CHOCORUA LAKE

2013 SAMPLING HIGHLIGHTS

TAMWORTH, NH

NEW HAMPSHIRE
LAKES LAY MONITORING

Chocorua Lake volunteers collected water quality data between May 10 and September 29, 2013.

Light Blue = Outstanding = Ultraoligotrophic

Blue = Excellent = Oligotrophic

Yellow = Fair = Mesotrophic

Red = Poor = Eutrophic

Light Gray = No Data

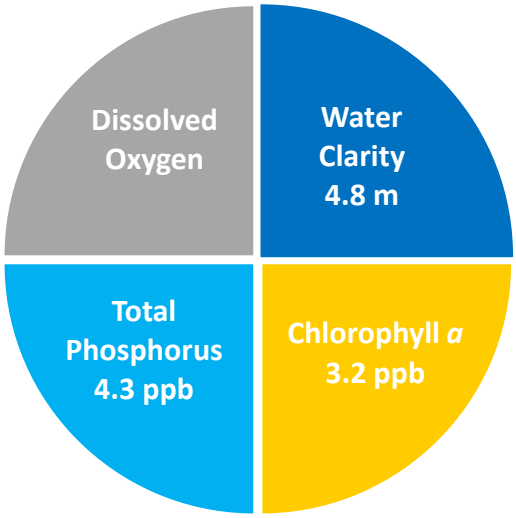

Figure 1. Average Water Quality Conditions

2013 RESULT HIGHLIGHTS

WATER CLARITY: Water clarity, measured as Secchi disk depth, averaged 4.8 meters in Chocorua Lake. The 2013 measurements indicated a decrease in the water clarity values relative to 2012.

CHLOROPHYLL: Chlorophyll *a*, a measure of microscopic plant life within the lake, averaged 3.2 parts per billion (ppb) in Chocorua Lake, and indicated an increase in microscopic plant life relative to 2012.

TOTAL PHOSPHORUS: Phosphorus is the nutrient most responsible for microscopic plant growth. Total phosphorus concentrations collected in Chocorua Lake averaged 4.3 ppb and remained well below 10 ppb, which is considered sufficient to support green water events that are referred to as algal blooms.

DISSOLVED OXYGEN: Dissolved oxygen concentrations were not monitored in Chocorua Lake in 2013.

COLOR: Color is a result of naturally occurring "tea" color substances from the breakdown of soils and plant materials. The Chocorua Lake color averaged 30.0 color units (CPU). Wet years tend to increase wetland drainage and the associated dissolved colored substances that enter the lake. This increase in the "tea" color reduces light penetration, and is oftentimes associated with reduced water clarity.

ALKALINITY/pH: Alkalinity measures the lake's resistance against acid rain. The average Chocorua Lake alkalinity measured 3.7 milligrams per liter (mg/L). The 2013 alkalinity indicates Chocorua Lake is moderately vulnerability to acid rain. The Chocorua Lake **pH**, a measure of lake acidity, ranged from 6.6 to 6.9 units in the surface waters and remained within the acceptable range for most aquatic organisms.

SPECIFIC CONDUCTIVITY: Specific conductivity is a general indicator of pollution. The Chocorua Lake specific conductivity ranged from 30.1 to 32.4 micro-Siemans per centimeter (uS/cm) and indicates low concentrations of dissolved substances such as phosphorus, sodium and chloride.

CYANOBACTERIA: Chocorua Lake did not participate in the 2013 cyanobacteria-monitoring. Please see recommendations on how to become involved.

Note: Site 1 South (see map) was used to as the reference point to give an overall representation of the Chocorua Lake water quality discussed above For a more detailed discussion of water quality measurements, refer to the executive summary within the annual Chocorua Lake report.

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

Parameter	Ultraoligotrophic "Outstanding"	Oligo "Excellent"	Meso "Fair"	Eutrophic "Poor"	Chocorua Lake Average (range)	Chocorua Lake Classification
Water Clarity (meters)	> 7.0	4.0 – 7.0	2.5 - 4.0	< 2.5	**4.8** meters (range: 3.7 – 6.7)	Oligotrophic
Chlorophyll *a* (ppb)	< 2.0	2.0 - 3.0	3.0 - 7.0	> 7.0	**3.2** ppb (range: 1.0 – 10.1)	Mesotrophic
Total Phosphorus (ppb)	< 7.0	15.0 – 7.0	15.0 - 25.0	> 25.0	**4.3** ppb (3.2 – 5.0)	Ultraoligotrophic
Dissolved Oxygen (mg/L)	> 7.0	5.0 – 7.0	2.0 – 5.0	<2.0	N/A	N/A
Cyanobacteria (cell counts or toxin concentration)	The Massachusetts Department of Public Health recommends a maximum level of <14,000 nanograms microcystins per Liter or 70,000 cyanobacteria cells per milliliter.			The New Hampshire Department of Environmental services encourages that an official be alerted and warnings be posted if concentrations of cyanobacteria exceed more than 70,000 cells per milliliter.		

LONG TERM TRENDS

WATER CLARITY: Over the past thirty-two years of sampling water clarity has decreased approximately 50 centimeters (cm), although this is not a statistically significant trend. A preliminary analysis of the interrelationship between water clarity measurements and precipitation (rainfall and snowfall) indicate years with elevated precipitation tend to coincide with shallower water clarity measurements relative to years with less rainfall. Rainfall data will be discussed further in next year's report and should provide additional insight into the annual water quality variability.

CHLOROPHYLL: The chlorophyll *a* concentration has decreased approximately 0.1 parts per billion (ppb) over the full span of volunteer water quality monitoring (1982 and 2013); however the data do not reveal a statistically significant trend. A closer examination of the chlorophyll *a* data indicates that the chlorophyll *a* concentrations increased between 1982 and 1999 while data collected between 2000 and 2013 leveled off, or decreased; the 1982 to 1999 trend was significantly significant while the 2000 to 2013 was not significantly significant. The annual Chocorua Lake chlorophyll *a* concentrations have stabilized since stormwater control measures were implemented along the Route 16 travel corridor in the year 2000.

COLOR: Color does not indicate a distinct trend over the past twenty-six years of sampling. Preliminary analysis of the relationship between precipitation and color indicates weak correlation between rainfall and color; color concentrations tend to be higher during wet years relative to dry years. Climatic data will be discussed further in next year's report.

TOTAL PHOSPHORUS: Total phosphorus concentrations have decreased over the past fifteen years of sampling but the relationship is not statistically significant.

In summary, there are indications that the Chocorua Lake water quality has improved slightly. Chlorophyll *a* concentrations have stabilized following a period of increasing concentrations between 1982 and 1999, while the total phosphorus concentrations have decreased slightly over the past fifteen years of sampling.

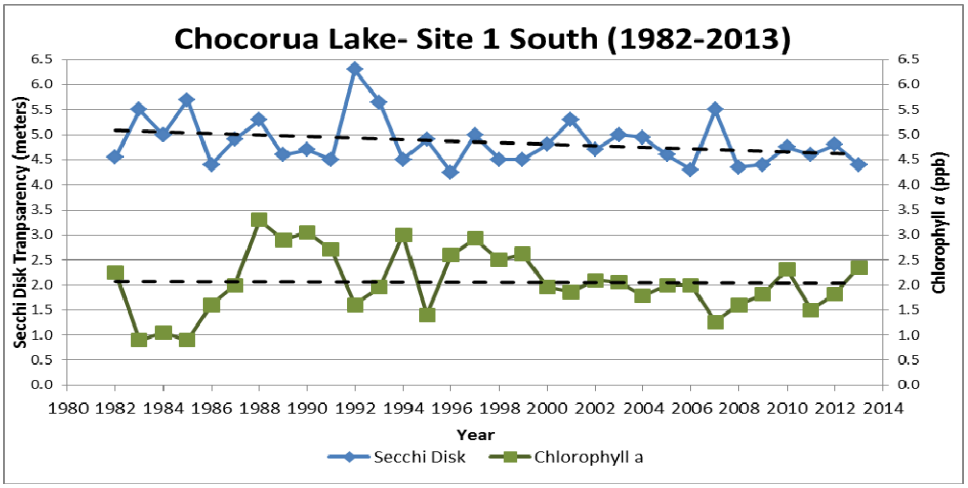

Figure 2. Changes in water clarity (secchi disk depth) and chlorophyll *a* measured from 1982-2013 at Site 1 South. There has been a declining trend in water clarity with time, although not statistically significant (dashed line). Decreasing water clarity is considered a negative trend for lakes if caused by increased algae or polluted runoff. Howvever, algae growth (chlorophyll; dashed line) has decreased slightly over time. Similar to the water clarity trend, the chlorophyll trend has not been consistent, or statistically significant, over time.

Recommendations:

- Continue early season sampling (April/May) to document Chocorua Lake's reaction to the period of spring thaw and periods of high streamflow.
- Continue to monitor and maintain the Berms, swales and other Best Management Practices along the Route 16 travel corridor that prevent pollutants, such as nutrient and sediments, from entering Chocorua Lake.
- Consider adding a simple cyanobacteria monitoring routine that is based on the existing water quality monitoring methods. 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 @ 862-3696 or bob.craycraft@unh.edu.

Chocorua Lake

Tamworth, NH

2013 Deep sampling sites with average seasonal water clarity

Aerial Orthophoto Source: NH GRANIT
Site locations GPS coordinates collected by the UNH Center of Freshwater Biology

University of New Hampshire
Cooperative Extension

New Hampshire Lakes Lay Monitoring