



March 10, 2017

To whom it may concern:

This past field season Krohns Lake in Kewaunee County was part of the DNR Directed Lakes Program. Through this program, Krohns Lake had multiple sampling techniques completed to help determine overall lake health. The largest of these sampling techniques was the aquatic plant index survey. This survey was conducted on August 18, 2016. This report details the plant survey and how the results can be interpreted. It also includes the water chemistry and aquatic invasive species survey results.

Plant Index 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 water milfoil and curly-leaf pondweed. Native aquatic plants also provide important reproductive, food, and cover habitat for fish, invertebrates, and wildlife. By leaving or restoring a natural buffer area of emergent vegetation along the shoreline, property owners can reduce erosion, help maintain water quality, and provide habitat and travel corridors for wildlife.

Point-Intercept Sampling Method

Based on area and depth specific to Krohns Lake, we mapped a 94-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 (figure 1). 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>

Species frequencies of occurrence reflect the percentage of times a species was found out of the total number of points sampled. Littoral frequency of occurrence (given in Table 1) 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 a FQI value, the closer that plant community is to an undisturbed ecosystem. Statewide and ecoregion averages are calculated from a subset of approximately 250 lakes across Wisconsin.

Table 1: Species Present

% Frequency of Occurrence (Littoral): This estimation of frequency of occurrence is calculated by taking the total number of times a species is detected in a lake divided by the total number of points in a lake at which the growth of plants is possible.

Common Name	Scientific Name	Growth Form (Floating, free floating, submerged, emergent)	% Frequency of Occurrence
Muskgrasses	<i>Chara spp.</i>	Submerged	70.00
Eurasian Water-Milfoil *	<i>Myriophyllum spicatum</i>	Submerged	20.00
Sago pondweed	<i>Stuckenia pectinate</i>	Submerged	10.00
Nitella	<i>Nitella spp.</i>	Submerged	5.00
Coontail	<i>Ceratophyllum demersum</i>	Submerged	5.00
Spatterdock	<i>Nuphar variegata</i>	Floating	5.00
White water lily	<i>Nymphaea odorata</i>	Floating	5.00
Slender Naiad	<i>Najas flexilis</i>	Submerged	2.50

* = species non-native and potentially invasive in WI

Table 2: Overall Survey Summary

	KROHNS LAKE	STATEWIDE AVERAGE	SWTP ECOREGION AVERAGE
Littoral Frequency of Occurrence (%)	87.5%	73.3%	79.0%
Maximum Depth of Plant Growth (ft)	20.0	15.3	15.4
Species Richness	8	16.8	15
Floristic Quality Index (FQI)	14.4	24.1	20

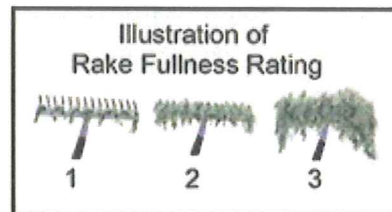
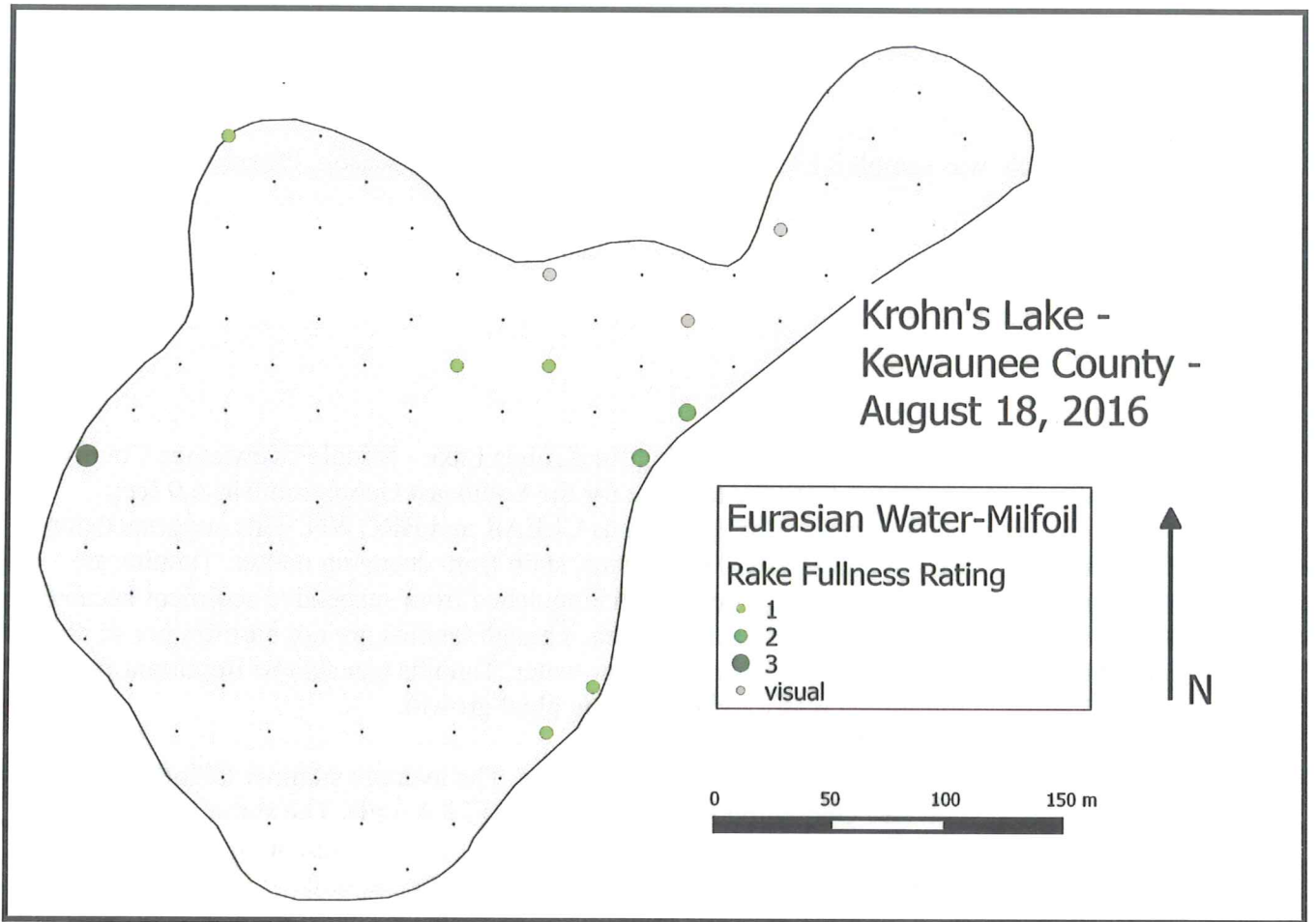


Figure 1: Eurasian Water-Milfoil distribution map with rake fullness ratings.

Plant Survey Results

As you can see from the overall plant index survey summary (Table 2), Krohns Lake has a relatively high frequency of occurrence in the littoral zone when compared to other lakes throughout the state and ecoregion. This can partly be contributed to the lakes bathymetry. With the majority of the Krohns Lake plant community being two plants; the species richness is much less than the statewide and ecoregion averages and the FQI values show a poor aquatic plant community overall. This is likely caused by sediment type, water quality, and the lake's bathymetry. Sometimes, a lake's biological conditions are perfect for one or two main plant species to dominate the ecosystem not allowing other plant species to flourish.

Water Chemistry

The following information is taken from the Krohns Lake webpage provided by the DNR.
<http://dnr.wi.gov/lakes/LakePages/LakeDetail.aspx?wbic=94700>.

Krohns Lake - Middle was sampled **13** different days during the 2016 season. Parameters sampled included:

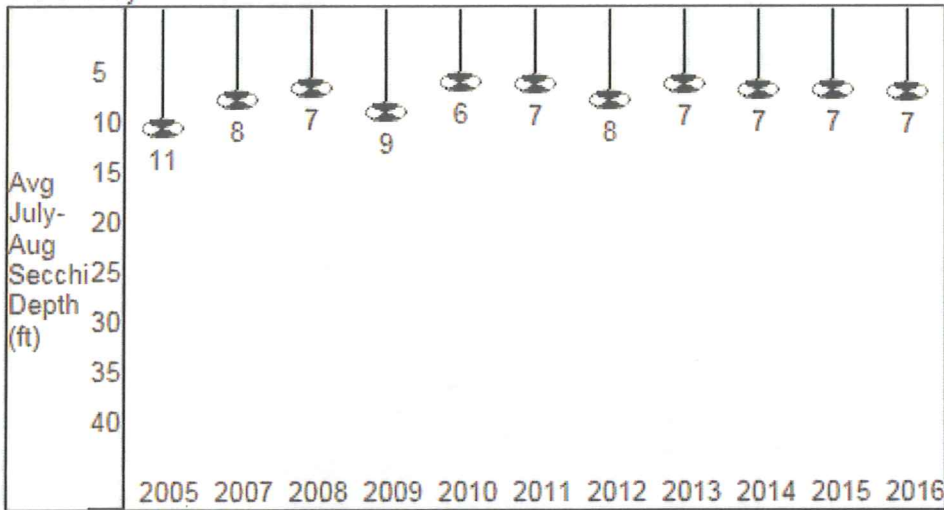
- water clarity (SD)
- temperature
- dissolved oxygen (D.O.)
- total phosphorus (TP)
- chlorophyll (CHL)

The average summer (July-Aug) secchi disk reading for Krohns Lake - Middle (Kewaunee County, WBIC: 94700) was 7.46 feet (Figure 2). The average for the Southeast Georegion was 6.9 feet. Typically the summer (July-Aug) water was reported as CLEAR and BROWN. 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.

Water chemistry data was collected on Krohns Lake - Middle. The average summer Chlorophyll was 2.8 µg/l (compared to a Southeast Georegion summer average of 23.4 µg/l). The summer Total Phosphorus average was 15.3 µg/l. Lakes that have more than 20 µg/l and impoundments that have more than 30 µg/l of total phosphorus may experience noticeable algae blooms.

The overall Trophic State Index (TSI- based on chlorophyll) for Krohns Lake - Middle was 42. The TSI suggests that Krohns Lake - Middle was mesotrophic. Mesotrophic lakes are characterized by moderately clear water, but have an increasing chance of low dissolved oxygen in deep water during the summer.

Krohns Lake
 Kewaunee County
 Waterbody Number: 94700



Past secchi averages in feet (July and August only).

Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
2005	10.94	6.25	16.5	4
2007	8.13	4	12	4
2008	6.92	4	13	6
2009	9.38	4.5	12	4
2010	6.34	4.3	7.8	5
2011	6.56	5	9.1	5
2012	8.14	5.2	10	5
2013	6.64	5.1	9.8	5
2014	7.22	5.3	8	5
2015	7.27	5	10	6
2016	7.46	5.6	9	8

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Figure 2: Secchi depth data from 2005-present.

Aquatic Invasive Species (AIS) Survey

AIS found while monitoring consist of Narrow-leaf Cattail (*Typha angustifolia*), Eurasian Watermilfoil (*Myriophyllum spicatum*), Pink Water Lily (non-native *Nymphaea* sp.), and Curly Leaf Pondweed (*Potamogeton crispus*). The Eurasian Watermilfoil was genetically confirmed in 2012 as Hybrid Eurasian Watermilfoil (*M. spicatum* x *sibiricum*). The ornamental pink water lily was first observed during an aquatic plant point-intercept (PI) survey conducted by WDNR in 2006, and is a relatively localized population (figure 3).

To learn more about aquatic invasive species and become more familiar with each specific species please visit the WDNR aquatic invasive species webpage at: <http://dnr.wi.gov/topic/Invasives/>



Figure 3: Pink dot represents non-native pink water lily population.

This report summarizes the 2016 monitoring results. To add to this data set, I am planning to collect water chemistry samples in Krohns Lake again in the summer of 2017. This monitoring effort will be a repeat of what was collected in 2016 as part of the Directed Lakes Program.

If you have any questions regarding the survey results from Krohns Lake, please feel free to contact me at 920-662-5489 or at mary.gansberg@wisconsin.gov.

Sincerely,
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