Lost Lake 2017 water quality monitoring

Item 6A.
BCWMC 2-15-18

About Lost Lake

BCWMC classification	Priority-2 shallow lake
Watershed area	61 acres
Lake size	22 acres
Average depth	3.5 feet
Maximum depth	6.5 feet
Ordinary high water level	941.2 feet
Normal water level	940.2 feet
Downstream receiving waterbody	Landlocked
Location (city)	Plymouth
MPCA impairments	None
Aquatic invasive species	None
Public access	None

The Bassett Creek Watershed Management Commission
Stewardship of water resources to protect and enhance our communities

Monitoring water quality in Lost Lake

The Bassett Creek Watershed Management Commission (BCWMC) has monitored water quality conditions in the watershed's 10 priority lakes and six ponds since 1972. This monitoring is done to detect changes or trends in water quality and evaluate the effectiveness of efforts to preserve or improve water quality. A summary of 2017 monitoring efforts on Lost Lake is provided below; more comprehensive information can be found on pages 2–6.

At a glance: 2017 monitoring results

In 2017, the BCWMC monitored Lost Lake for:

- Water chemistry (nutrients, chlorophyll a, chloride).
- Water measurements (e.g., clarity, dissolved oxygen).
- Phytoplankton and zooplankton (microscopic plants and animals).
- Macrophytes (aquatic plants).

Results of 2017 monitoring show that Lost Lake did not meet applicable Minnesota Pollution Control Agency (MPCA) and BCWMC water quality standards for lakes. Lost Lake is currently not on the State of Minnesota's 303(d) list of impaired waters, however the 2017 monitoring results indicate the lake would likely be considered impaired if more monitoring data were available to assess impairment. While there is not enough long-term monitoring data to perform trend analyses for Lost Lake, the lake has generally exhibited poor water quality conditions over the past 25 years. In addition, the plant community does not meet the Minnesota Department of Natural Resources (MDNR) plant index of biotic integrity (IBI) standards (see page 4).

Recommendations

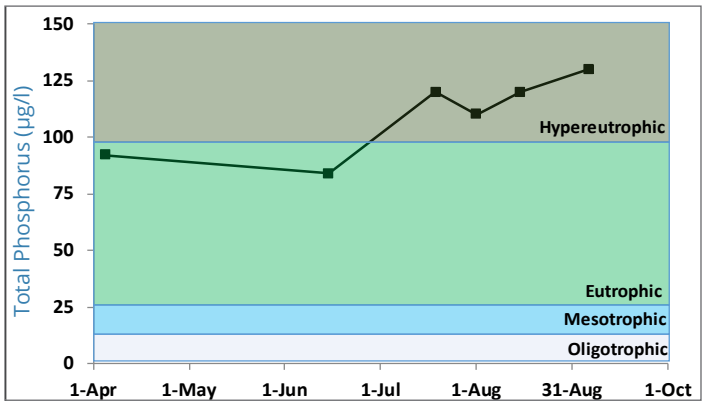
- Continue water quality and biological monitoring.
- Assess/quantify internal and external drivers of poor water quality/clarity in the lake.
- Management efforts for the lake should focus on flipping the lake from its current turbid water state (poor clarity) to a clear water state to promote greater species diversity and ecosystem health.
- Perform fish surveys to determine presence/absence of fish in the lake and (if applicable) what fish species are present.
- Assess watershed nutrient loading and implement best management practices and capital improvement projects.

Water chemistry monitoring: 2017

Total phosphorus levels

While phosphorus is necessary for plant and algae growth, excessive phosphorus leads to excessive growth, decreased water clarity, and water quality impairment.

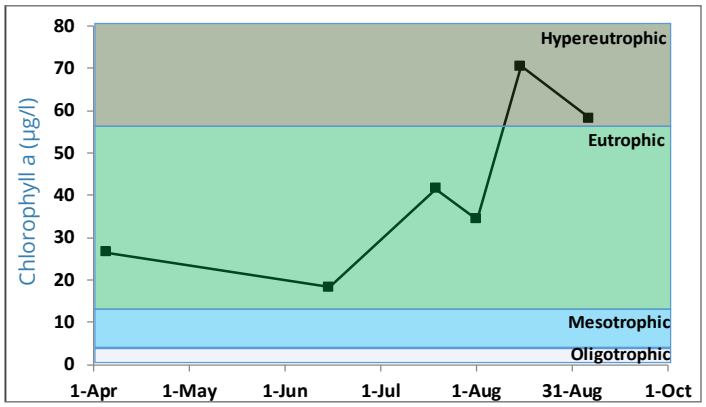
- BCWMC/MPCA standard: 60 micrograms per liter (µg/L) or less.
- Range: Total phosphorus concentrations ranged from a low of 84 µg/L in June to a high of 130 µg/L in September. All concentrations were within the eutrophic or hypereutrophic categories (high nutrient content).
- Summer average: 113 µg/L (did not meet BCWMC/MPCA standard).



Chlorophyll a levels

Chlorophyll a is a pigment in algae and generally reflects the amount of algae growth in a lake. Lakes which appear clear generally have chlorophyll a levels less than 15 micrograms per liter (µg/L).

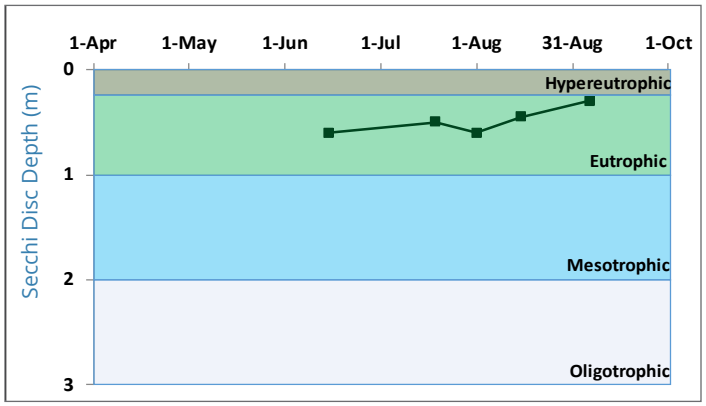
- BCWMC/MPCA standard: 20 µg/L or less.
- Range: Chlorophyll a concentrations ranged from a low of 18.3 µg/L in June to a high of 70.4 µg/L in August. Throughout 2017, chlorophyll a concentrations were in the hypereutrophic or eutrophic category, indicating poor water quality.
- Summer average: 44.5 µg/L (did not meet BCWMC/MPCA standard).



Water clarity

Water clarity is often affected by sediment and the amount of algae or other photosynthetic organisms in a lake. It is usually measured by lowering an 8-inch "Secchi" disc into the lake; the depth at which the disc's alternating black-and-white pattern is no longer visible is considered a measure of the water's transparency.

- BCWMC/MPCA standard: 1.0 meters or more.
- Range: From 0.6 meters in June to 0.3 meters in September.
- Summer average: 0.5 meters (did not meet BCWMC/MPCA standard).



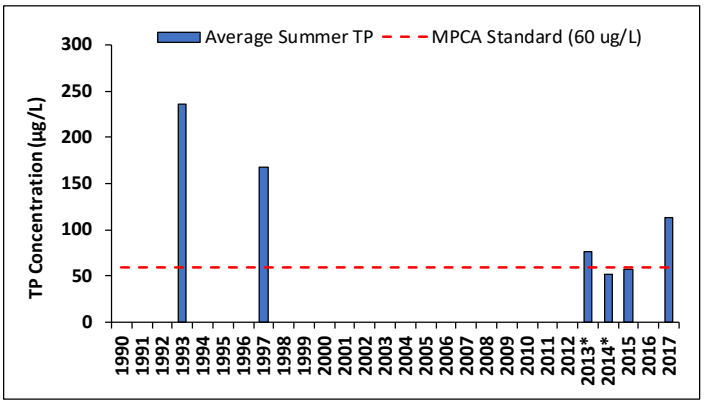
Definitions

- ***Eutrophic:*** Lake condition characterized by abundant accumulation of nutrients supporting dense growth of algae and other organisms; decay of algae can reduce lake oxygen levels
- ***Hypereutrophic:*** Nutrient-rich lake conditions characterized by frequent and severe algal blooms and low transparency
- ***Mesotrophic:*** Lake condition characterized by medium levels of nutrients and clear water
- ***Oligotrophic:*** Lake condition characterized by a low level of dissolved nutrients, high oxygen content, and sparse algae growth

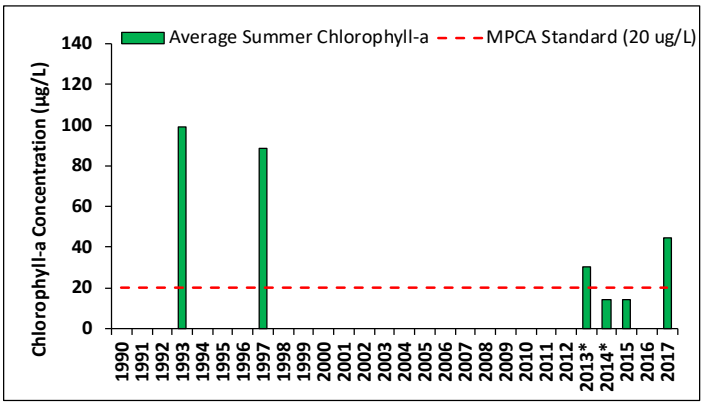
Water chemistry monitoring from 1993–2017: historical trends

Water quality in Lost Lake has been monitored since 1993. Total phosphorus, chlorophyll a, and Secchi disc transparency summer averages (June through September) for years with a minimum of four sample events are shown in the figures to the right. Summer averages for phosphorus, chlorophyll a and Secchi depth have failed to meet BCWMC/MPCA standards in four of the six years monitored. There is not enough data at this time to perform statistical trend analyses on the water quality data for Lost Lake.

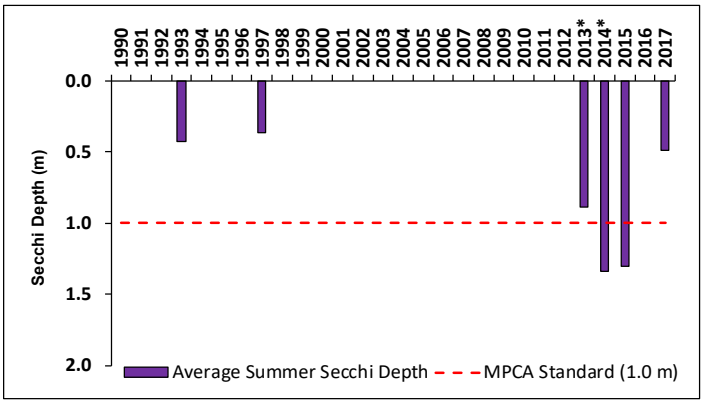
Total phosphorus trends



Chlorophyll a trends



Water clarity trends



Macrophytes

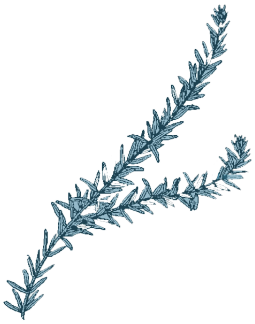
Lake Plant Eutrophication Index of Biological Integrity (IBI)

The MDNR recently developed metrics to determine the overall health of a lake's aquatic plant community. The Lake Plant Eutrophication Index of Biological Integrity (IBI) is used by the MPCA to determine whether a lake is meeting the federal Clean Water Act standards intended to protect aquatic life. The plant IBI includes two metrics: (1) the number of species in a lake and (2) the "quality" of the species, as measured by the floristic quality index (FQI).

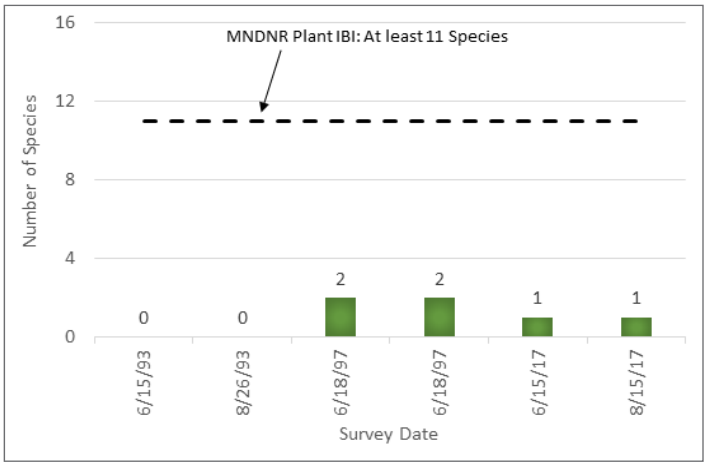
Plant survey data from 1993 through 2017 were assessed to determine plant IBI trends. The figures below show the Lost Lake FQI scores and number of species for that period compared to the MDNR plant IBI impairment threshold.

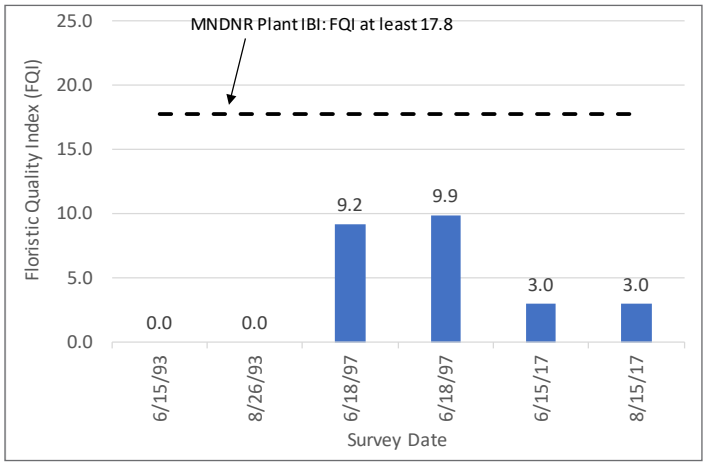
- **Number of species:** The number of species in Lost Lake decreased from two species in 1997 to one species in 2017. Canada waterweed (Elodea canadensis) was the only species noted during the 2017 survey. This species was present in high abundance and formed dense mats throughout much of the lake which made boating and navigation difficult.
- **FQI values (quality of species):** The impairment threshold, as measured by FQI, is a minimum value of 17.8. Similar to the number of species, 2017 FQI values for Lost Lake (3.0) were well below the 17.8 impairment threshold.
- **2017 results:** Because both the number of species in the lake and FQI values are below impairment thresholds, Lost Lake would be considered impaired for aquatic plants. The lake's vegetation community would benefit from improved water quality, particularly improved water clarity.

Aquatic species found in Lost Lake



Canadian waterweed
Elodea canadensis





Lost Lake fish

There is currently no fish data or surveys available for Lost Lake. In small, shallow lakes such as Lost, the fish community can change significantly from year to year depending on fish kill events, winter ice conditions, lake levels, spring flooding and other environmental factors. Water quality conditions within small, shallow lakes are often strongly linked to the presence of certain fish species, particularly bullheads and fathead minnows. Thus, it is recommended that a fish survey be performed on Lost Lake using shallow lake fish sampling techniques (i.e. mini-fyke nets) to determine if fish are currently in the system and, if so, what species are present and their general abundance.

Chloride levels in 2017

Chloride concentrations in many area lakes have increased since the early 1990s when many government agencies switched from sand or sand/salt mixtures to salt for winter road maintenance. When snow and ice melts, the salt goes with it, washing into lakes, streams, wetlands, and groundwater. It only takes 1 teaspoon of road salt to permanently pollute 5 gallons of water. And, once in the water, there is no way to remove chloride.

Because high concentrations of chloride can harm fish and plant life, the MPCA has established a chronic exposure chloride standard of 230 mg/l or less.

- Range of chloride concentrations in Lost Lake: From a high of 32 mg/L , measured in April, to a low of 30 mg/L, measured in September
- Average concentration: 31 mg/L (meets MPCA standard)

Increased use of chloride for road maintenance has had an impact on chloride levels in Twin Cities metro area lakes, including Lost Lake.

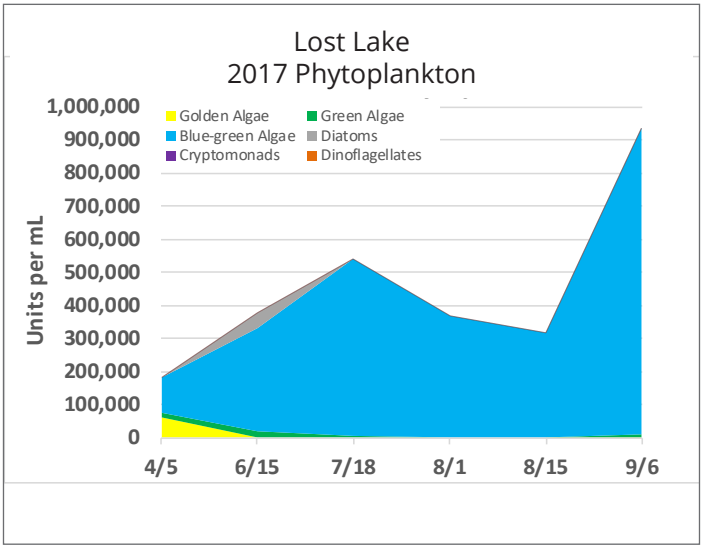
Phytoplankton and zooplankton

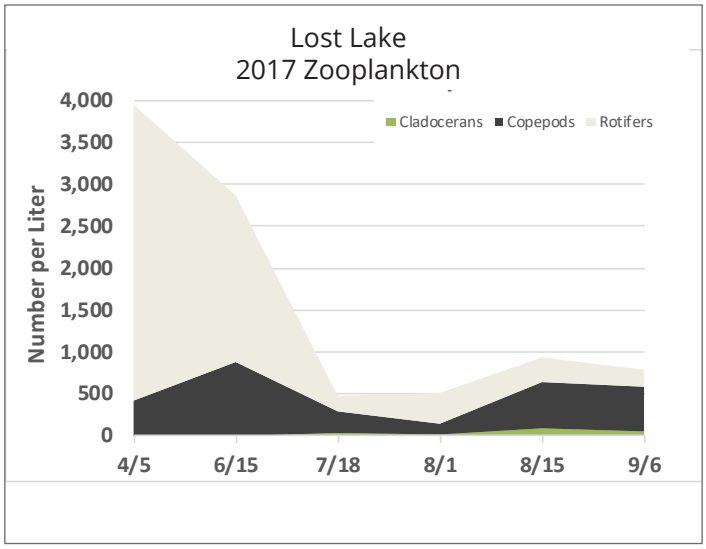
Samples of phytoplankton, microscopic aquatic plants, were collected from Lost Lake to evaluate water quality and the quality of food available to zooplankton (microscopic animals). As shown in the figure below, phytoplankton numbers increased between April and July, decreased slightly in August, and then increased sharply in early September. The community was dominated by blue-green algae, which is a poor food source to invertebrates. Blue-green algae can produce natural toxins; in high concentrations, these toxins can be harmful to pet and human health. The World Health Organization (WHO) has established the following guidelines for assessing the risk posed to lake users by exposure to blue-green algae.

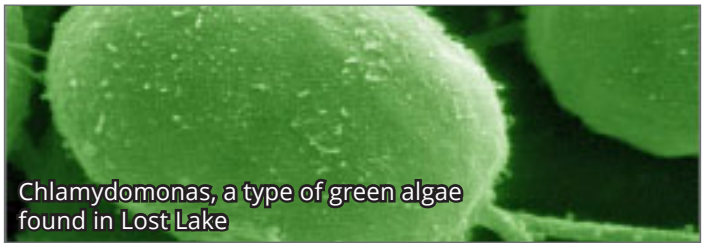
- Lakes with blue-green algae densities less than 20,000 cells per milliliter pose no risk to the health of humans or pets.
- Exposure to lakes with blue-green algae density levels between 20,000 and 100,000 cells per milliliter poses a low risk of adverse health impacts (i.e., skin irritation or allergenic effects such as watery eyes).
- Exposure to lakes with blue-green algae densities greater than 100,000 cells per milliliter poses a moderate health risk (i.e., long-term illness from algal toxins is possible).

In 2017, blue-green algae numbers were in the moderate risk category throughout the entire sampling period. Higher blue-green algae concentrations correlated with increasing surface water phosphorus and chlorophyll a concentrations.

Unlike phytoplankton, zooplankton do not produce their own food. As "filter feeders," they eat millions of small algae; given the right quantities and species they can filter the volume of an entire lake in a matter of days. They are also a valuable food source for planktivorous fish and other organisms. The numbers and community composition of zooplankton in Twin Lake were consistent with previous years. Small rotifers and copepods were prevalent throughout the summer, while cladocerans were observed only in mid-July (26/L), August (83/L) and September (58/L).






Chlamydomonas, a type of green algae found in Lost Lake


Filinia longiseta, a rotifer found in Lost Lake

Bassett Creek Watershed Management Commission
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