



December 19, 2017

To whom it may concern:

This past field season Shea Lake in Kewaunee County was part of the DNR Directed Lakes Monitoring Program. Through this program, Shea 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 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 Shea Lake, we mapped a 122-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
Coontail	<i>Ceratophyllum demersum</i>	Submerged	32.84
Muskgrass	<i>Chara</i> sp.	Submerged	22.39
Northern Water Milfoil	<i>Myriophyllum sibiricum</i>	Submerged	5.97
Eurasian Water milfoil*	<i>Myriophyllum spicatum</i>	Submerged	5.97
White Water Lily	<i>Nymphaea odorata</i>	Floating	4.48
Aquatic Moss	<i>Fontinalis antipyretica</i>	Submerged	2.99
Spatterdock	<i>Nuphar variegata</i>	Floating	1.49
Common Waterweed	<i>Elodea canadensis</i>	Submerged	Visual
Narrow Leaf Cattail*	<i>Typha angustifolia</i>	Terrestrial	Visual

* = species non-native and potentially invasive in WI

Table 2: Overall Survey Summary

	Shea Lake	Statewide Average	SWTP Ecoregion Average
Littoral Frequency of Occurrence (%)	43.28%	73.3%	79%
Maximum Depth of Plant Growth (ft)	14	15.3	15.4
Species Richness	6	16.8	15
Floristic Quality Index (FQI)	12.52	24.1	20

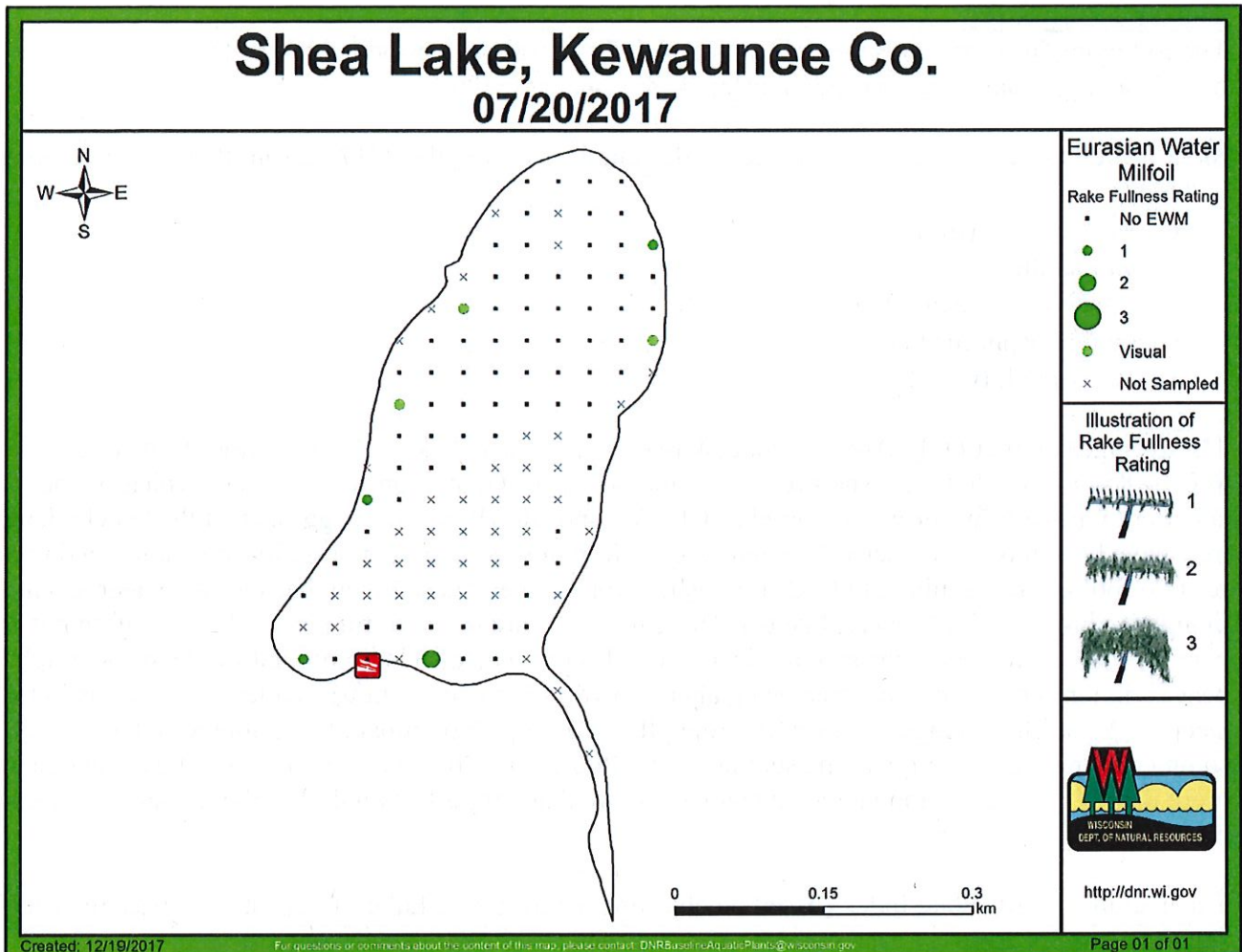


Figure 1: AIS distribution map with rake fullness ratings. Eurasian Water Milfoil (*Myriophyllum spicatum*) was collected on a GPS point. Visuals are made when a plant species is within 6 feet of the rake location without being collected on the rake.

Plant survey Results

As you can see from the overall plant index survey summary, Shea Lake has a relatively low 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 most of Shea Lake's plant community being two plants (*Chara* sp. and Coontail); the species richness is less than the statewide and ecoregion averages 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. Other lakes in this area display very similar characteristics.

Water Chemistry

The following information is taken from the Shea Lake webpage provided by the DNR.

<http://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=85400>

Shea Lake - Deepest Area was sampled 6 different days during the 2017 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 Sheas Lake - Deepest Area (Kewaunee County, WBIC: 85400) was 5.5 feet. The average for the Southeast Georegion was 6.3 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. Chemistry data was collected on Sheas Lake - Deepest Area. The average summer Chlorophyll was 17.3 $\mu\text{g/l}$ (compared to a Southeast Georegion summer average of 25.5 $\mu\text{g/l}$). The summer Total Phosphorus average was 41.7 $\mu\text{g/l}$. Lakes that have more than 20 $\mu\text{g/l}$ and impoundments that have more than 30 $\mu\text{g/l}$ of total phosphorus may experience noticeable algae blooms.

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

Lake Water Quality 2017 Annual Report

Shea Lake
Kewaunee County
Waterbody Number: 85400

Lake Type: SEEPAGE
DNR Region: NE
GEO Region: SE

Site Name	Storet #
Sheas Lake - Deepest Area	313029

Date	SD (ft)	SD (m)	Hit Bottom	CHL	TP	TSI (SD)	TSI (CHL)	TSI (TP)	Lake Level	Clarity	Color	Perception
06/27/2017	4.5	1.4	NO			55			HIGH	MURKY	BROWN	1-Beautiful, could not be nicer
07/19/2017				24.5	52.9		59	59				
07/19/2017										CLEAR	BROWN	
08/22/2017	5.5	1.7		10.1	30.4	53	52	55		CLEAR	BROWN	
09/11/2017	4.5	1.4	NO	18.2		55	57			CLEAR	BROWN	

07/19/2017		
Depth METERS	Temp. DEGREES C	D.O. MG/L
1	26.41	8.9
2	23.26	2.7
3	16.3	.3
4	12.49	.21
5	10.32	.19
6	9.72	.17

08/22/2017		
Depth METERS	Temp. DEGREES C	D.O. MG/L
1	24.17	6.46
2	23.95	6.29
3	17.94	.53
4	14.41	.29
5	11.22	.21
6	10.06	.21
	24.2	6.4

09/11/2017		
Depth METERS	Temp. DEGREES C	D.O. MG/L
1	18.23	6.38
2	18.05	4.24
3	17.82	3.01
4	14.82	.38
5	11.89	.27
6	10.4	.24
7	10.08	.24
	18.2	6.4

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter(ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD), TSI(CHL), TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet.

Aquatic Invasive (AIS) Species Survey

AIS found while monitoring consists of Narrow-leaf Cattail (*Typha angustifolia*) and Eurasian Water Milfoil (*Myriophyllum spicatum*). Curly leaf pondweed (*Potamogeton crispus*) has been previously verified but was not observed during the August 2017 survey (likely due to the late summer survey timing and/or very sparse population).

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

This report summarizes the 2017 monitoring results. To add to this data set, I am planning to collect water chemistry samples in Shea Lake again in the summer of 2018. This monitoring effort will be a repeat of what was collected in 2017 as part of the Directed Lakes Program

If you have any questions regarding the survey results from Shea Lake, please feel free to contact me at 920-662-5497 or at holly.stegemann@wisconsin.gov.

Sincerely,

A handwritten signature in cursive script that reads "Holly Stegemann".

Holly Stegemann

Water Resources Management Specialist
Wisconsin Department of Natural Resources