SQUAM LAKE

SITE 18 PIPER COVE
2013 SAMPLING HIGHLIGHTS

HOLDERNESS, NH

NEW HAMPSHIRE
LAKES LAY MONITORING

Squam Lake volunteers collected water quality data between June 3 and October 16, 2013 while more in depth water quality surveys of 18 Piper Cove were conducted by the **Center for Freshwater Biology** on June 19 and July 17 August 20, 2013.

Light Blue = Outstanding = Ultraoligotrophic

Blue = Excellent = Oligotrophic

Yellow = Fair = Mesotrophic

Red = Poor = Eutrophic

Light Gray = No Data

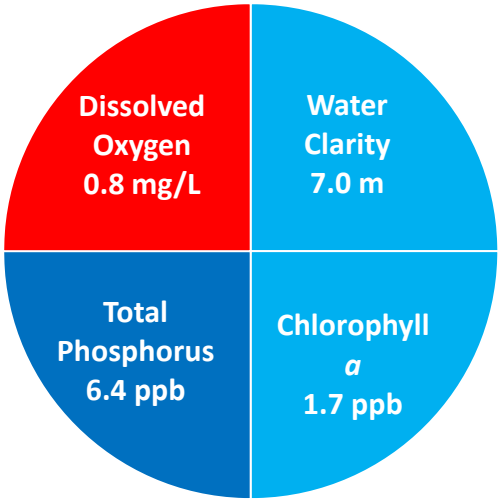


Figure 1. Average Water Quality Conditions

2013 RESULT HIGHLIGHTS

WATER CLARITY: Water clarity, measured as Secchi disk depth, averaged 7.0 meters (m) at Site 18 Piper Cove. The 2013 Site 18 Piper Cove water clarity decreased slightly relative to the 2012 water clarity readings.

CHLOROPHYLL: Chlorophyll *a*, a measure of microscopic plant life within the lake, averaged 2.0 parts per billion (ppb) at Site 18 Piper Cove. The 2013 chlorophyll *a* concentrations increased (greener water) relative to the 2012 readings.

TOTAL PHOSPHORUS: Phosphorus is the nutrient most responsible for microscopic plant growth. Total phosphorus concentrations taken from the surface waters averaged 6.4 parts per billion (ppb) and remained below 10 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.The Piper Cove dDissolved oxygen concentrations, collected in the bottom waters, ranged from 0.0 to 4.4 milligrams per liter (mg/L) on August 20. The Piper Cove dissolved oxygen concentrations near the lake bottom were below 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. The site 18 Piper Cove color averaged 9.7 color units (CPU).

ALKALINITY/pH: Alkalinity measures the resistance the lake has against acid rain. The site 18 Piper Cove alkalinity averaged 6.7 milligrams per liter (mg/L) and indicated a moderate vulnerability to acid rain. The **pH** is a measure of lake acidity. Values for this parameter were not collected at Site 18 Piper Cove during the 2013 sampling season.

SPECIFIC CONDUCTIVITY: Specific conductivity is a general indicator of pollution. Specific Conductivity ranged from 46 to 49 micro-Siemans per centimeter (*u*S/cm at Site 18 Piper Cove. The Piper 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 Squam Lake Site 18 Piper Cove 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 18 Piper Cv. Average (range)	Site 18 Piper Cv. Classification
Water Clarity (meters)	> 7.0	4.0 – 7.0	2.5 - 4.0	< 2.5	**7.0** meters (range: 5.4 – 8.4)	Oligotrophic
Chlorophyll *a* (ppb)	< 2.0	2.0 - 3.0	3.0 - 7.0	> 7.0	**2.0** ppb (range: 1.0 – 3.1)	Oligotrophic
Total Phosphorus (ppb)	< 7.0	15.0 – 7.0	15.0 - 25.0	> 25.0	**6.4** ppb (range: 5.3 – 7.2)	Ultraoligotrophic
Dissolved Oxygen (mg/L)	> 7.0	5.0 – 7.0	2.0 – 5.0	<2.0	**0.8** mg/L (range: 0.0 – 4.4)	Eutrohpic
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 20 centimeters (cm) in the past twenty-five years of sampling However, the trend is not statistically significant.

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

COLOR: Color concentrations have remained relatively stable over the nineteen years of sampling conducted since 1995. However, the trend is not statistically significant.

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

In summary, The Piper Cove water quality remains high. A slight decrease in the chlorophyll *a* concentrations corresponds to decreasing total phosphorus concentrations over time. The water clarity remains high as well but does exhibit a slight reduction in water clarity since the first samples were collected in 1979.

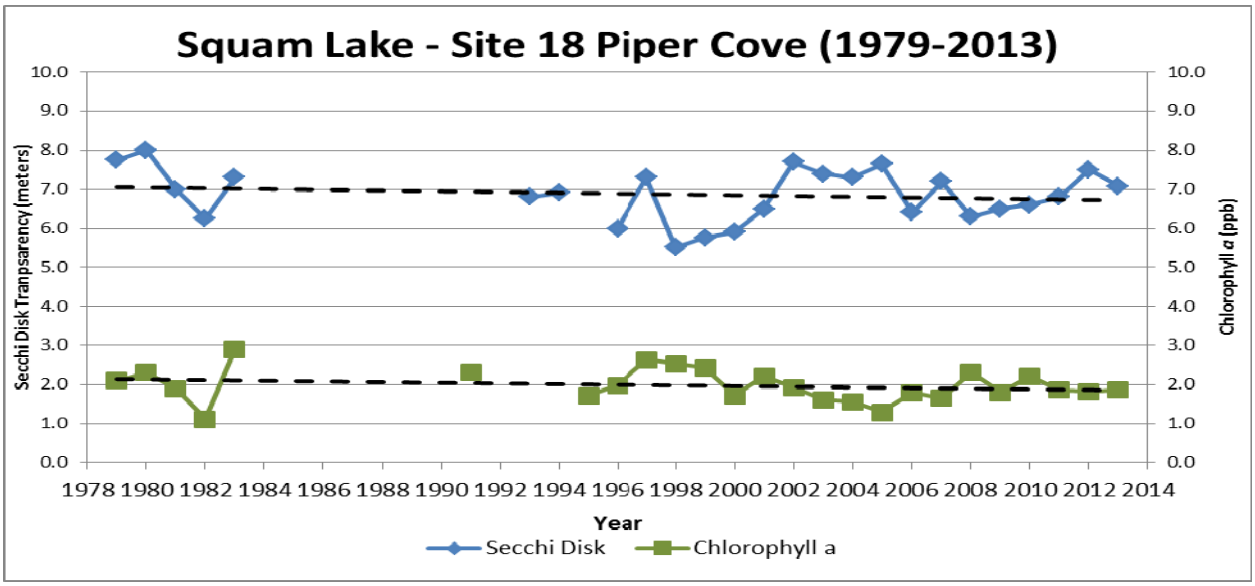


Figure 2. Changes in water clarity (Secchi disk depth) and chlorophyll *a* measured between 1979 and 2013 at Site 18 Piper Cove. There has been a slight decrease water clarity with time. However, the trend is not statistically significant (dashed line). Algal growth (chlorophyll) displays a slight decreasing trend since 1979. However, the trend is not statistically significant (dashed line).

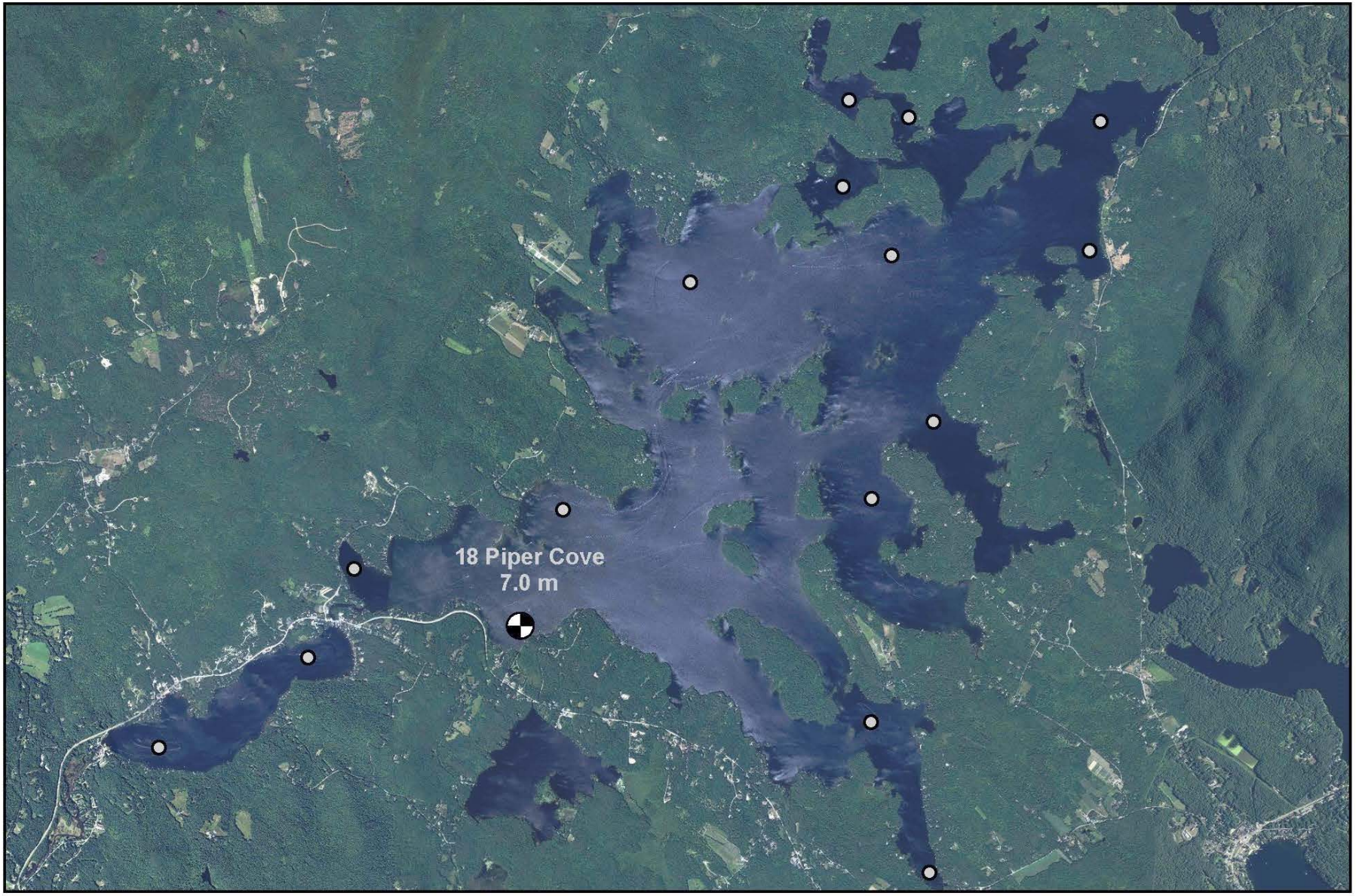
Recommendations:

- 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 18 Piper 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