

2015 Supple Marsh Water Quality Monitoring

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Aerial photo of Supple Marsh taken from north end, looking SW October 21, 2015.

Introduction

Supple Marsh is the largest wetland complex (approximately 277 acres) of Lake Winnebago, and therefore it is important to the water quality, wildlife and fishery of the lake. It is a degraded eutrophic system in need of restoration. The habitat of the marsh includes emergent and shallow water ecosystems. The emergent marsh is dominated by invasive cattail species, and invasive Phragmites is taking a firm hold. An important factor in addressing these two invaders is reducing nutrient content. Lowering nutrient inputs slows the expansion of cattails and gives the native vegetation more of chance to compete. As the first step in restoring the marsh, the nutrient inputs into the wetland via a small inlet under Hwy 45 and the Fond du Lac River (WBIC 133700) were monitored for nutrients and water clarity. The Lake Winnebago Water Quality Improvement Association (LWQIA) sponsored the research with membership fees, a generous donation from the Peters Family Foundation and additional donations from Jim and Anne Thomas and The Winnebago Lakes Council.

The type of water quality monitoring conducted at these stations is called trophic monitoring. Trophic refers to the NUTRIENT state of the lake, typically ranging from a turbid system dominated by algae and/or aquatic plants (Eutrophic) to a clear one with few nutrients (Oligotrophic). Mesotrophic condition marks a transition between oligotrophic and eutrophic. Hypereutrophic conditions have very high nutrients and frequent algae blooms. Excessive nutrients from the landscape--predominately in the form of phosphorous--drive the excessive growth of algae, as does the suspension of sediment due to waves and carp activity.



Figure 1. Description of trophic states (Mechenich and Klessing, 2004).

Methods and Location

Two sampling locations were chosen to monitor Supple Marsh water quality. Flow into or out of the marsh was not consistent at the Fond du Lac River sampling station. Water flowed into the marsh on two sampling days, and out of the marsh on four days.

Bridge at Hwy 45, Station Number 10042906, N43.7992° W088.4662°

Fond du Lac R. Howard Litscher Dr. Bridge, Station Number 10042859, N43.7947° W088.4564°



Figure 2. Supple Marsh sampling locations

Surface water was collected at each sample location, and temperature, pH and conductivity values were obtained with a Hanna HI 9812-5 portable meter. Water clarity was measured with a 60cm transparency tube. *Chlorophyll a* and Total Phosphorus samples were collected in jars, packed in ice and sent to the Wisconsin State Lab of Hygiene to be filtered and analyzed.

Water Clarity is typically measured with a Secchi Disk, which is a disk divided into four alternating black and white sections. Secchi Disks can be difficult to use from elevated positions, shallow water, and strong currents. All of these limiting factors were experienced at one or more of the sampling locations, depending on the day. Because of the limitations of the Secchi Disk, a 60 cm turbidity tube was used instead. The turbidity tube is a clear cylinder with a small disk of the Secchi pattern on the bottom. The tube is filled with water, and the water released until the disk becomes visible. The height of the water remaining in the tube is then measured. Although the turbidity tube has an advantage over the Secchi Disk in areas with a strong current and elevated position, it has the disadvantage in clear water where the tube isn't tall enough. Water was too clear to be measured on several occasions.

Results

Total Phosphorus

Phosphorous is typically the most important nutrient responsible for the growth of algae and aquatic plants. Too much phosphorous leads to algae blooms, excessive aquatic plant growth, and environmental and esthetic problems. Total Phosphorus (TP) is expressed in a concentration of mg/L of all forms of phosphorus in the water column.

Results from the tests indicate the concentrations of TP were very high, leading to very poor water quality during the growing season. In the fall conditions improved, but were still only in the fair category.

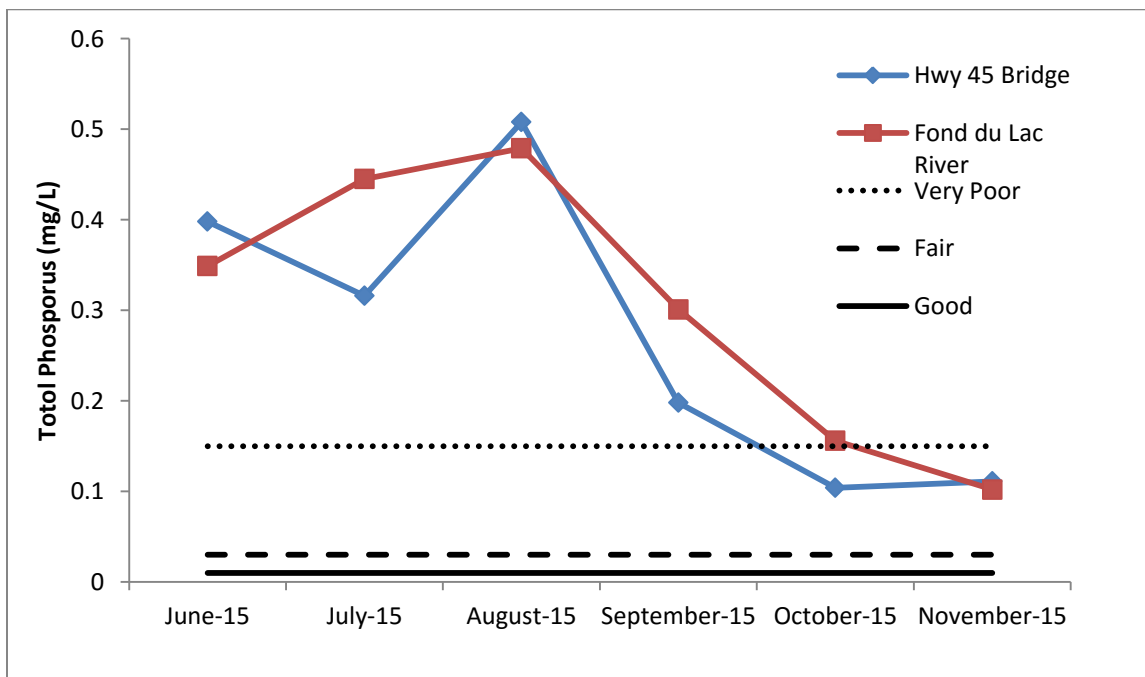


Figure 3. Total Phosphorus concentrations for Supple Marsh and Fond du Lac River.

Chlorophyll a

Chlorophyll a (*chl a*) one of the molecules responsible for photosynthesis in algae and plants and is used an indirect measure of algae (phytoplankton) suspended in the water column. The concentration is measured in $\mu\text{g/L}$. Results shown in figure 4 show that both sampling locations experienced high *chl a* levels, indicating a eutrophic system during the growing season and mesotrophic in the fall.

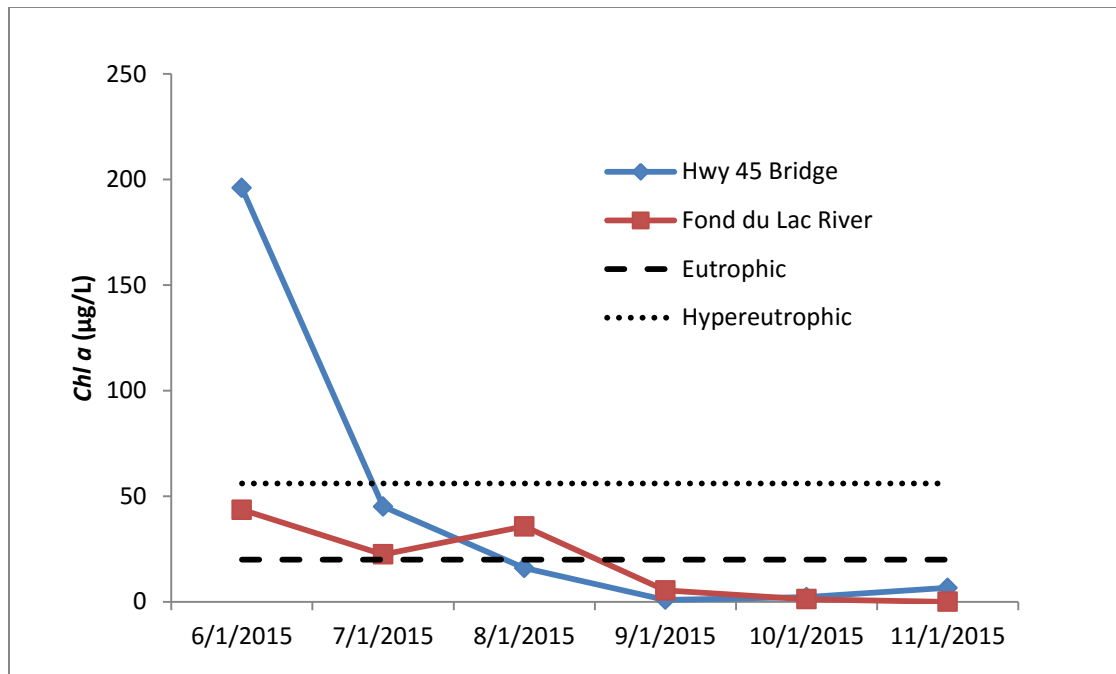


Figure 4. *Chlorophyll a* concentrations for Supple Marsh and Fond du Lac River.

Water Clarity

Water clarity as measured with a transparency tube ranged from 24.6 to greater than 60 cm. The difference between sites was sometimes very significant. For example, on August 19, 2015 water at Hwy 45 was so clear it exceeded 60cm, but at the Fond du Lac River the water was nearly half as clear. However, the difference between the mean transparency tube value was only 2.6 cm.

Table 1. Water Clarity (cm) measured with a transparency tube.

	Hwy 45 Bridge	Fond du Lac River
June 18, 2015	29.5	26.2
July 21, 2015	24.6	33
August 19, 2015	60*	35.5
September 21, 2015	60*	32.83
October 21, 2015	60*	60*
November 24, 2015	29.2	60*
Mean	43.9	41.3
Minimum	24.6	26.2
Maximum	60*	60*

*60 cm is the maximum value the can be recoded with the transparency tube.

Temperature

The temperature of the sample locations matched each other closely during the sampling period. The mean difference between sites was .5 °C (0.9) °F

Table 2. Temperature (°C) at sampling locations.

	Hwy 45 Bridge	Fond du Lac River
June 18, 2015	25	23
July 21, 2015	25	25
August 19, 2015	23	23
September 21, 2015	19	18
October 21, 2015	16	14
November 24, 2015	3	5
Mean	18.5	18
Minimum	3	5
Maximum	25	25

pH

pH is the measure of hydrogen ion concentration in the water column and indicates whether a liquid is acidic or basic. The pH scale runs from highly acidic 0, neutral 7, to highly basic 14. The mean pH value for the Hwy 45 station was 8.0 and Fond du Lac River 8.2. Further results are found in appendix

Conclusion

The water of Supple Marsh is highly eutrophic, and of poorer quality than that of the nearest water quality monitoring station on Lake Winnebago. The likely causes of the excessive phosphorus concentrations are run off from the land throughout the watershed. There may also be release of phosphorus from the sediments of the marsh. Over the course of the summer total phosphorus and *chl a* concentrations decrease. Likely, the aquatic vegetation of the marsh is absorbing excess phosphorus from the water column and decreasing the growth of phytoplankton.

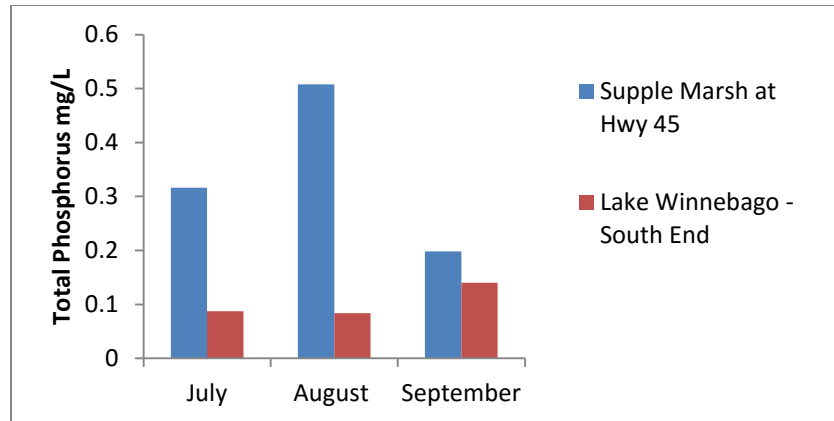


Figure 5. Total phosphorus readings of Supple Marsh at Hwy 45 and Wisconsin Department of Natural Resources long-term monitoring site (station 713244) in the southern portion of Lake Winnebago.

The flow in and out of the marsh from the Fond du Lac River monitoring station was variable. On most sampling days water flowed out of the marsh and into the Fond du Lac River. The change in flow direction is much like a tidal estuary (where a river meets the sea). This effect could be dependent on wind direction and speed, and the flow rate of the Fond du Lac River. The actual percentage of the days of flow in vs out of the marsh is not known. Because of this variable it is very difficult to determine the effect the marsh has on water quality, or how the marsh is affected by the water of the Fond du Lac River.

Water quality monitoring of the marsh can continue to develop a better understanding of the marsh's water quality over time. Further study would help understand the water flow and nutrient dynamics of the marsh, but such a study would likely be of minimal benefit to the management of the marsh. The next steps in the management of the marsh could be an inventory of the aquatic plant life, creation of a management plan, and control of invasive cattail species (*Typha spp.*) and phragmites (*Phragmites australis*)

References

Lillie, R. A., Mason, J. W. 1983. Limnological Characteristics of Wisconsin Lakes. WDNR Technical Bulletin 138. Madison, WI

Shaw, B., Mechenich, C., Klessing, L. 2004. Understanding Lake Data. UW Extension publication G3582

<http://learningstore.uwex.edu/assets/pdfs/G3582.pdf>

Appendix

Supple Marsh Hwy 45 Bridge

Station # 10042906

	Temp °C	pH	Conductivity (µs/cm)	Turbidity Tube (cm)	Total Phosphorus (mg/L)	<i>Chl a</i> (µg/L)
6/18/2015	25	8.7	540	29.5	0.398	196
7/21/2015	25	7.8	596	24.6	0.316	45.1
8/19/2015	23	7.6	550	60*	0.508	16
9/21/2015	19	7.6	450	60*	0.198	0.901
10/21/2015	16	7.9	590	60*	0.104	2.21
11/24/2015	3	8.1	610	29.2	0.111	6.62
Mean	18.5	8.0	556.0	43.9	0.273	44.5
Minimum	3	7.6	450	24.6	0.104	0.901
Maximum	25	8.7	610	60*	0.508	196

*60 cm is the maximum value the can be recoded with the transparency tube.

Fond du Lac R. Howard Litscher Dr. Bridge

Station # 10042859

	Temp °C	pH	Conductivity (µs/cm)	Turbidity Tube (cm)	Total Phosphorus (mg/L)	<i>Chl a</i> (µg/L)	Flow in or out of Marsh
6/18/2015	23	8	610	26.2	0.349	43.6	out
7/21/2015	25	7.9	670	33	0.445	22.4	in
8/19/2015	23	7.9	650	35.5	0.479	35.7	out
9/21/2015	18	7.9	610	32.83	0.301	5.34	out
10/21/2015	14	9	750	60*	0.156	1.18	in
11/24/2015	5	8.6	670	60*	0.102	NA	out
Mean	18	8.2	660	41.3	0.305	21.64	
Minimum	5	7.9	610	26.2	0.102	1.18	
Maximum	25	9	750	60*	0.479	43.6	

*60 cm is the maximum value the can be recoded with the transparency tube.