State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
2984 Shawano Avenue
Green Bay WI 54313-6727

Tony Evers, Governor
Preston D. Cole, Secretary
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

February 2, 2022

To Whom It May Concern:

Monitoring was completed on Mauthe Lake (WBIC 38200) in Fond du Lac County as part of the DNR Directed Lakes Monitoring Program. The purpose of this monitoring is to assess overall lake health. Monitoring was conducted in 2019 and 2020. This report summarizes the monitoring results.

The Directed Lake Monitoring protocols is available on our webpage at:
https://dnrx.wisconsin.gov/swims/downloadDocument.do?id=163086662

Monitoring consisted of an aquatic plant survey and water chemistry samples. The aquatic plant survey was completed in July 2019. Water samples were collected three times in both 2019 and 2020 and analyzed for chlorophyll *a* and total phosphorus. Water temperature and dissolved oxygen profile data was collected as well as water clarity (secchi disc depth) during each site visit.

Aquatic Plant Survey

Importance of Aquatic Plants

Aquatic plants form the foundation of healthy lake ecosystems. They not only protect water quality, but also produce life-giving oxygen. Aquatic plants are a lake's own filtering system, helping to clarify the water by absorbing nutrients like phosphorus and nitrogen that could stimulate algal blooms. Plant beds stabilize soft lake bottoms and prevent shoreline erosion by reducing the effect of waves and currents. Healthy native aquatic plant communities help prevent the establishment of invasive non-native plants such as Eurasian watermilfoil and curly-leaf pondweed. Native aquatic plants also provide important habitat for reproduction, food, and cover for fish, invertebrates, and wildlife.

Point-Intercept Sampling Method

Based on area and depth specific to Mauthe Lake, we mapped a 255-point sampling grid over the entire lake surface. Using a GPS, we navigated by boat to each of the pre-determined grid points. At each point we used a two-sided rake to sample approximately 1 foot along the bottom. After pulling the plants to the surface, the overall rake as well as individual species on the rake were assigned a fullness rating of 1, 2 or 3 to estimate density of plant growth. We also recorded visual sightings of species within six feet of the sample point, as well as any additional species seen in the lake during a general boat survey. For more detailed information on the point-intercept sampling method and how data were collected please visit:
http://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/ecology/Aquatic%20Plants/PI-Protocol-2010.pdf

Summary Statistics and Results

Summary statistics and plant survey results are shown in Tables 1 & 2.

- Species frequencies of occurrence reflect the percentage of points at which a species was found out of the total number of points sampled. Littoral frequency of occurrence indicates how often a species was found considering only areas of the lake that are capable of supporting plant growth (known as the "littoral area or zone").
- The maximum depth of plant growth is the deepest depth at which plants were found in the lake.
- Species richness is a count of the total number of different plant species found in a lake.
- The Floristic Quality Index (FQI) is a metric that evaluates the closeness of the flora in a lake to that of an undisturbed condition. The higher an FQI value, the closer that plant community is to an undisturbed ecosystem.
- The mean coefficient of conservatism (mean C) is a number assigned to each species reflecting its tolerance to disturbance.
- Statewide and ecoregion averages for all lake types are calculated from a subset of approximately 2,373 lakes across Wisconsin.

Two non-native species were found in Mauthe Lake: Eurasian watermilfoil and curly-leaf pondweed. The two most common species were coontail and Eurasian watermilfoil. Mauthe Lake has a low frequency of occurrence of aquatic plants in the littoral zone when compared to other lakes throughout the state and ecoregion. The species richness is well below both the statewide and ecoregion averages. The FQI shows an overall disturbed aquatic plant community (Table 2).

Table 1. Species Present

Common Name	Scientific Name	Growth Form (Floating, free floating, submerged, emergent)	% Frequency of Occurrence
Coontail	*Ceratophyllum demersum*	Submerged	51.2
Eurasian Watermilfoil*	*Myriophyllum spicatum*	Submerged	26.8
Common Waterweed	*Elodea canadensis*	Submerged	7.3
Small Duckweed	*Lemna minor*	Free Floating	3.7
Curly-leaf pondweed*	*Potamogeton crispus*	Submerged	3.7
Water star-grass	*Heteranthera dubia*.	Submerged	2.4
Flat-stem pondweed	*Potamogeton zosteriformis*	Submerged	2.4
Forked Duckweed	*Lemna trisulca*	Free Floating	1.2
Common Bladderwort	*Utricularia vulgaris*	Submerged	1.2
Spatterdock	*Nuphar variegata*	Floating-leaf	Visual
White water lily	*Nymphaea odorata*	Floating-leaf	Visual
Illinois pondweed	*Potamogeton illinoensis*	Submerged	Visual
Turion duckweed	*Lemna turionifera*	Free Floating	Visual

* =species non-native and potentially invasive in Wisconsin

Table 2. Overall Survey Summary

	Mauthe Lake	Statewide Average	SWTP Ecoregion Average
Littoral Frequency of Occurrence (%)	50	76.8	82.9
Maximum Depth of Plant Growth (ft)	16	14.4	15.8
Species Richness	9	23.7	21.3
Floristic Quality Index (FQI)	13.2	26.7	24.4
Mean Coefficient of Conservatism	5.0	5.89	4.98

Water Chemistry

Water chemistry data is available on the DNR webpage at:
https://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=38200

The average summer chlorophyll was 17 µg/l (compared to a Southeast Georegion summer average of 27.5 µg/l). The average summer total phosphorus was 44.1 µg/l. Lakes that have more than 20 µg/l of total phosphorus may experience noticeable algae blooms.

Water temperature and dissolved oxygen profile data

Mauthe Lake stratifies in the summer with warm water at the surface and cooler water temperatures near the lake bottom. Dissolved oxygen is adequate at the surface in the summer but drops off to anoxic conditions sharply at approximately 2-3 meters.

Secchi data (water clarity)

Mauthe Lake typically has clear and brown water. This suggests that the Secchi depth may have been mostly impacted by tannins, stain from decaying matter. Tannins are natural and not a result of pollution. Tannins can be distinguished from suspended sediment because the water, even though it's brown, it looks clear, like tea. Though tannins are not harmful per se, they are often not perceived as aesthetically pleasing as clear water. Tannins can also be important for decreasing light penetration into the water and decreasing algal growth.

TSI

The overall Trophic State Index (TSI) based on chlorophyll for Mauthe Lake was 56. The TSI suggests that Mauthe Lake is **eutrophic**. This TSI usually suggests decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, and warm-water fisheries (pike, perch, bass, etc.) only.

TSI is determined using a mathematical formula (Wisconsin has its own version). The TSI is a score from 0 to 110, with lakes that are less fertile having a low TSI.

TSI	TSI Description
TSI < 30	Classical oligotrophy: clear water, many algal species, oxygen throughout the year in bottom water, cold water, oxygen-sensitive fish species in deep lakes. Excellent water quality.
TSI 30-40	Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
TSI 40-50	Water moderately clear but increasing chance of low dissolved oxygen in deep water during the summer.
TSI 50-60	Lakes becoming eutrophic: decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.
TSI 60-70	Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
TSI 70-80	Becoming very eutrophic. Heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight).
TSI > 80	Algal scums, summer fish kills, few plants, rough fish dominant. Very poor water quality.

This report summarizes the 2019 and 2020 monitoring results. This completes the two-year Directed Lakes Monitoring effort on Mauthe Lake. If you have any questions regarding the survey results, please feel free to contact me at Mary.Gansberg@Wisconsin.gov

Sincerely,

Mary Gansberg

Mary Gansberg
Water Resources Management Specialist
Wisconsin Department of Natural Resources