NIPPO LAKE

2013 SAMPLING HIGHLIGHTS

Barrington, NH

NEW HAMPSHIRE
LAKES LAY MONITORING

Nippo volunteers collected water quality data between June 23 and October 5, 2013. A more in depth water quality survey of the Nippo Lake deep sampling stations was conducted by the Center for Freshwater Biology on July 30, 2013.

Light Blue = Outstanding = Ultraoligotrophic

Blue = Excellent = Oligotrophic

Yellow = Fair = Mesotrophic

Red = Poor = Eutrophic

Light Gray = No Data

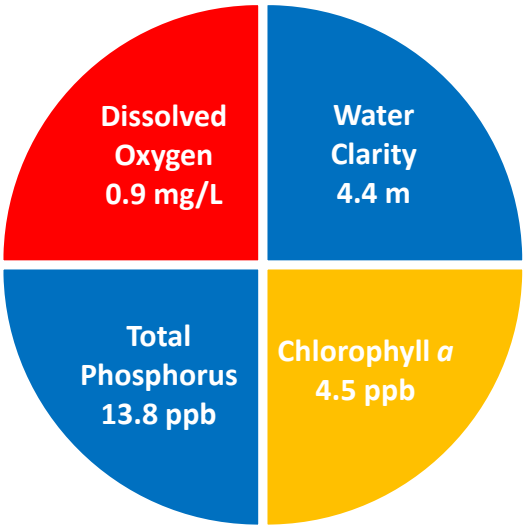


Figure 1. Average Water Quality Conditions

2013 RESULT HIGHLIGHTS

WATER CLARITY: Water clarity, measured as Secchi disk depth, averaged 4.4 meters (m) in Nippo Lake. The water was least clear in late-September and early October.

CHLOROPHYLL: Chlorophyll *a*, a measure of microscopic plant life within the lake, averaged 4.5 parts per billion (ppb) in Nippo Lake. The chlorophyll *a* concentrations were highest in late-September and early October. Higher chlorophyll *a* concentrations corresponded to shallower Nippo Lake water clarity.

TOTAL PHOSPHORUS: Phosphorus is the nutrient most responsible for microscopic plant growth. Total phosphorus concentrations averaged 13.8 parts per billion (ppb) and remained above 10 parts per billion (ppb), which is considered sufficient to support green water events that are referred to as algal blooms.

DISSOLVED OXYGEN: Dissolved oxygen is important for the health of fisheries. Dissolved Oxygen concentrations were highly reduced near the lake bottom on July 30, 2013. Oxygen concentrations near the lake bottom are too low for the successful growth and reproduction of trout and salmon. However, Nippo Lake is well oxygenated in the surface waters and is well suited for warm water fish such as bass and perch.

COLOR: Color, a result of naturally occurring "tea" color substances, had an average of 15.6 color units (CPU) in Nippo Lake. Wetland drainage may reduce clarity by increasing humic acid within the water column caused by organic decomposition. This increases the "tea" color in the lake and reduces light penetration; however, this often does not have an effect on overall water quality.

ALKALINITY: Alkalinity measures the resistance the lake has against acid rain. The Nippo Lake alkalinity averaged 7.3 milligrams per liter (mg/L) and indicates a moderate vulnerability to acid rain. Nippo Lake's **pH**, a measure of lake acidity, measured 7.2 units in the surface waters on July 30, 2013 and remained within the acceptable range for most aquatic organisms.

SPECIFIC CONDUCTIVITY: Specific conductivity is a general indicator of pollution. Specific Conductivity in Nippo Lake was 76.0 micro-Siemans per centimeter (uS/cm) on July 30, 2013, indicating moderate to high concentrations of dissolved substances, such as nutrients (e.g. phosphorus, nitrates) and other dissolved salts (e.g. sodium and chloride).

CYANOBACTERIA: Cyanobacteria are the measure of potentially harmful plant-like bacteria. On July 30, 2013, there were an abundance of *Oscillitoria, Microcystis and Anabaena* in Nippo Lake, all three genera of cyanobacteria have the potential to produce toxins. Surface cyanobacteria scums were observed on September 30 and November 17, 2013. The September 30 surface scum contained large concentrations of *Anabaena*.

Note: Site 1 Deep (see map) was used as the reference point to give an overall representation of the Nippo Lake water quality discussed above.

Table 1. 2013 Nippo 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"	Nippo Lake Average (range)	Nippo Lake Classification
Water Clarity (meters)	> 7.0	4.0 – 7.0	2.5 - 4.0	< 2.5	4.4 meters (range: 2.9 – 5.6)	Oligotrophic
Chlorophyll *a* (ppb)	< 2.0	2.0 - 3.0	3.0 - 7.0	> 7.0	4.5 ppb (range: 1.7 – 12.3)	Mesotrophic
Total Phosphorus (ppb)	< 7.0	15.0 – 7.0	15.0 - 25.0	> 25.0	13.8 ppb (range: 10.2 – 18.7)	Oligotrophic
Dissolved Oxygen (mg/L)	> 7.0	5.0 – 7.0	2.0 – 5.0	<2.0	* 0.9 mg/L (range: 0.4 – 2.1)	Eutrophic
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 are reported for the bottom waters**

LONG TERM WATER QUALITY TRENDS

WATER CLARITY: The Nippo Lake water clarity has decreased over the past twenty-seven years of sampling. However, the trend is not statistically significant.

CHLOROPHYLL: The Nippo Lake chlorophyll *a* values have fluctuated among years while the long-term trend has been stable. However, the trend is not statistically significant.

COLOR: The Nippo Lake color concentrations have decreased over the past seventeen years of sampling. However, the trend is not statistically significant.

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

In summary, over the twenty-seven years of sampling, there are some indications of decreasing water quality. The long-term water clarity has decreased while the long-term total phosphorus (nutrient) concentrations have increased. Furthermore, Nippo Lake has experienced short-term green water events that have been dominated by nuisance growth forms.

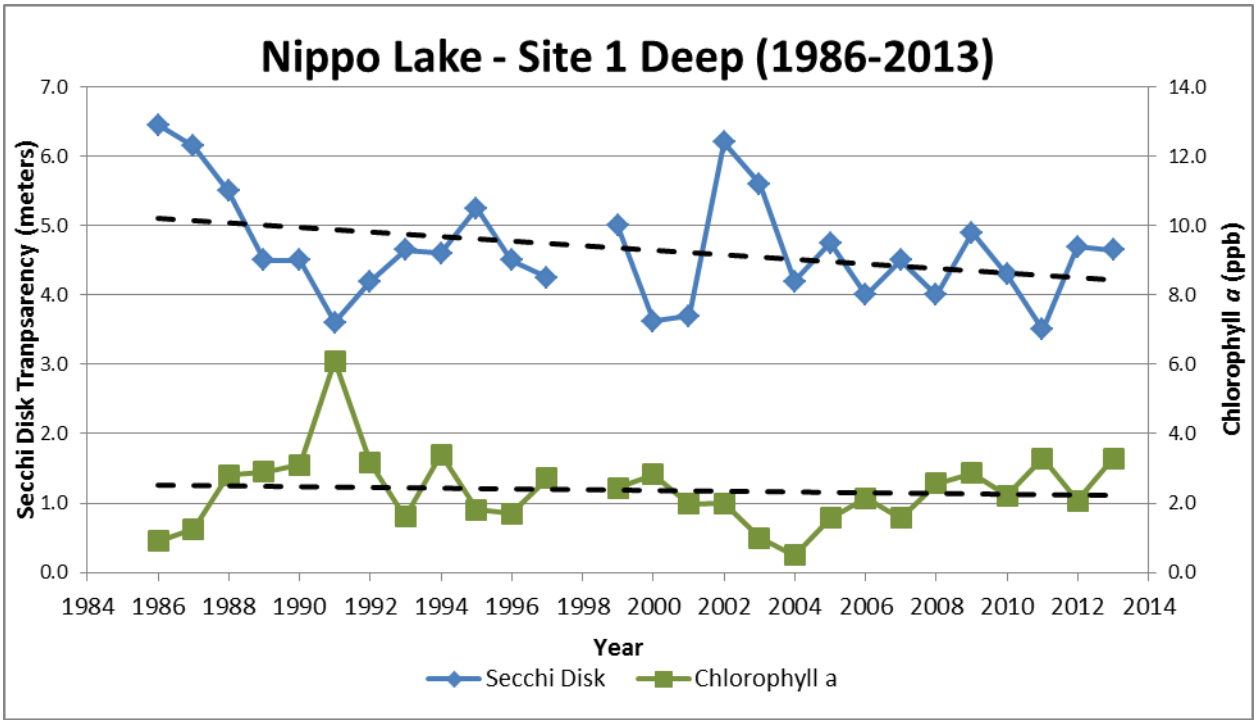


Figure 2. Changes in water clarity (Secchi disk depth) and chlorophyll *a* measured from 1986-2013 at Site 1 Deep. There has been a decreasing trend in water clarity with time (dashed line, indicating a non-statistically significant trend). Algal growth has a relatively stable trend (chlorophyll; dashed line) when comparing early data to more recent data. The chlorophyll *a* trend is not statistically significant with time.

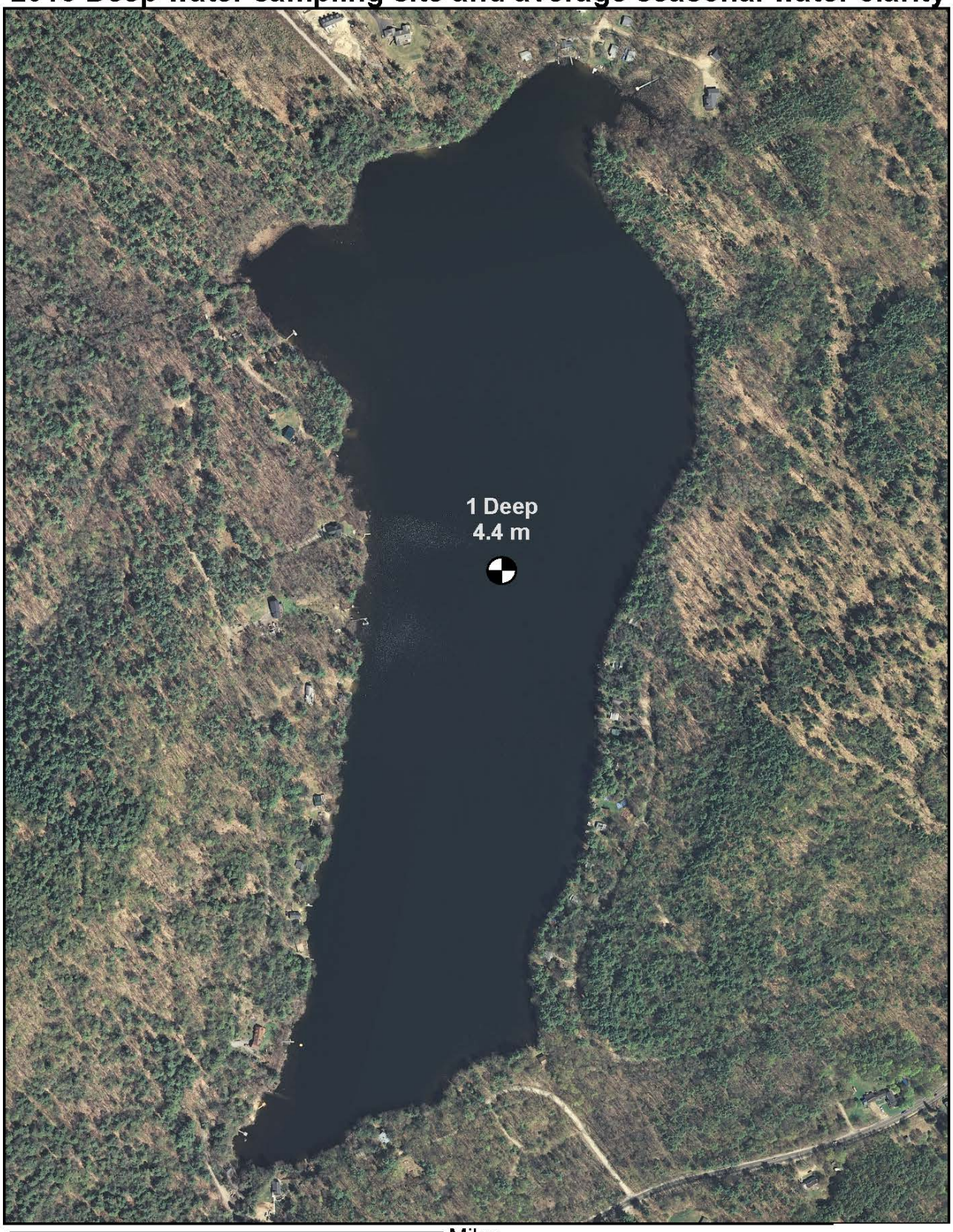
Recommendations:

- Continue early season sampling (April/May) to document Nippo Lake's reaction during and after spring thaw. Early season algal blooms were observed in Nippo Lake in both 2011 and 2012 and indicate that Nippo Lake is susceptible to short-term early season green water events.
- Implement Best Management Practices within the Nippo Lake watershed to minimize the adverse impacts of polluted runoff and erosion into the lake. Please 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
- Consider adding a simple cyanobacteria monitoring program that uses existing water quality sample collection protocols. Cyanobacteria collections from the spring through fall months can give insight into 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 @ 862-3696 or bob.craycraft@unh.edu.

Nippo Lake

Barrington, NH

2013 Deep water sampling site and average seasonal water clarity



Aerial Orthophoto Source: NH GRANIT
Site locations GPSed by the UNH Center of Freshwater Biology

University of New Hampshire
Cooperative Extension

New Hampshire Lakes Lay Monitoring