Leelanau Conservancy
Water Quality Program Summary: Spring 2019

Photo by Tim Keilty

Limnology 101: Phosphorus

- Phosphorus is a common constituent of agricultural fertilizers, manure, and organic wastes in sewage and industrial effluent. It is an essential element for plant life and required by living things-
- Forms in lakes: orthophosphate (PO_4^{-3}), organic phosphate (in living things, absorbed to organic matter), phosphine (PH_3, in environments with low oxygen)
- Organic phosphates are greater than 90% of phosphorus in fresh water
- Common measures of phosphorus in lakes: soluble reactive phosphorus (SRP, orthophosphate and dissolved inorganic), total phosphorus (TP, in living things like plankton and SRP)
- The amount of phosphorus influences the type and abundance of phytoplankton in water
  - Phytoplankton are important photosynthetic components of healthy aquatic systems
  - They form the base of the food web, similar to plants on land
  - For water quality, we often focus on three types of phytoplankton: diatoms, green algae and blue-green algae (cyanobacteria)

	Total Phosphorus (µg/L)
Ultra-oligotrophic	<5
Oligotrophic	5-10
Mesotrophic	10-30
Eutrophic	30-100
Hypereutrophic	>100

  - Lakes with high water quality contain low amounts of phosphorus. They are considered oligotrophic and are dominated by diatoms (learn more about diatoms here: https://diatoms.org/what-are-diatoms)
  - Lakes with poor water quality contain high amounts of phosphorus. They are considered eutrophic and are dominated by blue-green algae
  - Lakes in Leelanau are oligotrophic; Lake Erie is eutrophic
  - In water, just as on land, increasing phosphorus increases green growth

Water Quality Data Collected by the Leelanau Conservancy

We sample the seven major lakes and their tributaries from May to October using the same location, lab and sampling techniques that have been used since 1990.

Lake Sampling-

- Water samples analyzed for: total phosphorus, nitrates/nitrites and chlorophyll-a
- Measured using a Hydrolab: pH, temperature, dissolved oxygen, conductivity and chlorophyll-a, and using a Secchi disk which measures light penetration.

Stream Sampling-

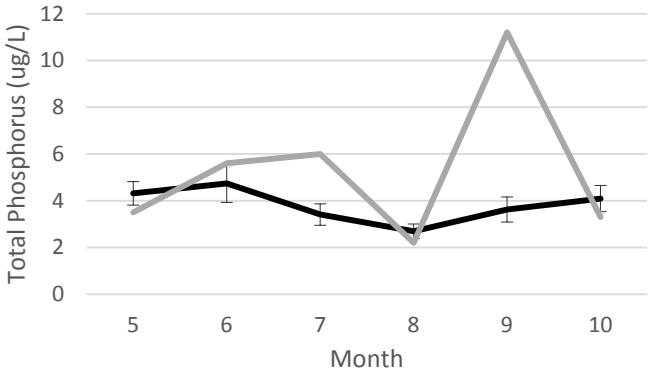
- Flow or discharge, temperature and total phosphorus

Leelanau County Lakes – Total Phosphorus

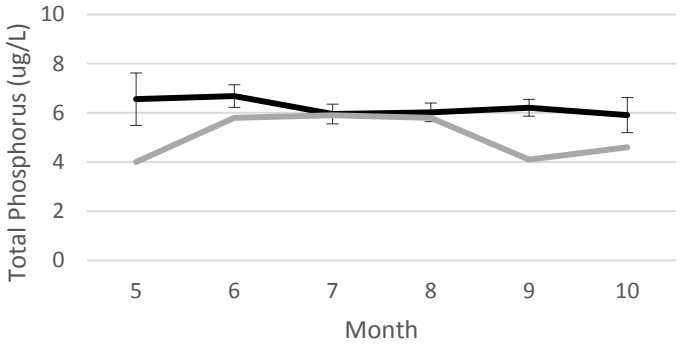
2018 data compared to long term mean values

Long Term Mean
2018

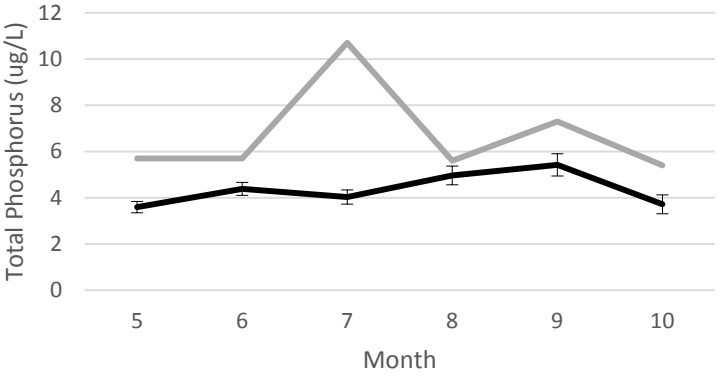
Big Glen Lake



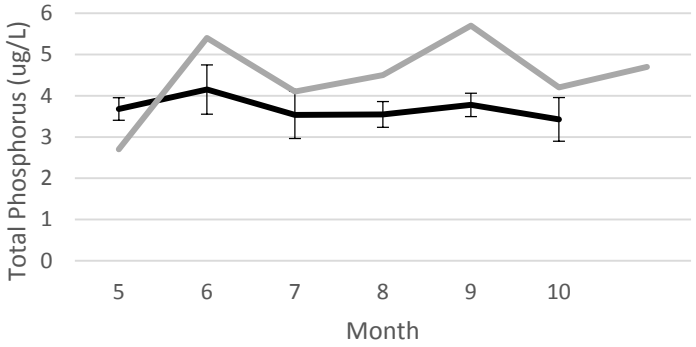
Little Glen Lake



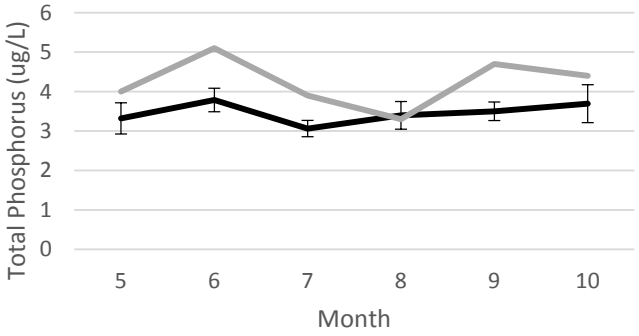
Little Traverse Lake



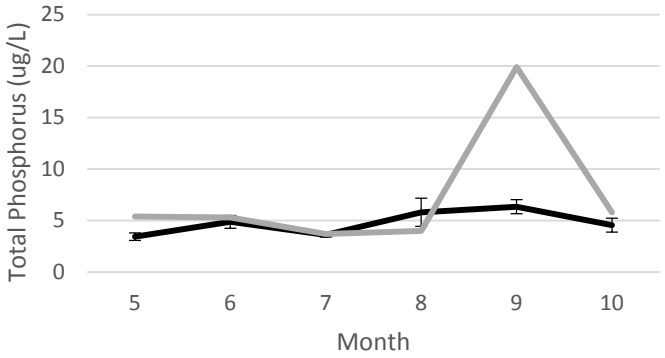
Lime Lake



North Lake Leelanau

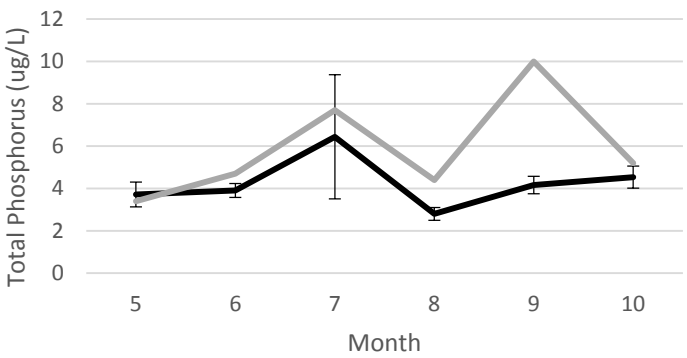


South Lake Leelanau



How to interpret these graphs: The purpose of these graphs is compare total phosphorus (TP) **measured at the surface** in 2018 with the historical data (approximately 1995-2017), and to compare values to the table on the previous page. The error bars represent standard error (standard deviation normalized by sample size). If TP measured in 2018 exceeds the long term mean, lake associations and individual lakefront landowners should consider mitigation techniques, but should also keep in mind the values from 2018 often include only one sample. If you have questions about these data, or figures, contact Yarrow Brown at 231-256-9665 or ybrown@leelanauconservancy.org.

Cedar Lake



What Does This Data Tell Us?

- In 2018, some Leelanau lakes contained total phosphorus values that exceeded the long-term "mean" (or average) values.
- The same lakes also had total phosphorus concentrations that exceeded the maximum range for oligotrophic systems (10 ug/L).
- Often these high values occurred in the month of September. This coincides with the end of the tourist and growing seasons, but also fall turnover (before the lakes mix from top to bottom).
- Higher concentrations of total phosphorus will support greater concentrations of phytoplankton, and perhaps different types of phytoplankton
- Values in 2018 represent single water samples. Although they are reliable (analyzed by a laboratory that specializes in water chemistry), they are only single samples and should be used to encourage mitigation and understanding, as opposed to being viewed as a red flag

What Can You Do?

- Join your lake association and get on the Leelanau Clean Water email list (https://www.leelanau.cc/lcw.asp)
- Limit phosphorus additions into waterways by minimizing the use of lawn fertilizers, or by using those free of phosphorus
- Plant buffer vegetation near shorelines to adsorb runoff
- Make sure your septic system is functioning property and is inspected regularly by the health department