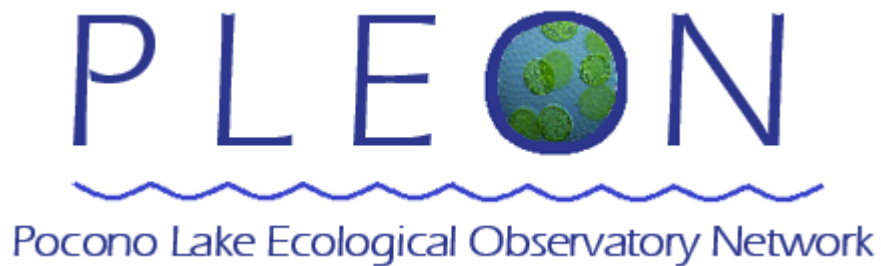


2018 Package Options for Lake Sampling

Pocono Lake Ecological Observatory Network (PLEON)

Lacawac Sanctuary

Lake Ariel, PA



The **Pocono Lake Ecological Observatory Network (PLEON)** provides water quality monitoring and public education to provide more effective management of lake ecosystems in a changing world.

What is PLEON?

The **Pocono Lake Ecological Observatory Network** is a regional lake monitoring program focused on educating the public and lake associations on water quality and lake management.

Our goals:

Empower the public to better understand and manage their freshwaters.

Create a community of scientists, students, environmental educators, and landowners to work together in improving the ecological state of Pennsylvania's lake ecosystems.

Complement a traditional lake consultant by providing ongoing monitoring data on lakes and ensuring that land owners fully understand the advantages and limitations of different lake management approaches.

Why PLEON?

Lakes are ecological treasures that form the economic backbone of tourism in the Pocono region. They provide both recreational enjoyment as well as critical habitat for a variety of wildlife, including plants and animals.

Lakes are complex ecosystems, and effective management requires good data as well as an understanding of the physical, chemical, and biological characteristics of lakes and their surrounding catchments.

Despite their aesthetic, recreational, and environmental importance, we know little about water quality in our Pocono lakes. Neither the state nor regional counties offer regular surveys to provide data essential for good management of these complex ecosystems. Increasing concerns about harmful algal blooms throughout the region make responsible lake management of central importance to the health of these ecosystems and the people, pets, and wildlife that depend on them.

Who is PLEON?

PLEON is based at Lacawac Sanctuary and Biological Field Station and is administered by Lacawac's Director of Science and Research. The program has a scientific advisory board consisting of experts in freshwater science.

Chief Scientist & Director Dr. Beth Norman
Director of Science and Research, Lacawac Sanctuary

Chief Scientific Advisor Dr. Craig Williamson
Ohio Eminent Scholar of Ecosystem Ecology & Professor of
Biology, Miami University of Ohio

Scientific Advisory Board Dr. Janet Fischer
Professor of Biology, Franklin and Marshall University

Dr. Elizabeth Rielly
Assistant Professor of Biology, Holy Family University

Dr. Sarah Princiotta
Murray State University – Postdoctoral Associate, Murray State
University

How PLEON works:

A team of PLEON scientists and interns will give your lake a “check-up.” We offer pre-formulated packages and à la carte options, allowing you to create a program specific to your needs. Key variables indicative of lake health include:

Light

The rate at which light intensity decreases with depth is an indicator of water clarity. Light is important for many lake organisms. The microscopic algae (phytoplankton) that are the base of the open water food web in lakes use light to grow, a process called photosynthesis. Light affects zooplankton behavior and most fish need light to feed.

Temperature

Water temperature determines the type of fish in the lake as well as the abundance of cyanobacteria, a type of phytoplankton that can cause toxic algal blooms when temperatures are warm. Temperature plays a role in the physical structure of a lake. During the summer, surface water is warmer than deep water and this difference keeps the top and

bottom waters stratified into layers. The layers mix in the spring when the ice melts and in the fall as winds pick up and surface waters cool. This mixing is called “turnover” and is a critical period where nutrients are brought to the surface where phytoplankton can use them. Monitoring water temperature will tell you if your lake is stratified or turning over.

Dissolved oxygen

Oxygen is dissolved in lake water. Oxygen can enter the water at the surface, or be produced by photosynthetic organisms such as algae. Oxygen is used up by the breathing, or respiration, of lake organisms. Problems occur when too much oxygen is consumed, as can happen following an algal bloom. When the algae eventually die, they sink to the bottom of the lake and are broken down by decomposers. High rates of respiration by these decomposers can create very low oxygen levels ("hypoxia") or even a nearly complete lack of oxygen ("anoxia"), conditions dangerous for organisms like fish, which need oxygen to live. Low dissolved oxygen can lead to regeneration of nutrients from the sediments of a lake, which in turn can contribute to algae blooms.

pH

Water pH is a measure of the acidity of lake, specifically the concentration of hydrogen ions dissolved in the water. Lake pH can determine which organisms can survive there, because organisms differ in their pH tolerance. Lake pH also affects carbon cycling in lakes.

Conductivity

Conductivity is a measure of the ability of water to conduct electricity. Electricity is conducted by ions dissolved in the water, so conductivity is an indication of the total amount of dissolved solids in the lake. Dissolved solids can come from the natural geology or they can be an indication of agricultural or sewage runoff.

Chlorophyll

Phytoplankton cells contain chlorophyll, which is a pigment that captures light for use in photosynthesis. Chlorophyll reflects green light, which is why algae often appear to be green. Animals do not have this pigment, so the amount of chlorophyll in the water can be used to estimate the amount of phytoplankton. A rapid increase in the amount of chlorophyll to a high level in your lake is an indication of an algal bloom.

Nutrients

Lake organisms require nitrogen and phosphorus to live. However, too much nitrogen and phosphorus essentially act as fertilizers and can cause algal blooms. Excess nutrients can come from runoff from improperly maintained or faulty septic systems, fertilized lawns, agriculture, and golf courses.

Plankton

Plankton are tiny organisms that live in lakes. Phytoplankton, also called algae, use photosynthesis for energy. Planktonic animals are called zooplankton. They are mostly algae-eaters, but can also eat dead organic matter or other zooplankton. Zooplankton are also an important food for many fish, especially juvenile fish. High concentrations of large zooplankton are a good sign in a lake. The type and abundance of both phytoplankton and zooplankton are good indicators of lake health.

Potentially Toxic Cyanobacteria (PTOX)

Cyanobacteria (or blue-green algae) are photosynthetic bacteria, some of which produce toxins that are harmful to humans and animals. This can be a problem in lakes that experience blooms of these cyanobacteria. PLEON monitors the abundance of potentially toxic cyanobacteria by examining water samples under a microscope. If the initial PTOX screening is positive, we may recommend further sampling to measure the concentration of various toxins.

Packages

PLEON offers the following pre-formulated packages. **Prices reflect cost per sampling effort.**

A. Introductory Package... \$640

PLEON will conduct a single sampling effort providing a “snap shot” of your lake. This is a good option for those who are just starting to monitor their lake or for lakes with no outstanding management challenges. This package includes the following:

- Secchi depth – measurement of lake transparency
- Depth profile – light, dissolved oxygen, temperature, pH, and conductivity are measured every ½ meter (in shallower lakes) to 1 meter (in deeper lakes) of depth to characterize the physical structure of the water column
- Nutrients – Total nitrogen and total phosphorus concentrations measured from 2 replicate samples at each of 3 depths
- Chlorophyll – Two replicate samples measured at each of 3 depths
- PTOX screening – presence of potentially toxic cyanobacteria assessed in 2 surface samples

B. Routine Sampling Package...\$536

PLEON will conduct regular sampling on a customizable schedule as determined by the lake association’s needs. Typical routines include once or twice a month during late spring/summer. This package is ideal for lakes with on-going management issues (e. g. toxic algal blooms, nutrient enrichment). This package includes:

- Secchi depth – measurement of lake transparency
- Depth profile – light, dissolved oxygen, temperature, pH, and conductivity are measured every ½ meter (in shallower lakes) to 1 meter (in deeper lakes) of depth to characterize the physical structure of the water column
- Chlorophyll – Two replicate samples measured at each of 3 depths
- PTOX screening – presence of potentially toxic cyanobacteria assessed in 2 surface samples

C. PTOX Mini-analysis Package...\$420

This package is ideal for those concerned about toxic algal blooms who want to monitor for toxic algae in their lake. This package includes:

- Depth profile – light, dissolved oxygen, temperature, pH, and conductivity are measured every ½ meter (in shallower lakes) to 1 meter (in deeper lakes) of depth to characterize the physical structure of the water column
- PTOX screening – presence of potentially toxic cyanobacteria assessed in 2 surface samples

D. Customized Package...contact for quote

A customized program of sampling can be assembled based on the needs of individual lake associations. Contact Dr. Beth Norman to formulate a custom sampling plan and a quote.

Individual Variables

PLEON offers sampling of individual variables, allowing you to pick those most relevant to the needs of your lake. These options can be added to any of the packages above.

A. Physical Profiles...\$220

Light, dissolved oxygen, temperature, pH, and conductivity are measured every ½ meter of depth to create a picture of the physical characteristics of the water column.

B. Plankton...\$580 if alone / \$460 if combined with profiles or package

PLEON will collect an integrated water column sample for detailed microscopic analysis of the phytoplankton and zooplankton.

C. Nutrients...\$180 if alone / \$100 if combined with profiles or package

PLEON will collect 2 replicate water samples at each of 3 depths for total nitrogen and phosphorus analysis.

D. Cyanobacteria Toxin Analysis... Price depends on PTOX results and lake association request

A detailed analysis of cyanobacteria and specific toxins. This analysis is only necessary with a positive PTOX screen. Price depends on PTOX screen results (abundance and type of cyanobacteria found) and the level of detail requested by the lake association.

Reporting

Reports are prepared by Dr. Beth Norman, Chief PLEON Scientist and Director of Science and Research at Lacawac Sanctuary.

A. Single Sampling Effort Report...\$180

A written report describing the results of a single sampling effort and the implications of these results in the context of lake health. Lake associations can discuss the report with PLEON Chief Scientist.

B. Multiple Sampling Effort Report...\$400

A written report describing trends observed over several sampling efforts. Detailed explanations of the trends and their implications for lake health are included. Lake associations can discuss the report with PLEON Chief Scientist. Comparisons of historical data may be included in this report (e. g. previous PLEON sampling). Contact Beth Norman for quote to provide historical context.

Workshops

Workshops at the Lacawac Sanctuary offer training on topics related to lake management and provide opportunities to interact with scientists and members of other lake associations.

Grant Writing Help

PLEON offers support for writing grants to cover costs of lake management and cleanup. Contact Beth Norman for details and quote.

**For additional information, quotes for service, or to schedule
sampling, please contact:**

Beth Norman, Chief Scientist and Director of PLEON

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