SQUAM LAKE

SITE 5 LIVERMORE COVE 2013 SAMPLING HIGHLIGHTS

HOLDERNESS, NH

NEW HAMPSHIRE
LAKES LAY MONITORING

Squam Lake volunteers collected water quality data between June 10 and October 16, 2013 while more in depth water quality surveys of Site 5 Livermore Cove were conducted by the **Center for Freshwater Biology** on June 19, July 17 and August 20, 2013.

Light Blue = Outstanding = Ultraoligotrophic

Blue = Excellent = Oligotrophic

Yellow = Fair = Mesotrophic

Red = Poor = Eutrophic

Light Gray = No Data

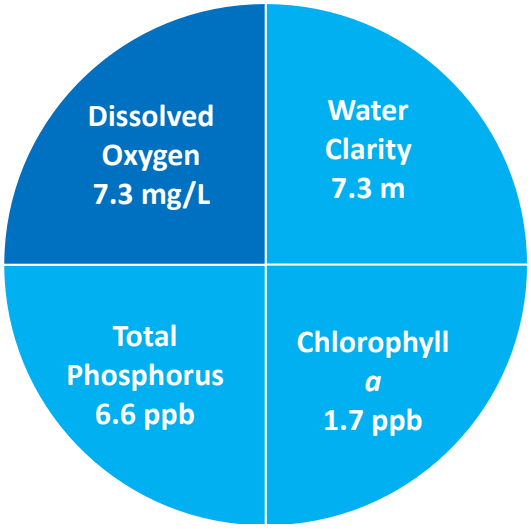


Figure 1. Average Water Quality Conditions

2013 RESULT HIGHLIGHTS

WATER CLARITY: Water clarity, measured as Secchi disk depth, averaged 7.3 meters (m) at Site 5 Livermore Cove. The 2013 water clarity was deeper than the 2012 water clarity measures.

CHLOROPHYLL: Chlorophyll *a*, a measure of microscopic plant life within the lake, averaged 1.7 parts per billion (ppb) at Site 5 Livermore Cove. The 2013 chlorophyll *a* concentrations were slightly higher (greener water) than what was seen in 2012.

TOTAL PHOSPHORUS: Phosphorus is the nutrient most responsible for microscopic plant growth. Total phosphorus concentrations taken from the surface waters averaged 6.6 parts per billion (ppb). A total phosphorus concentration of 10 ppb is considered sufficient to support green water events that are referred to as algal blooms.

DISSOLVED OXYGEN: Dissolved oxygen is important for healthy fisheries. Dissolved oxygen concentrations collected in the bottom waters ranged from 5.0 to 8.3 milligrams per liter (mg/L) on July 17. Dissolved oxygen concentrations were mostly above 5.0 mg/L, which is considered the threshold for the growth and reproduction of coldwater fish, such as trout and salmon.

COLOR: Color is a result of naturally occurring "tea" color substances from the breakdown of soils and plant materials. Site 5 Livermore Cove averaged 11.6 color units (CPU).

ALKALINITY: Alkalinity measures the resistance the lake has against acid rain. At Site 5 Livermore Cove, alkalinity averaged 6.6 milligrams per liter (mg/L) and indicated a moderate vulnerability to acid rain.

SPECIFIC CONDUCTIVITY: Specific conductivity is a general indicator of pollution. Specific Conductivity ranged from 46 to 51 micro-Siemans per centimeter (*u*S/cm) at Site 5 Livermore Cove. Specific conductivity indicates moderate concentrations of dissolved substances such as nutrients (e.g. phosphorus and nitrogen) and other dissolved salts (e.g. sodium and chloride).

CYANOBACTERIA: Squam Lake did not take part in the 2013 cyanobacteria monitoring program. Please refer to the recommendation section for further information.

Note: For a more detailed discussion of water quality measurements and a discussion on the inter-comparison of sample sites, please refer to the executive summary within the annual Squam Lake report.

Table 1. 2013 5 Livermore Site on Squam Lake Seasonal Average Water Quality Readings and Trophic Level Classification Criteria used by the New Hampshire Lakes Lay Monitoring Program

Parameter	Ultraoligo "Outstanding"	Oligo "Excellent"	Meso "Fair"	Eutrophic "Poor"	Site 5 Livermore Cove Average (range)	Site 5 Livermore Cove Classification
Water Clarity (meters)	> 7.0	4.0 – 7.0	2.5 - 4.0	< 2.5	**7.3** meters (range: 6.0 – 8.3)	Ultraoligotrophic
Chlorophyll *a* (ppb)	< 2.0	2.0 - 3.0	3.0 - 7.0	> 7.0	**1.7** ppb (range: 0.4 – 2.8)	Ultraoligotrophic
Total Phosphorus (ppb)	< 7.0	15.0 – 7.0	15.0 - 25.0	> 25.0	**6.6** ppb (range: 5.2 – 6.6)	Ultraoligotrophic
Dissolved Oxygen (mg/L)	> 7.0	5.0 – 7.0	2.0 – 5.0	<2.0	**7.3** mg/L (range: 5.0 – 8.3)	Oligotrophic
Cyanobacteria (cell counts, microcystin concentration & Water safety)	The Massachusetts Department of Public Health considers dangerous microcystin (MC) levels to be 14 micrograms per liter (ug/l) lake water, and/or 70,000 cyanobacteria cells per milliliter lake water.				The New Hampshire Department of Environmental services posts warnings at State beaches when cyanobacteria cell numbers exceed 70,000 cells per milliliter lake water.	

*** Dissolved oxygen concentrations taken from the bottom layers**

LONG TERM WATER QUALITY TRENDS

WATER CLARITY: Water clarity has decreased approximately 100 centimeters (cm) in the past thirty-five years of sampling.

CHLOROPHYLL: Chlorophyll *a* has increased approximately 0.3 parts per billion (ppb) between 1979 and 2013. However the trend is not statistically significant.

COLOR: Color concentrations have increased over the sampling years. However, the trend is not statistically significant.

TOTAL PHOSPHORUS: Total phosphorus has increased over twenty years of sampling. However, the trend is not statistically significant.

In summary, there are some indications of a decrease in the Site 5 Livermore Cove Lake water quality over the past thirty-five years of water quality monitoring. The water clarity has decreased, while there has been a corresponding increase in chlorophyll *a* and total phosphorus concentrations. Furthermore, color concentrations have increased. Although water clarity was the only parameter that displayed statistical significance, increasing long-term total phosphorus (nutrient) levels remain a threat to the water quality at Site 5 Livermore Cove.

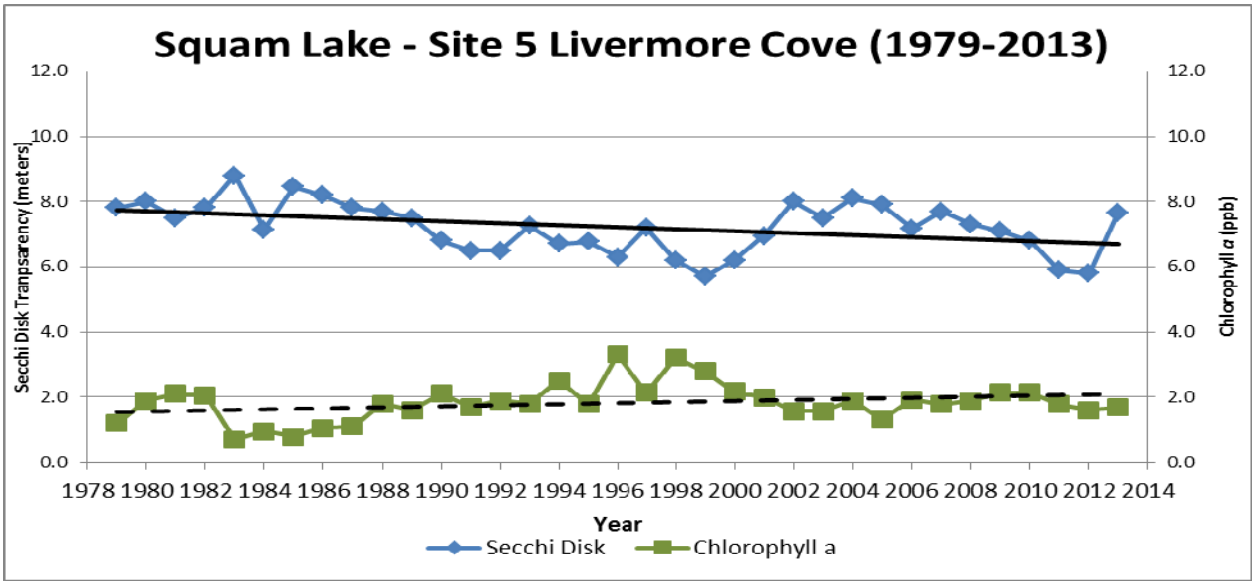


Figure 2. Changes in water clarity (Secchi disk depth) and chlorophyll *a* measured between 1979 and 2013 at Site 5 Livermore Cove. There has been a statistically significant decrease in water clarity with time (solid line), while Algal growth (chlorophyll *a*) has increased slightly since 1979, although the trend is not statistically significant (dashed line).

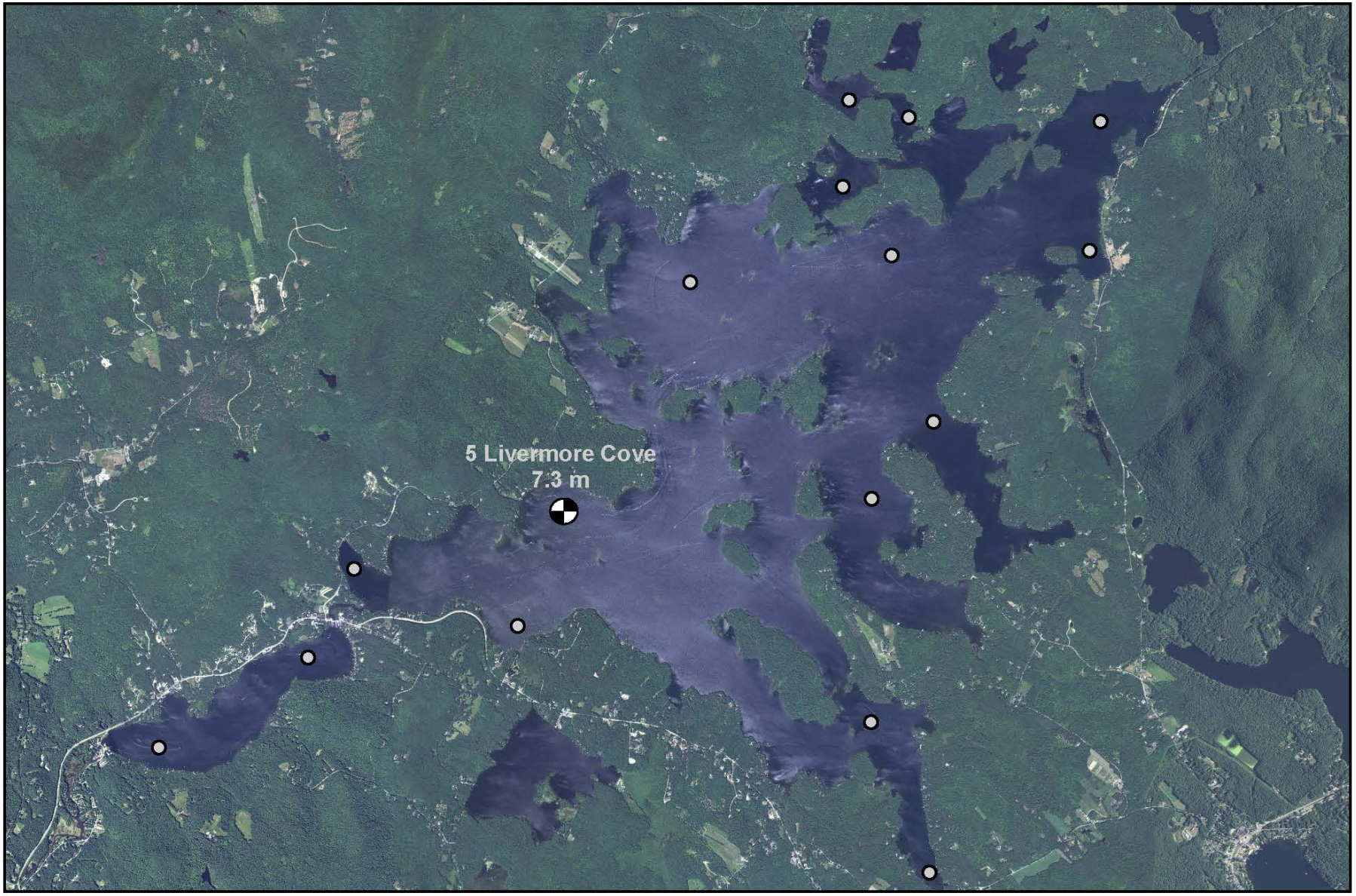
Recommendations:

- Conduct early season sampling (April/May) to document Squam's reaction to periods of high stream flow during and after spring thaw.
- Implement a simple cyanobacteria-monitoring routine into the conventional water quality monitoring methods including monthly water samples. Cyanobacteria collections throughout the summer and fall months can give insight as to how these populations are distributed throughout the seasons and when they are most likely to be at harmful levels. If you are interested in discussing additional water quality monitoring options that would meet your needs please contact Bob Craycraft by phone, 862-3696, or via email, bob.craycraft@unh.edu
- Implement Best Management Practices within the Squam Lake watershed to minimize the adverse impacts of polluted runoff and erosion into the lake. Refer to "Landscaping at the Water's Edge: An Ecological Approach" and "New Hampshire Homeowner's Guide to Stormwater Management: Do-It-Yourself Stormwater Solutions for Your Home" for more information on how to reduce nutrient loading caused by overland run-off.
    - https://extension.unh.edu/resources/files/Resource001799_Rep2518.pdf
    - http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf

Squam Lakes - Site 5 Livermore Cove

Holderness, NH

2013 Deep water sampling site locations with annual seasonal water clarity



Aerial Orthophoto Source: NH GRANIT
Site location GPS coordiniates collected by theUNH Center of Freshwater Biology

University of New Hampshire
Cooperative Extension

New Hampshire Lakes Lay Monitoring