Long-Term Depressional Wetland Monitoring Site: Wood Lake

Wood Lake is a depressional wetland complex located within the Wood Lake Nature Center in Richfield, Minnesota. The area surrounding the nature center is a mixture of residential, commercial, and industrial land use, and an interstate highway forms its western border. A trail/floating boardwalk system runs throughout the wetland and adjacent upland areas, allowing visitors a close-up view of the aquatic life inhabiting this wetland. The wetland edges are partially shaded on all sides by various aged hardwood trees growing in the immediate surrounding upland. Sticklebacks (*Culaea inconstans*) and fathead minnows (*Pimephales promelas*) have been collected from this site, fish species commonly found in marshes.

Significant physical alterations were made to this wetland in 1996 and 1998 with dredging occurring on both the east and west sides of the wetland. Dredging removed storm water sediment deposits from several areas of the wetland as well as created a basin to reduce the amount of sediment and other pollutants entering the wetland from adjacent interstate highway 35W. Even with these improvements, however, this wetland still receives significant storm water runoff from its predominantly urban catchment area.

Site information
County: Hennepin Size 94 acres
Ecoregion: Mixed Wood Plains
DNR ID#: 27-0026-00

Monitoring activities

Wood Lake has been monitored by the Minnesota Pollution Control Agency (MPCA) Biological Monitoring Unit since 1995. Plant, macroinvertebrate, and water quality sampling has occurred during the summer months of 1995, 1999, 2001, 2002, 2003, 2006, 2010, and 2012 (Figure 1). Macroinvertebrate sampling takes place in June, while plant sampling occurs in July. Water samples were typically collected during the macroinvertebrate visit, though supplemental water quality data (May-October) was also collected in 2008, 2009, and 2010.

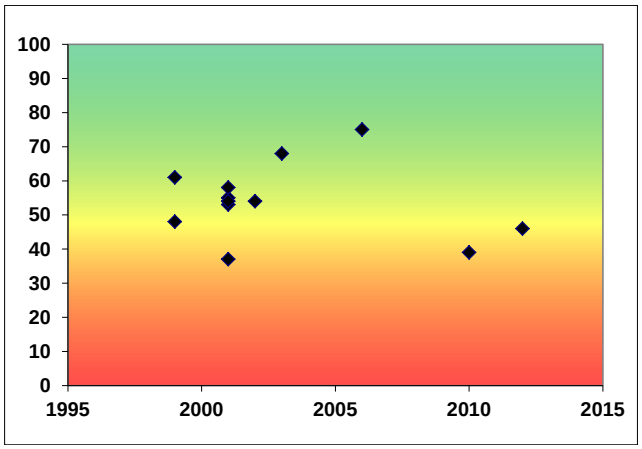
Plant and macroinvertebrate sampling adheres to standard operating procedures (SOPs) in order to ensure data quality and comparability of results between wetlands and across years. These SOPs can be found on the MPCA wetland monitoring and assessment webpage (see Contact information).

Figure 1. Aquatic macroinvertebrate sampling locations

The purpose of biological monitoring is to evaluate the condition or ecological integrity of water bodies. The MPCA uses a plant and macroinvertebrate index of biological integrity (IBI) to evaluate depressional wetland condition. These two indicators determine whether a wetland is in good, fair, or poor condition by comparing its IBI score to the distribution of scores from least-disturbed, reference wetlands within the same ecoregion. Each IBI consists of ten attributes of the community (called 'metrics') that respond in a predictable manner to human disturbance. Examples of commonly used metrics include: total taxa richness, percentage of tolerant taxa, and vascular plant genera richness.

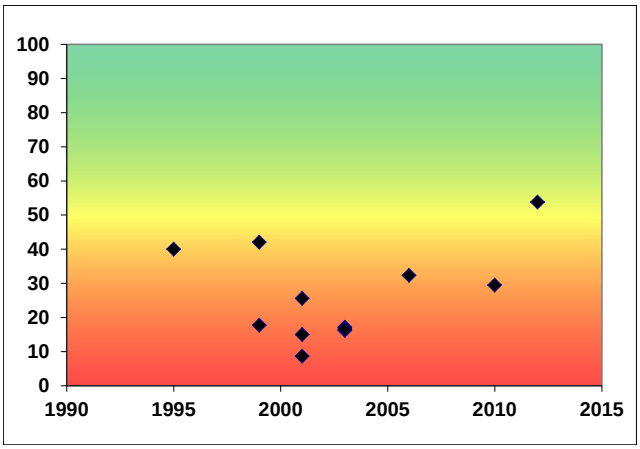
Monitoring results

Macroinvertebrate IBI Scores



The macroinvertebrate community (aquatic insects, snails, leeches, crustaceans) of this wetland has typically received a "fair" condition rating over the years it has been monitored. A "fair" rating means that compositional changes in the community have taken place due to the replacement of sensitive species by tolerant ones, but in large part the community is still intact enough to maintain vital ecosystem processes. An aquatic invasive species, the Chinese Mystery Snail (*Cipangopaludina chinensis*), has consistently been collected from this wetland by MPCA biologists. An analysis of the macroinvertebrate IBI data set found no significant trend over the period of 1999 to 2012.

Plant IBI Scores



Plant IBI scores tended to fall more in the "poor" condition range, dipping to relatively low scores in the summer of 2001 and 2002. A "poor" rating is indicative of a community that has lost the majority of its sensitive species and is dominated by tolerant and/or invasive species, resulting in the loss of some ecosystem functions. The emergent vegetation zone of this wetland is largely comprised of two invasive plant species: Hybrid cattail (*Typha X glauca*) and Reed canary grass (*Phalaris arundinacea*). An analysis of the plant IBI data set found no significant trend over the period of 1999 to 2012.

Water chemistry

Surface water chemistry of Wood Lake has varied from year to year over the period of 1995 to 2012. This variation is exemplified by the June chloride concentrations, ranging from 35 mg/L in 2001 to 310 mg/L in 2009 (see graph). Concentrations of this analyte in the water column depend on a multitude of factors, including the amount of snowfall received during the previous winter (i.e., influencing the amount of de-icing compounds necessary to keep roadways safe), the amount of storm water received by the wetland, and whether or not the volume of water in the wetland is increasing or decreasing over the summer months (i.e., concentrating or diluting effects). The aquatic life water quality (chronic) standard for chloride in lakes and wetlands is 230 mg/L. Chloride concentrations in Wood Lake exceeded this criterion in 2009, but quickly fell below the standard later in the summer. These high values are not unexpected given the urban landscape in which this wetland occurs, however, chloride should be closely monitored due to the threat it poses to the aquatic life inhabiting this freshwater environment.

Turbidity measured from 1995 to 2006 ranged from 1.3 to 8.1 NTU, well below the 25 NTU aquatic life water quality standard, indicating that water clarity in this wetland is beneficial to aquatic life. In 2007, the MPCA began using a transparency tube (analogous to the Secchi disk used in lakes) to measure water clarity in wetlands. From 2008 to 2012, water clarity ranged from 0.6 m to > 1 m (i.e., the length of the tube), providing further evidence that water clarity is not detrimental to aquatic plants as well as other organisms inhabiting this wetland.

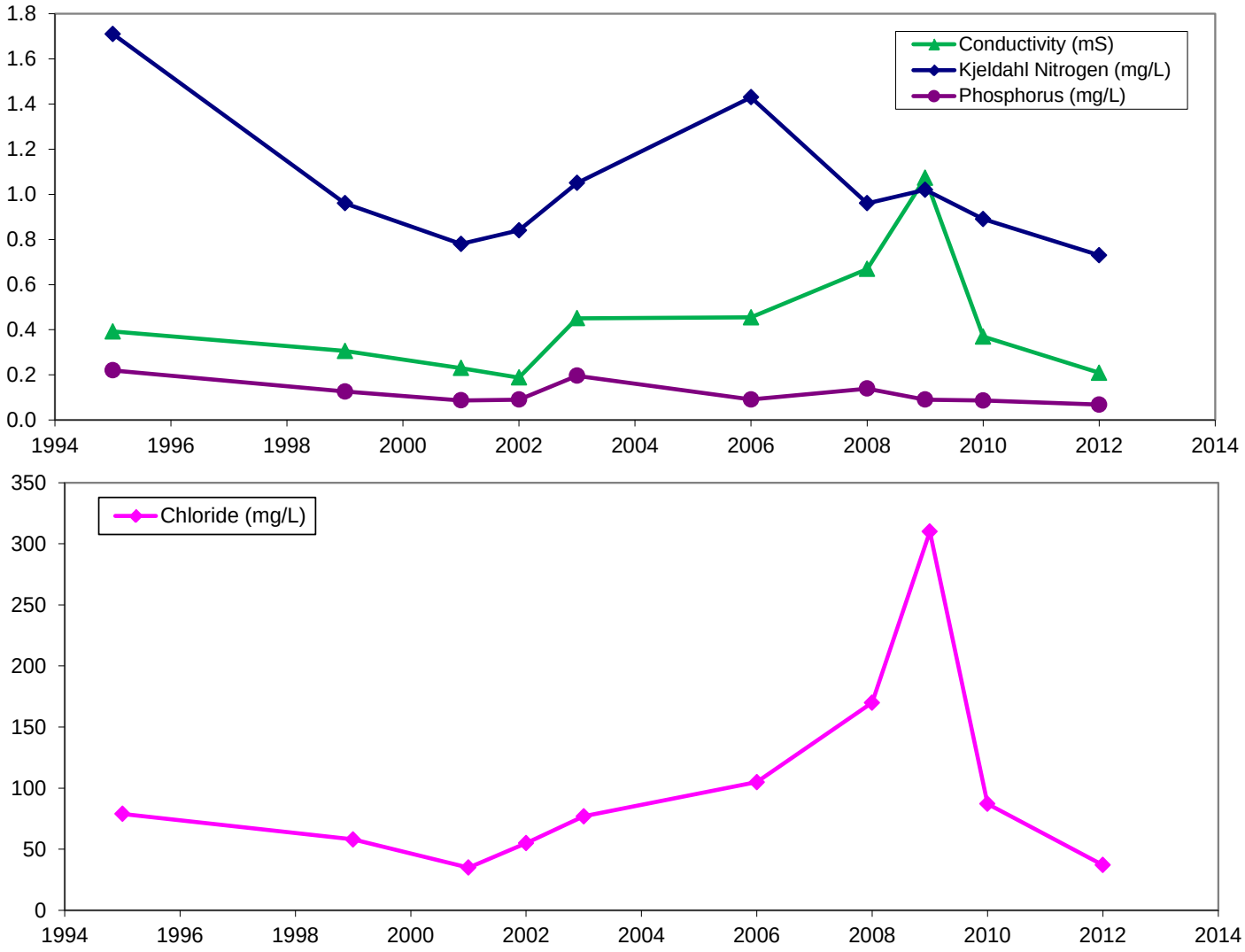
Given the clarity of the water column and abundance of submerged plants it is not surprising that daytime dissolved oxygen concentrations can exceed 10 mg/L in this wetland. However, on the one occasion it was measured shortly after sunrise, dissolved oxygen was 0.8 mg/L, indicating that there may not be sufficient oxygen levels for aquatic organisms throughout the daily cycle.

Total phosphorus concentrations in June have been quite variable over the time period monitored, ranging from 0.09 mg/L to 0.20 mg/L. Compared to least-disturbed reference sites occurring within the region, such values would be categorized as ‘low’ to ‘medium’. Total Kjeldahl nitrogen (organic N + ammonia N) has also varied substantially (see graph); again values would be considered to be ‘low’ to ‘medium’. Nitrate + nitrite nitrogen has been below detection (< 0.05 mg/L) in all samples (2006-2012). These relatively low nutrient concentrations are likely contributing to the maintenance of the aquatic plant-dominated, clear-water state of this wetland.

The concentration of sulfate has consistently been below 5 mg/L at this site. In 2012, concentrations were even below the detection limit of 1 mg/L.

Trends

Water chemistry data were analyzed for trends over the period of 1995 to 2012 using the Seasonal Kendall Test for Trends (only June data displayed below). None of the measured parameters exhibited a significant trend at the 95 percent confidence level.



Contact information

For more information on wetland monitoring in Minnesota go to the MPCA wetland monitoring and assessment webpage: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/wetlands/wetland-monitoring-and-assessment.html.

Or contact the MPCA at 651-296-6300 or 800-657-3864.