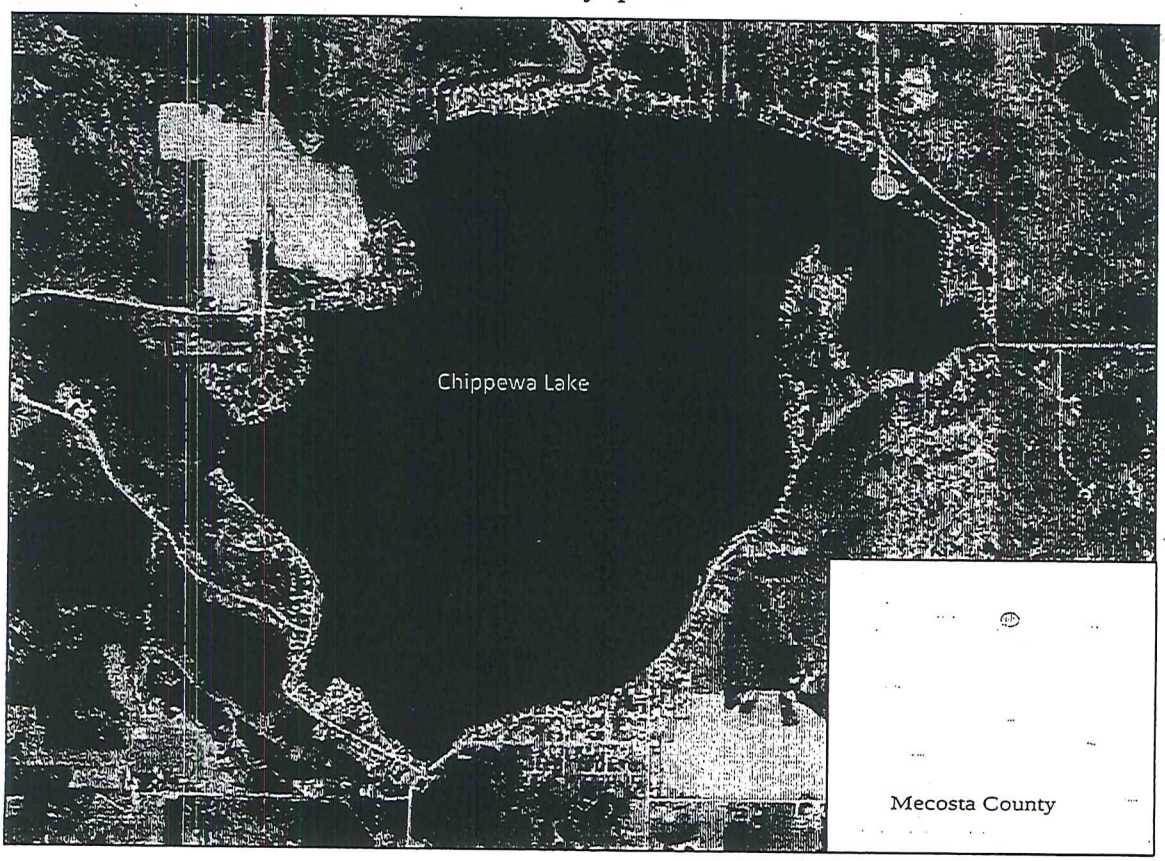

Figure 1. Chippewa Lake in Mecosta County, Michigan. The circle is the location of the public boat launch.

Methods

Chippewa Lake was surveyed using a variety of gear types outlined in the Status and Trends Lakes protocol from June 13 to June 16, 2022, as described by Wehrly et al. (in press; Figure 2). Sampling gears used included one seine net, two trap nets, two experiment gillnets (relocated 3x), two small mesh and three large mesh fyke nets. Three 600 s boat electrofishing transects were conducted on the night of the June 9. The total effort for the survey was five seine hauls and 35 net-nights. A limnological survey (e.g. dissolved oxygen and temperature regime, shoreline alteration) was conducted on August 9, 2022.

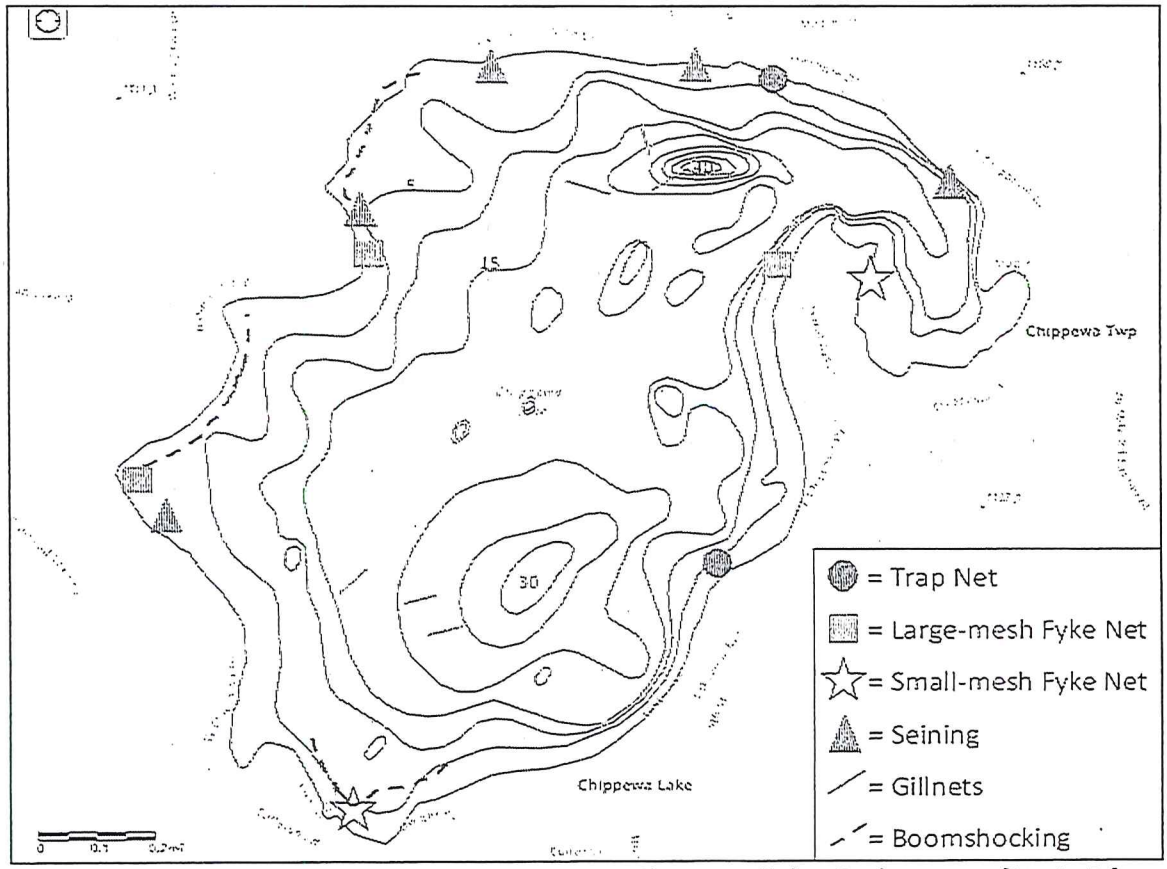

Figure 2. Location of gear set June 13-16, 2022 on Chippewa Lake. Each contour line is 5 ft intervals.

Results

Limnology

The shoreline had 6 submerged trees. A total of 353 docks and 449 dwellings were noted in the 27 sampled segments along with 67% of the shoreline characterized as armored. Submerged

trees offer valuable fisheries habitat and are important in reducing erosion rates by stabilizing shoreline areas.

The maximum depth measured was 29.2 ft and temperature declined from 76.6°F at the surface to 72°F at the bottom (Table 1). The thermocline was deep, occurring between 24 and 25 feet deep. This depth is where the dissolved oxygen rapidly declines below 3.0 ppm, which is considered hypoxic and inadequate for many fish species. The pH of Chippewa Lake was fairly constant throughout the water column (9.2-9.5). The specific conductivity was also constant ranging from 236-245 µ S/cm. Water temperatures during fish sampling ranged from 71° F.

Table 2. Temperature, dissolved oxygen (DO), and pH profile from the water surface to the bottom in Chippewa Lake, Mecosta County, Michigan, August 2022.

Depth (ft)	Temperature (°F)	Dissolved Oxygen (ppm)	pH	Specific conductance (mS/cm)
0	76.6	7.5	8.9	0.237
1	76.7	7.6	9.2	0.236
2	76.8	7.6	9.4	0.236
3	76.8	7.6	9.5	0.236
4	76.7	7.6	9.5	0.236
6	76.8	7.5	9.5	0.236
11	76.7	7.5	9.5	0.236
4.8	76.8	7.6	9.5	0.236
7.2	76.8	7.6	9.5	0.236
8.3	76.8	7.6	9.5	0.236
9.6	76.7	7.6	9.5	0.236
12.4	76.7	7.5	9.5	0.236
13.8	76.6	7.1	9.5	0.237
15.2	76.0	5.9	9.4	0.239
16.4	75.8	4.9	9.3	0.239
17.8	75.8	4.7	9.2	0.240
19.1	75.7	4.7	9.2	0.240
20.4	75.6	4.7	9.1	0.240
21.7	75.6	4.6	9.1	0.240
23.3	75.5	4.4	9.1	0.240
24.7	75.4	4.1	9.1	0.240
27.5	74.8	3.7	9.0	0.240
28.2	74.0	1.7	8.8	0.243
29.2	72.0	0.3	8.7	0.245

Fisheries

A total of 2,732 fish representing 24 species were captured in Chippewa Lake (Table 3). The fish community was dominated by Bluegill making up 50% of the collection. Most of the remaining species collected made up 5% or less of the fish community, except for Pumpkinseed (25.7%). Panfish species made up 80.4% by number and 44.2% by weight and included previously mentioned species in addition to Black Crappie, hybrid sunfish (Green Sunfish x Bluegill), Green Sunfish, Warmouth, and Yellow Perch. The sport predator community includes Largemouth Bass, Northern Pike, Smallmouth Bass, Rock Bass, and Walleye which made up only 6.4% of the total catch by number and 29.9% by weight. The forage base for small piscivorous fish species collected in this survey was dominated by Bluntnose Minnows and Banded Killifish. These species made up 4.5% of the total catch and all ranged from 1 to 6 in excluding the White Sucker population. Bullhead, Bowfin, Common Carp, and Longnose Gar comprised the non-sport fish community captured and made up just 8.7% by number and 24.6% by weight.

A total of 1,366 Bluegill (mean TL = 5 in) were collected with all five survey gear types with 26% of the catch larger than the generally accepted harvest length of 6-in. Trap nets and large mesh fyke nets accounted for nearly 71% of the total catch combined with 200 of the individuals captured while boomshocking. Qualitative examination of the data indicated that mean TL of Bluegill did not differ by more than 1 in between gear types that captured more than one individual. Age and growth analysis indicated Bluegill were growing slightly below but similar to the statewide average with a mean growth index of -0.7 in. A Schneider Index score of 2.4 was calculated based on several of the above parameters, which indicated a Bluegill population of poor-acceptable ranking (Schneider 1990). Multiple year classes (ages 1-10) were found suggesting stable recruitment into a harvestable fishery.

A total of 67 Largemouth Bass averaging 12.1 in were collected with 28% of the catch larger than the 14-in MSL. There were no differences among gear types for Largemouth Bass. Age and growth analysis indicated Largemouth Bass were growing below the statewide average with a mean growth index of -1.0 in. Multiple year classes (ages 1-12) were found suggesting stable recruitment to the harvestable fishery.

A total of 40 Yellow Perch (mean TL = 6.6 in) were collected with 18% of the catch larger than the generally accepted 7-in minimum size for harvest (although there is not a mandated MSL). Age and growth analysis indicated Yellow Perch were growing below the statewide average with a mean growth index of -1.9 in. Multiple year classes (ages 3-6) were found suggesting limited reproduction and recruitment to the fishery.

A total of 51 Black Crappie averaging 8 in were collected with 69% of the catch larger than the generally accepted harvest length of 7 in. Experimental gillnets captured majority of the Black Crappie. Qualitative examination of the data indicated that the experimental gillnets captured a more diverse size range than the trap net and large mesh fyke net. Age and growth analysis indicated Black Crappie were growing similar to the statewide average with a mean growth

index of -0.3 in. Multiple year classes (ages 2-7) were found suggesting stable recruitment to the harvestable fishery.

A total of 701 Pumpkinseed averaging 5.8 in were collected with 51% of the catch larger than the generally accepted harvest length of 6 in. Large mesh fyke net captured majority of the Pumpkinseed (52%). Qualitative examination of the data indicated that mean TL of Pumpkinseed did not differ by more than 1 in between gear excluding small mesh fyke net. Age and growth analysis indicated Pumpkinseed were growing similar to the statewide average with a mean growth index of -0.4 in. Multiple year classes (ages 2-8) were found suggesting stable recruitment to the harvestable fishery.

A total of 26 Northern Pike averaging 26.1 in were collected with 62% of the catch larger than the 24-in MSL. Gillnetting accounted of 100% of the total catch. Age and growth analysis indicated Northern Pike were growing above the statewide average with a mean growth index of +1.6 in. Multiple year classes (ages 2-7) were found suggesting stable recruitment into a harvestable fishery.

A total of 9 Walleye averaging 18.5 in were collected with 89% of the catch larger than the 15-in MSL for inland lakes. Qualitative examination of the data indicated that mean TL of Walleye did not differ by more than 1 in between gear that captured more than one individual. Age and growth analysis indicated Walleye were growing above the statewide average with a mean growth index of +2.3 in. Multiple year classes (ages 1-14) were found aligning with stocked years. Without OTC marks and annual stocking events it is impossible to determine if there is any level of natural reproduction. However, there appears to be harvestable fishery supported by stocking efforts.

Other popular sport fish species collected included Smallmouth Bass, Warmouth, Green Sunfish, and Rock Bass. Of these species only the Smallmouth Bass were aged. The two individuals measured 8.8 in (age-2) and 12.3 in (age 3).

Table 3. Fish species captured during the June 2022 Status and Trends survey on Chippewa Lake. Columns represent number of fish, length range (in), mean length of each species captured and mean growth index (MGI) were appropriate.

Species	Number	Length Range (in)	Average Length (in)	Percent of Harvestable Size	MGI
Banded Killifish	19	2-2	2.5	100	-
Black Crappie	51	5-13	8	69	-0.3
Bluegill	1,366	1-8	5	26	-0.7
Bluntnose Minnow	44	0-2	1.8	100	-
Bowfin	5	19-26	24.3	100	-
Brown Bullhead	91	6-14	10	99	-
Central Mudminnow	1	4-4	4.5	100	-
Common Carp	1	19-19	19.5	100	-
Emerald Shiner	8	2-2	2.5	100	-
Green Sunfish	7	4-6	5	14	-
hybrid sunfish	1	5-5	5.5	0	-
Iowa Darter	1	2-2	2.5	100	-
Lake Chubsucker	1	6-6	6.5	100	-
Largemouth Bass	67	3-17	12.1	28	-1.0
Longnose Gar	12	19-35	26.2	100	-
Northern Pike	26	18-30	26.1	62	+1.6
Pumpkinseed	701	1-8	5.8	51	-0.4
Rock Bass	69	4-10	6.8	43	-
Smallmouth Bass	2	8-12	10.5	0	-
Walleye	9	10-23	18.5	89	+2.3
Warmouth	27	3-7	5.4	33	-
White Sucker	51	1-21	11.5	100	-
Yellow Bullhead	132	5-13	9.9	92	-
Yellow Perch	40	5-8	6.6	18	-1.9

Conclusions

The size structure for most of the panfish species in Chippewa Lake has remained fairly constant since the last Status and Trends survey in 2009 (Figure 3). The mean growth index for the Yellow Perch and Largemouth Bass population is significantly slower than the previously noted, but the Northern Pike MGI has greatly improved. Chippewa Lake has a diverse community with an acceptable species composition. The Northern Pike population is likely benefiting from the White Sucker population – a preferred prey item given their high protein levels and soft rayed fins. To maintain this trophy Northern Pike fishery, White Suckers should be protected.

Hardened shoreline (i.e., seawalls, riprap) can negatively impact the aquatic ecosystem by increasing turbidity and bottomland scouring through wave deflection, change damage to

neighboring properties, decrease water quality, and make it easier for aquatic invasive species to expand. Given the extremely high level of development and shoreline alterations, it is important to give more attention to the habitat and how it may be related to the poor size structure Yellow Perch and Largemouth Bass of Chippewa Lake (i.e., poor growth of panfish and therefore lack of suitable prey for predators). It is well known the benefits of vegetation in aquatic ecosystems. The deep vertically growing root systems of aquatic vegetation protect the shoreline from unnatural rates of erosion and filters excessive nutrients from run off (e.g., lawn fertilizers). The aboveground portion of vegetation creates a refuge for prey species and spawning/nursery habitat for most freshwater species. Additionally, studies throughout the Midwest have shown that coarse woody debris (CWD) supports a diverse and healthy macroinvertebrate communities and provides refuge from predation, all-in-all improving the food web dynamics of the aquatic ecosystem. The removal of CWD has been linked the poor growth rates and declines in fish abundance, especially that of forage fish species; while the addition of CWD leads to improved growth of panfish and increased abundance and diversity of prey items among other benefits.

It should be noted that Michigan DNR Fisheries does not conduct aquatic vegetation surveys; therefore, all comments about vegetation densities relies on private company management data which can be limited. Chippewa Lake was treated by Professional Lake Management (PLM) since 2004 with other companies sprinkled throughout for algae, Eurasian Watermilfoil, etc. These long-term records of weed control showcases the never-ending cycle that over-management can cause. For example, the lack of vegetation and increased presence of chemicals can lead to the increased presence of algae every year which leads to more weed control measures. Additionally, when native plant species die-off invasive species, such as the Eurasian Watermilfoil, are able to rapidly recolonize the now defenseless lake bottom. Weed management history can be found at WB-315-4: Cranberry Lake: Michigan Lakefront Solutions LLC • MiEnviro Portal.

No fish-based management actions are recommended; however, the Chippewa Lake residents should explore options for improving their shoreline by implementing best management practices and reconsidering their weed management strategy to give panfish refuge to grow and, therefore, providing the predators a healthier meal.

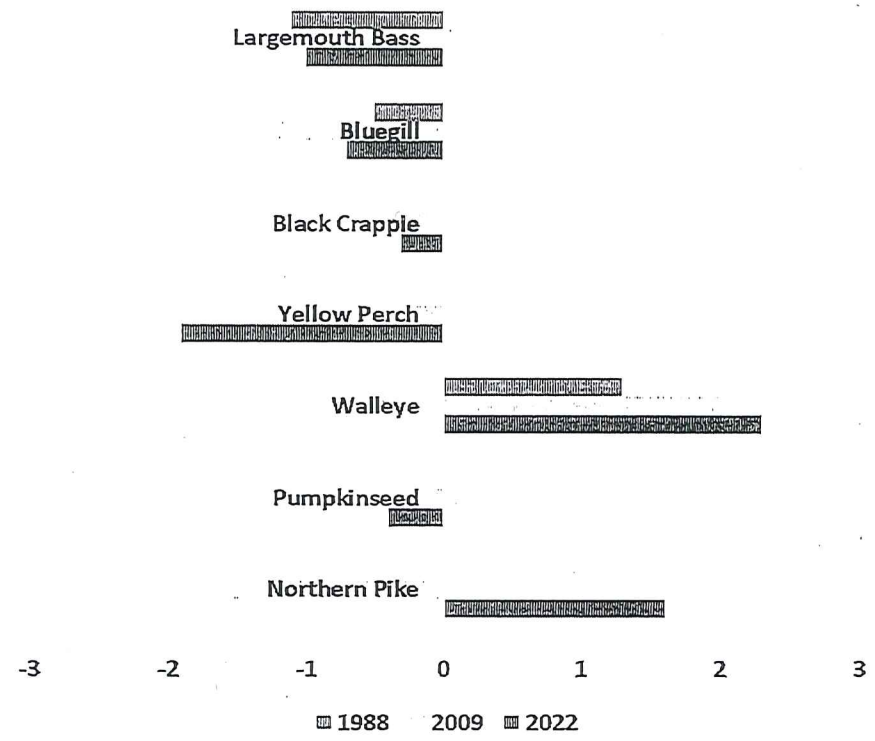

Figure 3. Mean growth index (x-axis) for sportfish captured in adequate numbers in 1988, 2009, and 2022. The larger the bar to the left or right of zero, the larger the deviation from the statewide average and the slower or faster the growth rate, respectively.

References

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