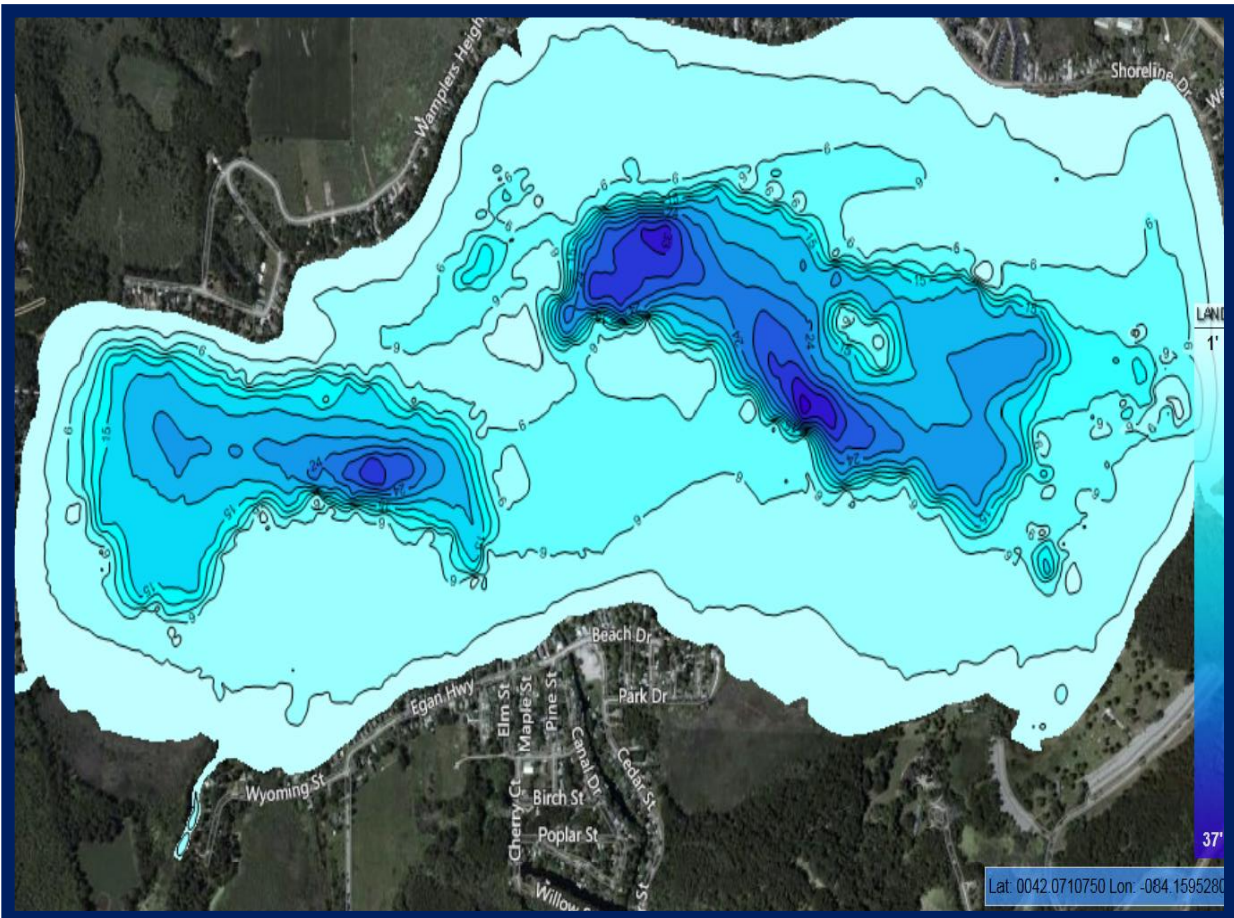




Wamplers Lake 2022 Aquatic Vegetation, Water Quality, & 2023 Management Recommendations Report



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Table of Contents

Section 1: Wamplers Lake Summary (2022)	4
Section 2: Wamplers Lake Water Quality Data (2022)	5
Section 3: Wamplers Lake Aquatic Vegetation Data (2022)	9
Section 4: Management Recommendations for 2023	15

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The following information is a summary of key lake findings collected during 2022.

The overall condition of Wamplers Lake is ranked in the top 25% of developed lakes of similar size in the state of Michigan. The lake has good water clarity and also has enough nutrients (phosphorus and nitrogen) to support some algae and submersed aquatic plant growth. Invasive species such as Eurasian Watermilfoil (EWM), Curly-leaf Pondweed (CLP), and Starry Stonewort are able to grow in moderate nutrient waters and thus are a challenge to the Wamplers Lake ecosystem. In 2022 all invasives were reduced and all treatments were successful. There was a late season EWM invasion that will be treated in spring of 2023 if it survives the winter. The water temperatures cannot be under 50°F at depth for the herbicides to be effective.

Protection of the 26 native aquatic plant species is paramount for the health of the lake fishery and these plants should not be managed unless they are a nuisance to lakefront property owners and possess navigational and recreational hazards (i.e., lily pads or nuisance growth in the canals). The plan for 2023 will include whole-lake aquatic vegetation sampling and scanning and spot-treatment of remaining invasives (milfoil, Curly-leaf Pondweed, and Starry Stonewort) as needed. The new systemic herbicide ProcellaCOR® will also be used for more sustained control of the milfoil.

Wamplers Lake Water Quality Data (2022)

Water Quality Parameters Measured



There are hundreds of water quality parameters one can measure on an inland lake, but several are the most critical indicators of lake health. These parameters include water temperature (measured in °F), dissolved oxygen (measured in mg/L), pH (measured in standard units-SU), conductivity (measured in micro-Siemens per centimeter- $\mu\text{S}/\text{cm}$), total dissolved solids (mg/L), Secchi transparency (feet), total phosphorus and total nitrate nitrogen (both in $\mu\text{g}/\text{L}$), chlorophyll-*a* (in $\mu\text{g}/\text{L}$), and algal species composition. Water quality was measured in the deep basin of Wamplers Lake in August of 2022.

Table 1 below demonstrates how lakes are classified based on key parameters. Wamplers Lake would be considered mesotrophic (relatively productive) since it does contain ample phosphorus, nitrogen, and aquatic vegetation growth but has excellent water clarity and moderate algal growth. 2022 water quality data for Wamplers Lake is shown below in Table 2.

Table 1. Lake trophic classification (MDNR).

<i>Lake Trophic Status</i>	<i>Total Phosphorus ($\mu\text{g L}^{-1}$)</i>	<i>Chlorophyll-<i>a</i> ($\mu\text{g L}^{-1}$)</i>	<i>Secchi Transparency (feet)</i>
Oligotrophic	< 10.0	< 2.2	> 15.0
Mesotrophic	10.0 – 20.0	2.2 – 6.0	7.5 – 15.0
Eutrophic	> 20.0	> 6.0	< 7.5

Table 2. Wamplers Lake water quality parameter data collected in the deep basin (August 26, 2022).

<i>Depth ft.</i>	<i>Water Temp °F</i>	<i>DO mg L⁻¹</i>	<i>pH S.U.</i>	<i>Cond. μS cm⁻¹</i>	<i>Turb. NTU</i>	<i>Total Kjeldahl Nitrogen mg L⁻¹</i>	<i>Chl-a μg L⁻¹</i>	<i>Total Phos. mg L⁻¹</i>
0	75.2	8.4	8.5	380	0.7	< 0.5	2.0	< 0.020
18	72.6	7.2	8.5	380	1.2	0.5	--	0.020
36	65.7	3.7	8.4	381	2.4	1.0	--	0.040

Water Clarity (Transparency) Data

Secchi transparency is a measure of water clarity using a weighted disk with black and white markings. The depth is recorded as a mean of the depth at which the disk disappears and reappears. Elevated Secchi transparency readings allow for more aquatic plant and algae growth. The transparency throughout Wamplers Lake was adequate (13.5-18.0 feet) to allow abundant growth of algae and aquatic plants in the majority of the littoral zone of the lake during the season. Secchi transparency depends on the amount of suspended particles in the water (often due to windy conditions of lake water mixing) and the amount of sunlight present at the time of measurement. Other parameters such as turbidity (measured in NTU's) are correlated with water clarity and show an increase as clarity decreases. The turbidity and total dissolved solids in Wamplers Lake were low at ≤ 2.4 NTU's and 76 mg/L, respectively during the 2022 sampling event.

Total Phosphorus

Total phosphorus (TP) is a measure of the amount of phosphorus (P) present in the water column. Phosphorus is the primary nutrient necessary for abundant algae and aquatic plant growth. TP concentrations are usually higher at increased depths due to higher release rates of P from lake sediments under low oxygen (anoxic) conditions and due to mineralization. Phosphorus may also be released from sediments as pH increases. In summer, the dissolved oxygen levels are lower at the bottom and likely cause release of phosphorus from the bottom. TP concentrations from <0.020-0.040 mg L⁻¹ from top to bottom during the 2022 sampling event. These TP concentrations are moderate for a lake the size and depth of Wamplers Lake and are ample to promote aquatic vegetation and algae growth.

pH

Most Michigan lakes have pH values that range from 6.5 to 9.5 with typical being slightly basic (pH>7.0). Acidic lakes (pH < 7) are rare in Michigan and are most sensitive to inputs of acidic substances due to a low acid neutralizing capacity (ANC). Wamplers Lake is considered “slightly basic” on the pH scale. The pH of Wamplers Lake ranged from 8.4-8.5 S.U. during the 2022 sampling event, which is ideal for an inland lake. pH is usually lower at the lake bottom and can increase when aquatic vegetation is actively growing due to photosynthesis.

Conductivity

Conductivity is a measure of the amount of mineral ions present in the water, especially those of salts and other dissolved inorganic substances. Conductivity generally increases as the amount of dissolved minerals and salts in a lake increases, and also increases as water temperature increases. The conductivity values for Wamplers Lake was moderate during the 2022 sampling event and ranged from 380-381 $\mu\text{S}/\text{cm}$. Severe water quality impairments in freshwater lakes do not occur until values exceed 800 $\mu\text{S}/\text{cm}$ and are toxic to aquatic life around 1,000 $\mu\text{S}/\text{cm}$.

Chlorophyll-*a* and Algal Species Composition

Chlorophyll-*a* is the primary photosynthetic pigment found in all plants and algae. Chlorophyll-*a* is a measure of the amount of green plant pigment present in the water, often in the form of planktonic algae. High chlorophyll-*a* concentrations are indicative of nutrient-enriched lakes. Chlorophyll-*a* concentrations greater than 6 $\mu\text{g L}^{-1}$ are found in eutrophic or nutrient-enriched aquatic systems, whereas chlorophyll-*a* concentrations less than 2.2 $\mu\text{g}/\text{L}$ are found in nutrient-poor or oligotrophic lakes. The chlorophyll-*a* concentration during the 2022 sampling event in Wamplers Lake was 2.0 $\mu\text{g}/\text{L}$ which is moderate for an inland Michigan lake yet favorable.

The algal genera were determined from composite water samples collected over the deep basin of Wamplers Lake in 2022 were analyzed with a compound bright field microscope. The genera present included the Chlorophyta (green algae; Figure 1): *Chlorella* sp., *Rhizoclonium* sp., and *Cladophora* sp., *Scenedesmus* sp., and *Mougeotia* sp.; The Cyanophyta (blue-green algae; Figure 2): *Oscillatoria* sp.; The Bascillariophyta (diatoms; Figure 3): *Synedra* sp., *Cymbella* sp., *Navicula* sp., and *Rhoicosphenia* sp. The aforementioned species indicate a diverse algal flora and represent a good diversity of alga with an abundance of diatoms that are indicative of great water quality. Photos of the general algae types are shown below.

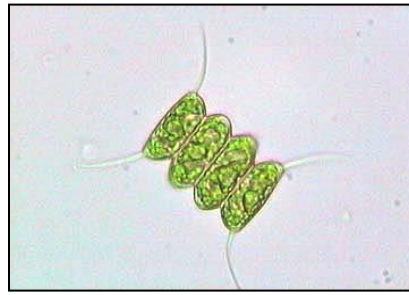


Figure 1. A Green Alga



Figure 2. A Blue-Green Alga

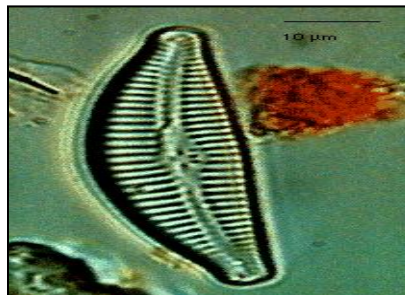


Figure 3. A Diatom Alga

Aquatic Vegetation Data (2022)

Status of Native Aquatic Vegetation in Wamplers Lake

A whole-lake grid survey (n=441 sampling points) and bottom scanning survey of Wamplers Lake was conducted on May 30, 2022 by RLS scientists. The native aquatic vegetation present in Wamplers Lake is essential for the overall health of the lake and the support of the lake fishery.

This most recent survey determined that there were a total of 19 native aquatic plant species in Wamplers Lake. These included 11 submersed species, 1 floating-leaved species, and 7 emergent species. This indicates a very high biodiversity of aquatic vegetation in Wamplers Lake. The overall % cover of the lake by native aquatic plants is low relative to the lake size and thus these plants should be protected unless growing near swim areas at nuisance levels.

Among the most dominant native aquatic plants was the macro alga, Chara (Figure 4) which lies close to the lake bottom and serves as excellent fish spawning habitat. In addition, Chara also helps to keep the small sediment particles from being suspended in the water column. The plant has a distinctive musky odor which smells skunk-like. Also abundant was the Illinois Pondweed (Figure 5), a native perennial herb with narrow leaves and divided, whorled flower spikes that remain completely submerged throughout the growing season.

A list of all native aquatic plant species found in Wamplers Lake in 2022 is shown in Table 3 below.



Figure 4. Chara



Figure 5. Illinois Pondweed

Table 3. Wampplers Lake Native Aquatic Plant Species (May 30, 2022).

<u>Aquatic Plant Species</u>	<u>Common Name</u>	<u>Growth Form</u>	<u>Frequency (%)</u>
<i>Chara vulgaris</i>	Muskgrass	Submersed	22.6
<i>Potamogeton zosteriformis</i>	Flat-stem Pondweed	Submersed	0.7
<i>Potamogeton gramineus</i>	Variable-leaf Pondweed	Submersed	11.0
<i>Potamogeton filiformis</i>	Thin-leaf Pondweed	Submersed	5.5
<i>Potamogeton illinoensis</i>	Illinois Pondweed	Submersed	19.3
<i>Potamogeton amplifolius</i>	Large-leaf Pondweed	Submersed	4.0
<i>Potamogeton natans</i>	Floating-leaf Pondweed	Submersed	0.7
<i>Vallisneria americana</i>	Wild Celery	Submersed	9.5
<i>Myriophyllum sibiricum</i>	Northern Watermilfoil	Submersed	0.7
<i>Ceratophyllum demersum</i>	Coontail	Submersed	1.5
<i>Elodea canadensis</i>	Common Waterweed	Submersed	2.0
<i>Lemna minor</i>	Duckweed	Floating-leaf	0.4
<i>Sagittaria</i> sp.	Arrowhead	Emergent	1.0
<i>Peltandra virginica</i>	Arrow Arum	Emergent	0.6
<i>Pontedaria cordata</i>	Pickerelweed	Emergent	0.4
<i>Rhynchospora</i> sp.	Beak Rush	Emergent	0.4
<i>Typha latifolia</i>	Cattails	Emergent	0.3
<i>Schoenoplectus</i> sp.	Bulrushes	Emergent	0.2
<i>Decodon verticillata</i>	Swamp Loosestrife	Emergent	0.7

Status of Invasive (Exotic) Aquatic Plant Species in Wamplers Lake

The amount of Eurasian Watermilfoil (Figure 6) present in Wamplers Lake varies each year and is dependent upon climatic conditions, especially runoff-associated nutrients. This year we saw above average temperatures and precipitation and many lakes experienced nuisance milfoil and algal outbreaks. The May 30, 2022 survey revealed that approximately 17.9 acres of hybrid milfoil was found throughout the entire lake. On June 22, 2022, the milfoil was treated with diquat. RLS was present to oversee the treatments conducted by Aqua-Weed Control, Inc. On August 1, 2022, a thorough treatment of the canals was conducted. A late summer whole-lake aquatic plant survey revealed that the treatment was very successful but a large area of EWM was noted in the south area of the lake and will be treated in spring 2023 if it survives the winter. An additional 19.3 acres of very dense Curly-leaf Pondweed (Figure 7) was also treated with diquat at the same time. Figure 8 shows a late-season outbreak of milfoil.

The Treatment maps for milfoil for each of these invasive species are shown in the maps below (Figures 9-10).



Figure 6. Eurasian Watermilfoil



Figure 7. Curly-leaf Pondweed



Figure 8. Late season EWM growth in Wamplers Lake (August, 2022)

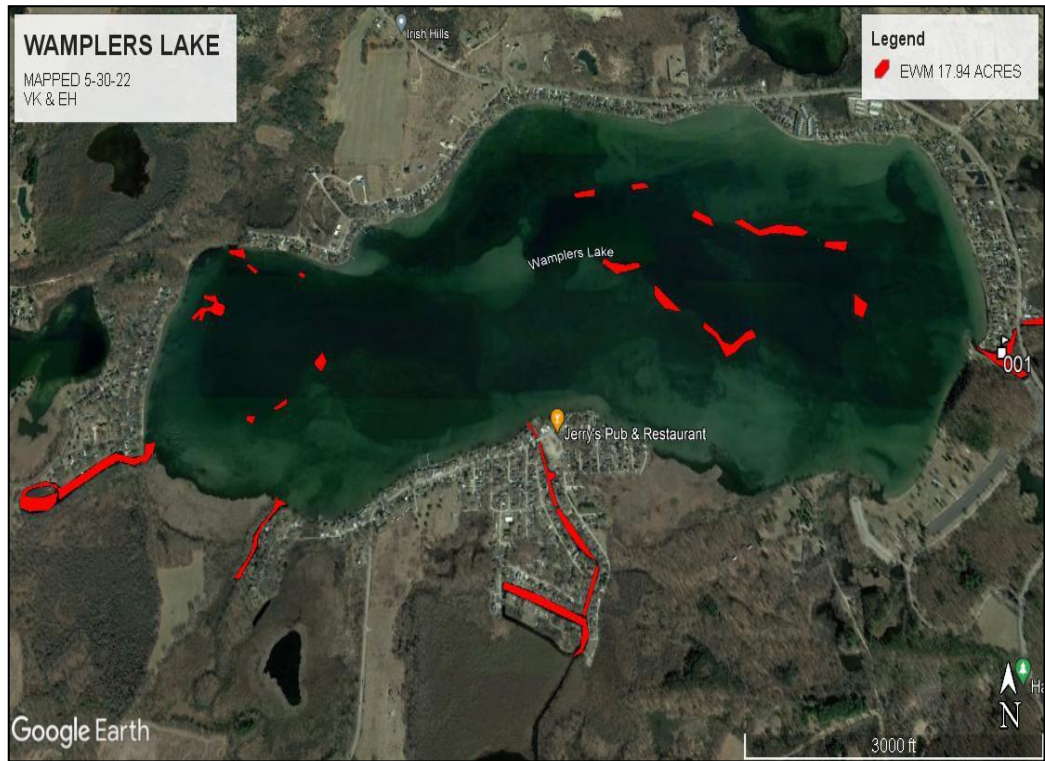


Figure 9. Eurasian Watermilfoil distribution in Wamplers Lake (May 30, 2022).

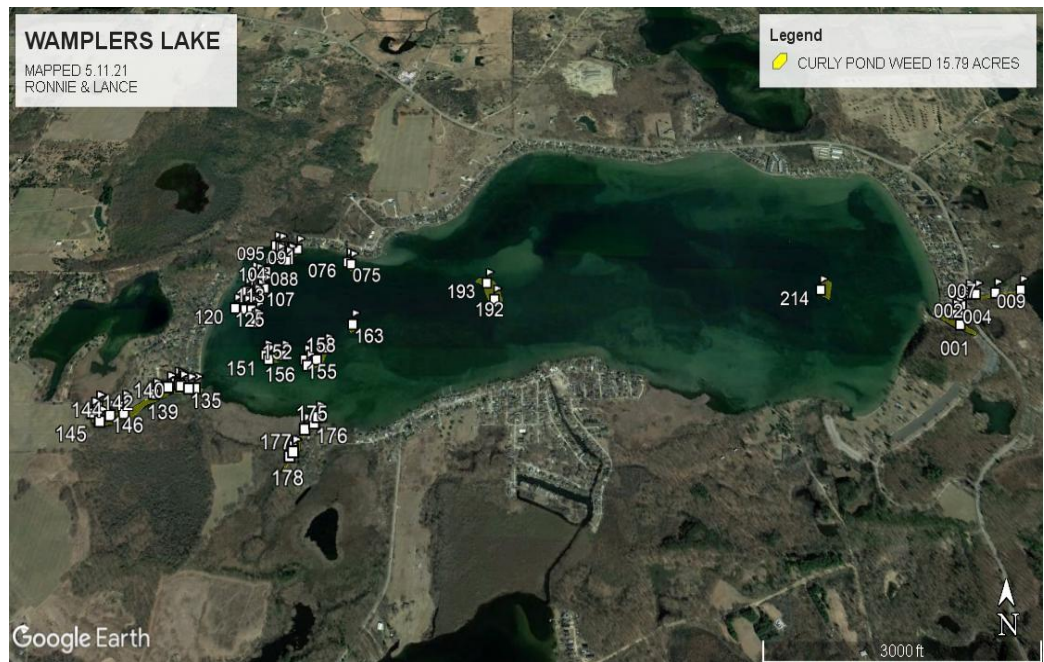


Figure 10. Curly-Leaf Pondweed distribution in Wamplers Lake (May 30, 2022).

Management Recommendations for 2023

Continuous aquatic vegetation surveys are needed to determine the precise locations of EWM, CLP, or Starry Stonewort (primarily found in the canals) or other problematic invasives in Wamplers Lake. These surveys should occur in mid to late-May to early-June and again post-treatment in 2023.

Due to the relative scarcity of native aquatic vegetation in Wamplers Lake, the treatment of these species with aquatic herbicides is not recommended (one exception is the overgrowth of nuisance weeds in the canals). The plan for 2023 includes the use of higher doses of systemic aquatic herbicides due to the genetically determined strains of hybrid milfoil that require such doses for effective treatment. A new systemic herbicide ProcellaCOR® may also be used and has demonstrated good efficacy. It is costly but has sustained control. The nuisance growth in the canals would respond well to flumioxazin at 200 ppb if needed or with a combination of diquat and hydrothol. Curly-leaf Pondweed will respond well to Aquathol-K® at 1-2 gallons per acre or with diquat at the same doses. Starry Stonewort will respond well to a mixture of Clipper® at 200 ppb and chelated copper.

In conclusion, Wamplers Lake is a healthy lake with good aquatic plant biodiversity, good water clarity, moderate nutrients, and a healthy lake fishery. Management of the EWM, CLP, and Starry Stonewort are paramount for the long-term health of the lake. Thus far, the invasive species management efforts have been very successful with over 80% of the original milfoil infestation reduced.