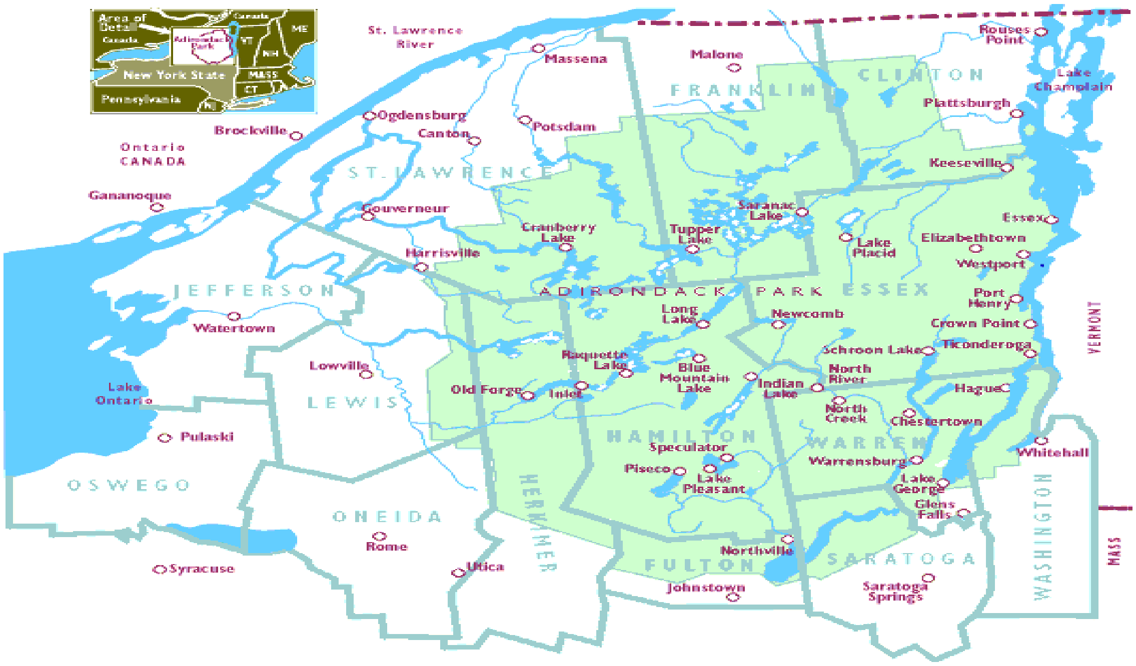
# Adirondack Lake Assessment Program
## 2010




**Thirteen Years in the program**
**Cranberry Lake, Loon Lake, Oven Mountain Pond, Blue Mountain Lake, Silver Lake, Eagle Lake**
**Twelve Years in the program**
**Little Long Lake, Gull Pond, Stony Creek Ponds, Thirteenth Lake, Eli Pond**
**Eleven Years in the program**
**Austin Pond, Osgood Pond, Middle Saranac Lake, White Lake, Brandreth Lake, Trout Lake**
**Ten Years in the program**
**Hoel Pond, Great Sacandaga Lake, Tripp Lake, Sherman Lake, Wolf Lake, Twitchell Lake, Deer Lake, Arbutus Pond, Rich Lake, Catlin Lake, Pine Lake, Lake of the Pines, Pleasant Lake**
**Nine Years in the program**
**Spitfire Lake, Upper St. Regis, Lower St. Regis, Garnet Lake, Lens Lake, Snowshoe Pond, Lake Ozonia, Long Pond, Lower Saranac Lake**
**Eight Years in the program**
**Raquette Lake, Lake Colby, Kiwassa Lake, Canada Lake**
**Seven Years in the program**
**Indian Lake, Schroon Lake, Lake Eaton, Chazy Lake, Big Moose Lake**
**Six Years in the program**
**Dug Mountain Pond, Seventh Lake, Abanakee Lake, Moss Lake, Mountain View Lake, Indian Lake, Tupper Lake**
**Five Years in the program**
**Sylvia Lake, Fern Lake**
**Four Years in the program**
**Adirondack Lake, Lower Chateaugay Lake, Upper Chateaugay Lake, Lake Easka, Lake Tekeni**
**Three Years in the program**
**Simon Pond**
**Two Years in the program**
**Amber Lake, Jordan Lake, Otter Pond, Rondaxe Lake**
**One Year in the program**
**Auger Lake, Lake Titus, Star Lake**

# Adirondack Lake

# ***Assessment Program***

## Lower Saranac Lake

## Summer 2010

*January 2011*

**Author**

**Michael De Angelo**

**Project Participants**

***Michael De Angelo, Environmental Chemist, Aquatics Director of the AWI***
Cory Laxson, Research Associate, AWI
Elizabeth Yerger, Laboratory and Field Technician, AWI

Prepared by:
The Adirondack Watershed Institute at Paul Smith's College
P.O. Box 244, Paul Smiths, NY 12970-0244
Phone: 518-327-6270; Fax: 518-327-6369; E-mail: mdeangelo@paulsmiths.edu

Program Management by:
Protect the Adirondacks! Inc.
P.O. Box 1180
Saranac Lake, NY 12983
E-mail: ALAP@protectadks.org

## Introduction

The Adirondack Lake Assessment Program is a volunteer monitoring program established by the Residents' Committee to Protect the Adirondacks (RCPA) and the Adirondack Watershed Institute (AWI). The program is now in its' thirteenth year. The program was established to help develop a current database of water quality in Adirondack lakes and ponds. There were 70 participating lakes in the program in 2010.

## Methodology

Each month participants (trained by AWI staff) measured transparency with a secchi disk and collected a 2-meter composite of lake water for chlorophyll-a analysis and a separate 2-meter composite for total phosphorus and other chemical analyses. The participants filtered the chlorophyll-a sample prior to storage. Both the chlorophyll-a filter and water chemistry samples were frozen for transport to the laboratory at Paul Smith's College.

In addition to the volunteer samples, AWI staff sampled water quality parameters in most of the participating lakes as time and weather allowed. In most instances, a 2-meter composite of lake water was collected for chlorophyll-a analysis. Samples were also collected at depths of 1.5 meters from the surface (epilimnion) and within 1.5 meters of the bottom (hypolimnion) for chemical analysis. Once collected, samples were stored in a cooler and transported to the laboratory at Paul Smith's College.

All samples were analyzed by AWI staff in the Paul Smith's College laboratory using the methods detailed in *Standard Methods for the Examination of Water and Wastewater, 21st edition* (Greenberg, *et al*, 2005). Volunteer samples were analyzed for pH, alkalinity, conductivity, color, nitrate, chlorophyll a and total phosphorus concentrations. Samples taken by AWI staff were analyzed for the same parameters, as well as for calcium, chloride, and aluminum concentrations.

## Results Summary

Volunteers sampled Lower Saranac Lake twice in 2010. Samples were collected on the following date: 7/12/10 and 11/07/10. Results for 2010 are presented in Appendix A and will be discussed in the following sections. Results are presented as concentrations in milligrams per liter (mg/L) or its equivalent of parts per million (ppm) and micrograms per liter (μg/L) or its equivalent of parts per billion (ppb).

1 mg/L = 1 ppm; 1 μg/L = 1 ppb; 1 ppm = 1000 ppb.

Adirondack lakes are subject to the effects of acidic precipitation (i.e., snow, rain). A waterbody's susceptibility to acid producing ions is assessed by measuring pH, alkalinity, calcium concentrations, and the Calcite Saturation Index (CSI). These parameters define both the acidity of the water and its buffering capacity. Based on the results of the 2010 Adirondack Lake Assessment program, the acidity status of Lower Saranac Lake appears not threatened by acidic inputs. The pH values were satisfactory and the alkalinity, calcium and CSI values showed a lake with a low sensitivity to further acidic inputs.

Limnologists, the scientists who study bodies of fresh water, classify lake health (trophic status) into three main categories: oligotrophic, mesotrophic, and eutrophic. The trophic status of a lake is determined by measuring the level of three basic water quality parameters: total phosphorus, chlorophyll-a, and secchi disk transparency. These parameters will be defined in the sections that follow. Oligotrophic lakes are characterized as having low levels of total phosphorus, and, as a consequence, low levels of chlorophyll-a and high transparencies. Eutrophic lakes have high levels of total phosphorus and chlorophyll-a, and, as a consequence, low transparencies. Mesotrophic lakes have moderate levels of all three of these water quality parameters. Based upon the results of the 2010 Adirondack Lake Assessment Program, Lower Saranac Lake is considered to be a mesotrophic lake.

## PH

The pH level is a measure of acidity (concentration of hydrogen ions in water), reported in standard units on a logarithmic scale that ranges from 1 to 14. On the pH scale, 7 is neutral, lower values are more acidic, and higher numbers are more basic. In general, pH values between 6.0 and 8.0 are considered optimal for the maintenance of a healthy lake ecosystem. Many species of fish and amphibians have difficulty with growth and reproduction when pH levels fall below 5.5 standard units. Lake acidification status can be assessed from pH as follows:

| | |
|---|---|
| pH less than 5.0 | Critical or Impaired |
| pH between 5.0 and 6.0 | Endangered or Threatened |
| pH greater than 6.0 | Satisfactory or Acceptable |

The pH in the upper water of Lower Saranac Lake ranged from 7.12 to 7.27 and the average was 7.20. Based solely on pH, Lower Saranac Lake's acidity levels should be considered satisfactory.

## Alkalinity

Alkalinity (acid neutralizing capacity) is a measure of the buffering capacity of water, and in lake ecosystems refers to the ability of a lake to absorb or withstand acidic inputs. In the northeast, most lakes have low alkalinities, which mean they are sensitive to the effects of acidic precipitation. This is a particular concern during the spring when large amounts of low pH snowmelt runs into lakes with little to no contact with the soil's natural buffering agents. Alkalinity is reported in milligrams per liter (mg/L) or microequivelents per liter (μeq/L). Typical summer concentrations of alkalinity in northeastern lakes are around 10 mg/l (200 μeq/L). Lake acidification status can be assessed from alkalinity as follows:

| | |
|---|---|
| Alkalinity less than 0 ppm | Acidified |
| Alkalinity between 0 and 2 ppm | Extremely sensitive |
| Alkalinity between 2 and 10 ppm | Moderately sensitive |
| Alkalinity between 10 and 25 ppm | Low sensitivity |
| Alkalinity greater than 25 ppm | Not sensitive |

The alkalinity of the upper water of Lower Saranac Lake ranged from 19.0 ppm to 19.2 ppm and the average was 19.1 ppm. These values indicate a low sensitivity to acidification.

**Calcium**

Calcium is one of the buffering materials that occurs naturally in the environment. However, it is often in short supply in Adirondack lakes and ponds, making these bodies of water susceptible to acidification by acid precipitation. Calcium concentrations provide information on the buffering capacity of that lake, and can assist in determining the timing and dosage for acid mitigation (liming) activities. Adirondack lakes containing less than 2.5 ppm of calcium are considered to be sensitive to acidification.

The calcium in the upper water of Lower Saranac Lake ranged from 5.28 ppm to 5.37 ppm and the average was 5.33 ppm. These values show a lake that is not sensitive to acidification at this time.

**Calcite Saturation Index**

The Calcite Saturation Index (CSI) is another method that is used to determine the sensitivity of a lake to acidification. High CSI values are indicative of increasing sensitivity to acidic inputs. CSI is calculated using the following formula:

$$CSI = -\log_{10} \frac{Ca}{40000} - \log_{10} \frac{Alk}{50000} - pH + 2$$

Where $Ca$ = Calcium level of water sample in ppm or mg/L
$Alk$ = Alkalinity of the water sample in ppm or mg/L
$pH$ = pH of the water sample in standard units

Lake sensitivity to acidic inputs is assessed from CSI as follows:

| | |
|---|---|
| CSI greater than 4 | Very vulnerable to acidic inputs |
| CSI between 3 & 4 | Moderately vulnerable to acidic inputs |
| CSI less than 3 | Low vulnerability to acidic inputs |

The CSI value for Lower Saranac Lake was calculated and it was determined to be 2.60. This value tells us that Lower Saranac Lake has a very low vulnerability to further acidic inputs.

**Total Phosphorus**

Phosphorus is one of the three essential nutrients for life, and in northeastern lakes, it is often the controlling, or limiting, nutrient in lake productivity. Total phosphorus is a measure of all forms of phosphorus, both organic and inorganic. Total phosphorus concentrations are directly related to the trophic status (water quality conditions) of a lake. Excessive amounts of phosphorus can lead to algae blooms and a loss of dissolved oxygen within the lake. Surface water (epilimnion) concentrations of total phosphorus less than 10 ppb are associated with oligotrophic (clean, clear water) conditions. Concentrations greater than 25 ppb are associated with eutrophic (nutrient-rich) conditions.

The total phosphorus in the upper waters of Lower Saranac Lake ranged from 18 ppb to 23 ppb and the average concentration was 20.5 ppb. This is indicative of mesotrophic conditions.

**Chlorophyll-a**

Chlorophyll-a is the green pigment in plants used for photosynthesis, and measuring it provides information on the amount of algae (microscopic plants) in lakes. Chlorophyll-a concentrations are also used to classify a lakes trophic status. Concentrations less than 2 ppb are associated with oligotrophic conditions and those greater than 8 ppb are associated with eutrophic conditions.

The chlorophyll-a concentrations in the upper waters of Lower Saranac Lake ranged from 4.61 ppb to 7.85 ppb and the average was 6.23. This is indicative of mesotrophic conditions.

**Secchi Disk Transparency**

Transparency is a measure of water clarity in lakes and ponds. It is determined by lowering a 20 cm black and white disk (Secchi) into a lake to the depth where it is no longer visible from the surface. This depth is then recorded in meters. Since algae are the main determinant of water clarity in non-stained, low turbidity (suspended silt) lakes, transparency is also used as an indicator of the trophic status of a body of water. Secchi disk transparencies greater than 4.6 meters (15.1 feet) are associated with oligotrophic conditions, while values less than 2 meters (6.6 feet) are associated with eutrophic conditions (DEC & FOLA, 1990).

Secchi disk transparency in Lower Saranac Lake was recorded one one sampling occasion and it was found to be 2.5 meters. This is indicative of mesotrophic conditions.

**Nitrate**

Nitrogen is another essential nutrient for life. Nitrate is an inorganic form of nitrogen that is naturally occurring in the environment. It is also a component of atmospheric pollution. Nitrogen concentrations are usually less than 1 ppm in most lakes. Elevated levels of nitrate concentration may be indicative of lake acidification or wastewater pollution.

The nitrate in the upper waters of Lower Saranac Lake was found to range from 0.177 to 0.187 ppm. The average nitrate concentration was found to be 0.182 ppm for both samples collected.

**Chloride**

Chloride is an anion that occurs naturally in surface waters, though typically in low concentrations. Background concentrations of chloride in Adirondack Lakes are usually less than 1 ppm. Chloride levels 10 ppm and higher is usually indicative of pollution and, if sustained, can alter the distribution and abundance of aquatic plant and animal species. The primary sources of additional chloride in Adirondack lakes are road salt (from winter road de-icing) and wastewater (usually from faulty septic systems). The most salt impacted waters in the Adirondacks usually have chloride concentrations of 100 ppm or less.

The chloride in the upper water of Lower Saranac Lake ranged from 9.28 ppm to 10.1 ppm and the average was 9.69 ppm. These values are slightly elevated and could be do to road salt contamination entering the lake.

**Conductivity**

Conductivity is a measure of the ability of water to conduct electric current, and will increase as dissolved minerals build up within a body of water. As a result, conductivity is also an indirect measure of the number of ions in solution, mostly as inorganic substances. High conductivity values (greater than 50 μohms/cm) may be indicative of pollution by road salt runoff or faulty septic systems. Conductivities may be naturally high in water that drains from bogs or marshes. Eutrophic lakes often have conductivities near 100 μohms/cm, but may not be characterized by pollution inputs. Clean, clear-water lakes in our region typically have conductivities up to 30 μohms/cm, but values less than 50 μohms/cm are considered normal.

The conductivity in the upper water of Lower Saranac ranged from 52.1μohms/cm to 64.0 μohms/cm and averaged 58.1μohms/cm.

**Color**

The color of water is affected by both dissolved (e.g., metallic ions, organic acids) and suspended (e.g., silt and plant pigments) materials. Water samples are collected and compared to a set of standardized chloroplatinate solutions in order to assess the degree of coloration. The measurement of color is usually used in lake classification to describe the degree to which the water body is stained due to the accumulation of organic acids. The standard for drinking water color, as set by the United States Environmental Protection Agency (US EPA) using the platinum-cobalt method, is 15 Pt-Co. However, dystrophic lakes (heavily stained, often the color of tea) are common in this part of the country, and are usually found in areas with poorly drained soils and large amounts of coniferous vegetation (i.e., pines, spruce, hemlock). Dystrophic lakes usually have color values upwards of 75 Pt-Co.

Color can often be used as a possible index of organic acid content since higher amounts of total organic carbon (TOC) are usually found in colored waters. TOC is important because it can bond with aluminum in water, locking it up within the aquatic system and resulting in possible toxicity to fish (see Aluminum).

The color in the upper waters of Lower Saranac Lake ranged from 26.0 Pt-Co to 32.0 Pt-Co and averaged 29.0 Pt-Co.

**Aluminum**

Aluminum is one of the most abundant elements found within the earth's crust. Acidic runoff (from rainwater and snowmelt) can leach aluminum out of the soil as it flows into streams and lakes. If a lake is acidic enough, aluminum may also be leached from the sediment at the bottom of it. Low concentrations of aluminum can be toxic to aquatic fauna in acidified water bodies, depending on the type of aluminum available, the amount of dissolved organic carbon available to bond with the aluminum, and the pH of the water. Aluminum can form thick mucus that has been shown to cause gill destruction in aquatic fauna (i.e., fish, insects) and, in cases of prolonged exposure, can cause mortality in native fish populations (Potter, 1982). Aluminum concentrations are reported as mg/L of total dissolved aluminum.

The aluminum in the upper water of Lower Saranac Lake ranged from 0.014 ppm to 0.040 ppm and averaged 0.027 ppm. These values are very low and will cause no problems for life in the lake.

**Dissolved Oxygen**

The dissolved oxygen in a lake is an extremely important parameter to measure. If dissolved oxygen decreases as we approach the bottom of a lake we know that there is a great amount of bacterial decay that is going on. This usually means that there is an abundance of nutrients, like phosphorous that have collected on the lake bottom. Oligotrophic lakes tend to have the same amount of dissolved oxygen from the surface waters to the lake bottom, thus showing very little bacterial decay. Eutrophic lakes tend to have so much decay that their bottom waters will have very little dissolved oxygen. Cold-water fish need 6.0 ppm dissolved oxygen to thrive and reproduce. Warm water fish need 4.0 ppm oxygen.

The dissolved oxygen and temperature profiles for Lower Saranac Lake for 2008 can be found in the appendix. The dissolved oxygen stayed constant from the surface to about a depth of 12 meters. The oxygen level lowered slightly over the last three meters. The oxygen levels were high enough for cold and warm water fish survival.

**Summary**

Based upon the results of the 2010 Adirondack Lake Assessment Program, Lower Saranac Lake's trophic status can be considered mesotrophic. The pH, calcium, CSI and alkalinity can be considered satisfactory with a low sensitivity from further acidic inputs. The dissolved oxygen stayed constant from the surface to about a depth of 12 meters. The oxygen level lowered slightly over the last three meters. The oxygen levels were high enough for cold and warm water fish survival.

Eight years worth of data is sufficient to begin to detect water quality trends. A comparison can also be made with the results from 2010 compared to the results from 2009. In 2010, the pH, alkalinity, total phosphorous, chlorophyll a, aluminum, and calcium values increased from 2009. Conversely, the conductivity, color, Secchi disk transparency, and nitrate levels decreased in 2010 when compared to 2009.

Over the last eight years, the pH values have increased almost every year while the alkalinity, conductivity and color have shown year to year fluctuations but over all there have been very little change. The last few years have shown an increase in total phosphorous which has caused more algae growth and an increase in chlorophyll-a levels. This has also led to rapidly falling Secchi disk transparencies. This seems to be a real issue since 2004 and it is a concern.

## Literature Cited

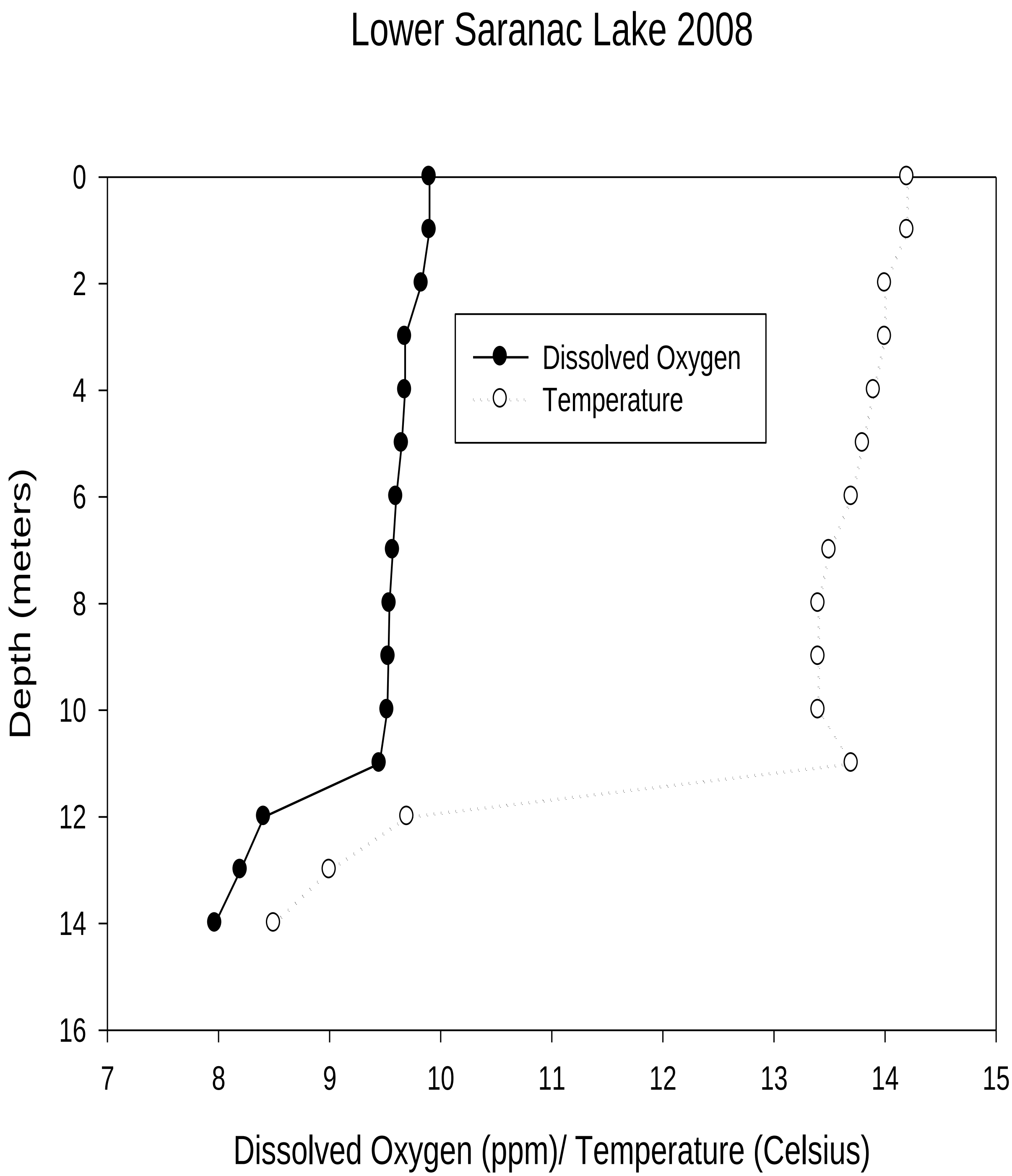
DEC & FOLA. (1990). Diet for a Small Lake: A New Yorker's Guide to Lake Management. New York State Department of Environmental Conservation & The Federation of Lake Associations, Inc.: Albany, New York.

Greenberg, A.E., Eaton, A.D., and Leseri, L.A. (editors). (2005). Standard Methods for the Examination of Water and Wastewater, 21st Edition. American Public Health Association: Washington, D.C.

Potter, W. (1982). *The Effects of Air Pollution and Acid Rain on Fish, Wildlife and Their Habitats – Lakes*. Technical Report FWS/OBS – 80/50.4. United States Fish and Wildlife Service, Biological Services Program: Washington, D.C.

# Appendix A

## Water Quality Data



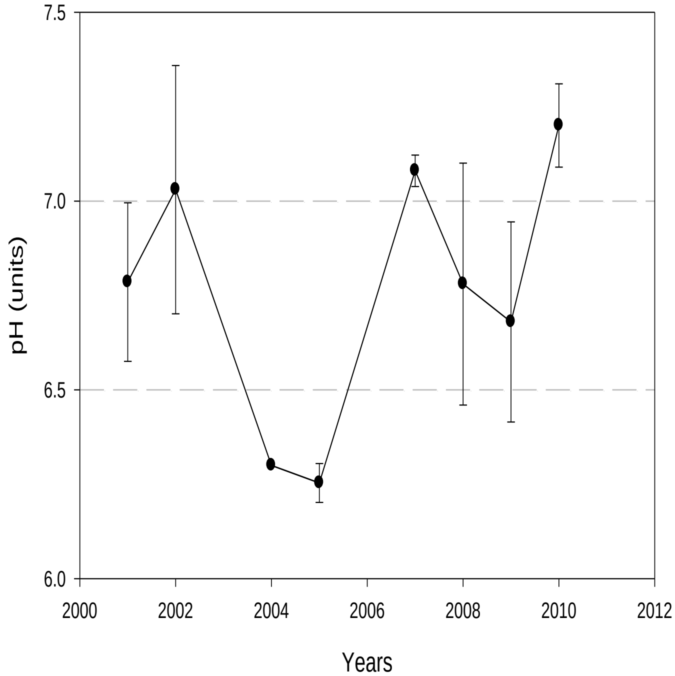
Lower Saranac Lake 2008
Dissolved Oxygen
Temperature
Depth (meters)
0
2
4
6
8
10
12
14
16
7
8
9
10
11
12
13
14
15
Dissolved Oxygen (ppm)/ Temperature (Celsius)

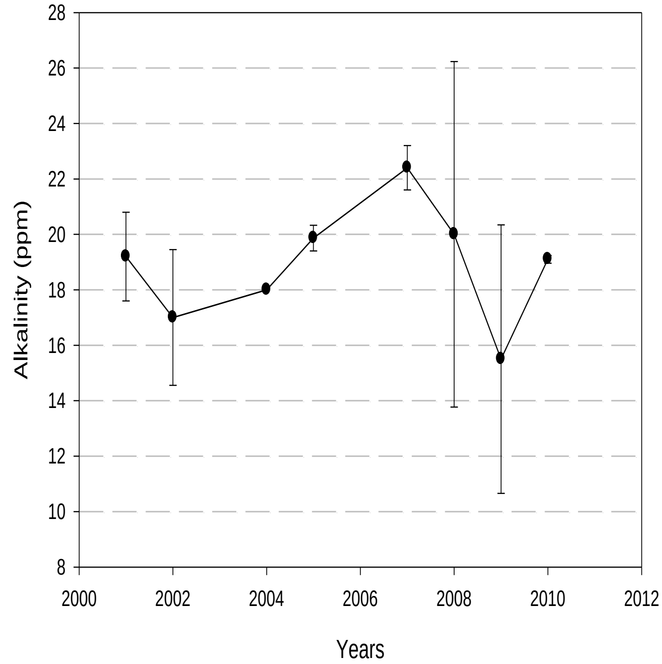
| Source | Lake/Pond Name | Sampling Location | Sampling Date | pH (units) | Alkalinity (ppm) | Conductivity (μohms/cm) | Color (Pt-Co) | Total P (ppm) | Chl a (μg/l) |
|---|---|---|---|---|---|---|---|---|---|
| Vol | Crecent Bay | Deephole | 9/9/2001 | 6.6800 | 18.4000 | 70.3000 | 24.0000 | 0.0140 | 8.7100 |
| Vol | Ampers Bay | Deephole | 9/9/2001 | 6.6800 | 18.4000 | 65.8000 | 34.0000 | 0.0120 | 8.3400 |
| Vol | Fish Creek | Deephole | 9/9/2001 | 6.6800 | 18.4000 | 63.2000 | 32.0000 | 0.0140 | 8.6800 |
| Vol | Main Lake | Deephole | 9/9/2001 | 7.1000 | 21.6000 | 98.5000 | 26.0000 | 0.0150 | 9.1500 |
| | | | MIN | 6.6800 | 18.4000 | 63.2000 | 24.0000 | 0.0120 | 8.3400 |
| | | | MAX | 7.1000 | 21.6000 | 98.5000 | 34.0000 | 0.0150 | 9.1500 |
| | | | MEAN | 6.7850 | 19.2000 | 74.4500 | 29.0000 | 0.0138 | 8.7200 |
| | | | Std Dev | 0.2100 | 1.6000 | 16.2994 | 4.7610 | 0.0013 | 0.3322 |
| | | | | | | | | | |
| Vol | Robinson | Deephole | 9/2/2001 | 6.7800 | 18.8000 | 53.0000 | 47.0000 | 0.0120 | |
| Vol | Ampersand | Deephole | 9/2/2001 | 6.7600 | 18.0000 | 57.2000 | 24.0000 | 0.0150 | |
| | | | MIN | 6.7600 | 18.0000 | 53.0000 | 24.0000 | 0.0120 | 0.0000 |
| | | | MAX | 6.7800 | 18.8000 | 57.2000 | 47.0000 | 0.0150 | 0.0000 |
| | | | MEAN | 6.7700 | 18.4000 | 55.1000 | 35.5000 | 0.0135 | 0.0000 |
| | | | Std Dev | 0.0141 | 0.5657 | 2.9698 | 16.2635 | 0.0021 | 0.0000 |
| | | | | | | | | | |
| Vol | L Saranac L | Lemay | 8/31/2002 | 7.6200 | 20.4000 | 48.6000 | 31.0000 | 0.0300 | 1.9400 |
| Vol | L Saranac L | Crescent Bay | 8/31/2002 | 7.1200 | 18.0000 | 44.6000 | 39.0000 | 0.0400 | 1.3200 |
| Vol | L Saranac L | Fish Creek | 8/31/2002 | 7.0600 | 15.6000 | 40.8000 | 33.0000 | 0.0500 | 1.1400 |
| Vol | L Saranac L | SLHS | 8/31/2002 | 7.0200 | 16.4000 | 44.9000 | 30.0000 | 0.0500 | |
| Vol | L Saranac L | Trudeau | 8/31/2002 | 7.1000 | 19.6000 | 46.4000 | 40.0000 | 0.0500 | |
| Vol | L Saranac L | Scheefers | 8/31/2002 | 6.9600 | 14.8000 | 37.7000 | 27.0000 | 0.0500 | |
| Vol | L Saranac L | Saranac River | 8/31/2002 | 6.9500 | 18.0000 | 40.8000 | 53.0000 | 0.0500 | |
| Vol | L Saranac L | __wood | 8/31/2002 | 6.4100 | 13.2000 | 32.7000 | 32.0000 | 0.0500 | |
| | | | MEAN | 7.0300 | 17.0000 | 42.0625 | 35.6250 | 0.0463 | 1.4667 |
| | | | Std Dev | 0.3290 | 2.4472 | 5.1536 | 8.2797 | 0.0074 | 0.4197 |
| | | | | | | | | | |
| Vol | L Saranac L | Deephole | 7/24/2004 | 6.3000 | 18.0000 | 72.5000 | 6.0000 | 0.0080 | 7.4300 |
| | | | | | | | | | |
| Vol | L Saranac L | Deephole | 6/19/2005 | 6.2400 | 19.6000 | 63.4000 | 43.0000 | 0.0050 | 2.5600 |
| Vol | L Saranac L | Deephole | 7/24/2005 | 6.3100 | 20.4000 | 53.4000 | 58.0000 | 0.0060 | |
| Vol | L Saranac L | Deephole | 9/14/2005 | 6.2100 | 19.6000 | 57.7000 | 48.0000 | 0.0230 | 6.9300 |
| | | | Mean | 6.2533 | 19.8667 | 58.1667 | 49.6667 | 0.0113 | 4.7450 |
| | | | Std Dev | 0.0513 | 0.4619 | 5.0163 | 7.6376 | 0.0101 | 3.0901 |
| | | | | | | | | | |
| Vol | L Saranac L | Deephole | 7/30/2006 | 6.9900 | 15.6000 | 45.9000 | 29.0000 | 0.0130 | 3.8800 |
| | | | | | | | | | |
| Vol | L Saranac L | Deephole | 6/29/2007 | 7.0900 | 22.4000 | 57.4000 | 16.0000 | 0.0140 | 4.8700 |
| Vol | L Saranac L | Deephole | 7/30/2007 | 7.1100 | 23.2000 | 57.3000 | 16.0000 | 0.0130 | 4.7800 |
| Vol | L Saranac L | Deephole | 10/12/2007 | 7.0300 | 21.6000 | 66.2000 | 23.0000 | 0.0190 | 5.9500 |
| | | | Mean | 7.0767 | 22.4000 | 60.3000 | 18.3333 | 0.0153 | 5.2000 |
| | | | Std Dev | 0.0416 | 0.8000 | 5.1098 | 4.0415 | 0.0032 | 0.6511 |
| | | | | | | | | | |
| AWI | L Saranac L | Epi | 5/27/2008 | 7.0400 | 25.2000 | 63.1000 | 33.0000 | 0.0180 | 4.7200 |
| Vol | L Saranac L | Deephole | 5/27/2008 | 7.0200 | 26.2000 | 65.1000 | 28.0000 | 0.0190 | 4.7200 |
| Vol | L Saranac L | Deephole | 6/25/2008 | 6.3200 | 12.8000 | 64.1000 | 40.0000 | 0.0160 | 4.3900 |
| Vol | L Saranac L | Deephole | 7/27/2008 | 6.9800 | 24.0000 | 64.0000 | 34.0000 | 0.0120 | 5.0400 |
| Vol | L Saranac L | Deephole | 9/22/2008 | 6.8000 | 16.8000 | 53.4000 | 35.0000 | 0.0120 | 2.9900 |
| | | | Mean | 6.7800 | 19.9500 | 61.6500 | 34.2500 | 0.0148 | 4.2850 |
| | | | Std Dev | 0.3212 | 6.2319 | 5.5224 | 4.9244 | 0.0034 | 0.9032 |
| AWI | L Saranac L | Hypo | 5/27/2008 | 7.1100 | 23.8000 | 62.4000 | 30.0000 | 0.0140 | x |

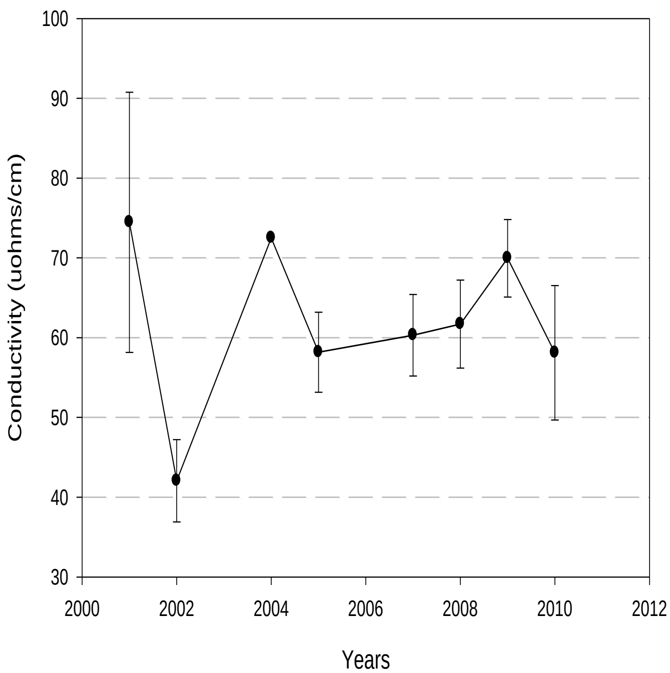
| Source | Lake/Pond Name | Sampling Location | Sampling Date | pH (units) | Alkalinity (ppm) | Conductivity (μohms/cm) | Color (Pt-Co) | Total P (ppm) | Chl a (μg/l) |
|---|---|---|---|---|---|---|---|---|---|
| Vol | L Saranac L | Deephole | 7/15/2009 | 6.5900 | 14.8000 | 67.8000 | 37.0000 | 0.0170 | 5.2800 |
| Vol | L Saranac L | Deephole | 9/15/2009 | 6.7600 | 16.2000 | 72.1000 | 27.0000 | 0.0160 | 4.8800 |
| | | | Mean | 6.6750 | 15.5000 | 69.9500 | 32.0000 | 0.0165 | 5.0800 |
| | | | Std Dev | 0.2651 | 4.8429 | 4.8604 | 5.1316 | 0.0015 | 0.2828 |
| | | | | | | | | | |
| Vol | L Saranac L | Deephole | 7/12/2010 | 7.2700 | 19.2000 | 52.1000 | 26.0000 | 0.0180 | 4.6100 |
| Vol | L Saranac L | Deephole | 11/7/2010 | 7.1200 | 19.0000 | 64.0000 | 32.0000 | 0.0230 | 7.8500 |
| | | | Mean | 7.1950 | 19.1000 | 58.0500 | 29.0000 | 0.0205 | 6.2300 |
| | | | Std Dev | 4.0017 | 8.2320 | 31.2801 | 14.1032 | 0.0112 | 3.7966 |

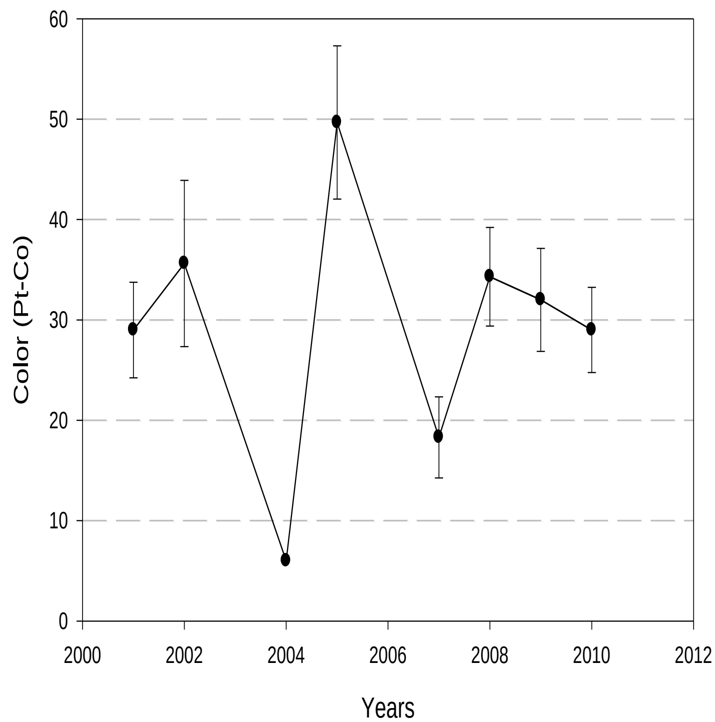
| Source | Lake/Pond Name | Sampling Location | Sampling Date | Secchi (meters) | Nitrate (ppm) | Sulfate (ppm) | Chloride (ppm) | Aluminum (ppm) | Calcium (ppm) |
|---|---|---|---|---|---|---|---|---|---|
| Vol | Crecent Bay | Deephole | 9/9/2001 | | 0.2000 | | | | |
| Vol | Ampers Bay | Deephole | 9/9/2001 | | 0.1000 | | | | |
| Vol | Fish Creek | Deephole | 9/9/2001 | | 0.1000 | | | | |
| Vol | Main Lake | Deephole | 9/9/2001 | | 0.2000 | | | | |
| | | | MIN | 0.0000 | 0.1000 | | | | |
| | | | MAX | 0.0000 | 0.2000 | | | | |
| | | | MEAN | | 0.1500 | | | | |
| | | | Std Dev | | 0.0577 | | | | |
| | | | | | | | | | |
| Vol | Robinson | Deephole | 9/2/2001 | | 0.0000 | | | 0.0180 | |
| Vol | Ampersand | Deephole | 9/2/2001 | | 0.1000 | | | 0.0230 | |
| | | | MIN | 0.0000 | 0.0000 | | | | |
| | | | MAX | 0.0000 | 0.1000 | | | | |
| | | | MEAN | 0.0000 | 0.0500 | | | | |
| | | | Std Dev | 0.0000 | 0.0707 | | | | |
| | | | | | | | | | |
| Vol | L Saranac L | Lemay | 8/31/2002 | 5.0000 | 0.1000 | | | | |
| Vol | L Saranac L | Crescent Bay | 8/31/2002 | 5.0000 | 0.2000 | | | | |
| Vol | L Saranac L | Fish Creek | 8/31/2002 | 5.0000 | 0.1000 | | | | |
| Vol | L Saranac L | SLHS | 8/31/2002 | 5.0000 | 0.1000 | | | | |
| Vol | L Saranac L | Trudeau | 8/31/2002 | 5.0000 | 0.1000 | | | | |
| Vol | L Saranac L | Scheefers | 8/31/2002 | 5.0000 | 0.1000 | | | | |
| Vol | L Saranac L | Saranac River | 8/31/2002 | 5.0000 | 0.1000 | | | | |
| Vol | L Saranac L | __wood | 8/31/2002 | 5.0000 | 0.1000 | | | | |
| | | | MEAN | 5.0000 | 0.1125 | | | | |
| | | | Std Dev | 0.0000 | 0.0354 | | | | |
| | | | | | | | | | |
| Vol | L Saranac L | Deephole | 7/24/2004 | | 0.2000 | | | | |
| | | | | | | | | | |
| Vol | L Saranac L | Deephole | 6/19/2005 | 3.2500 | 0.1000 | | | | |
| Vol | L Saranac L | Deephole | 7/24/2005 | 4.5000 | 0.2000 | | | | |
| Vol | L Saranac L | Deephole | 9/14/2005 | 3.5000 | 0.2000 | | | | |
| | | | Mean | 3.7500 | 0.1667 | | | | |
| | | | Std Dev | 0.6614 | 0.0577 | | | | |
| | | | | | | | | | |
| Vol | L Saranac L | Deephole | 7/30/2006 | | 0.0000 | | | | |

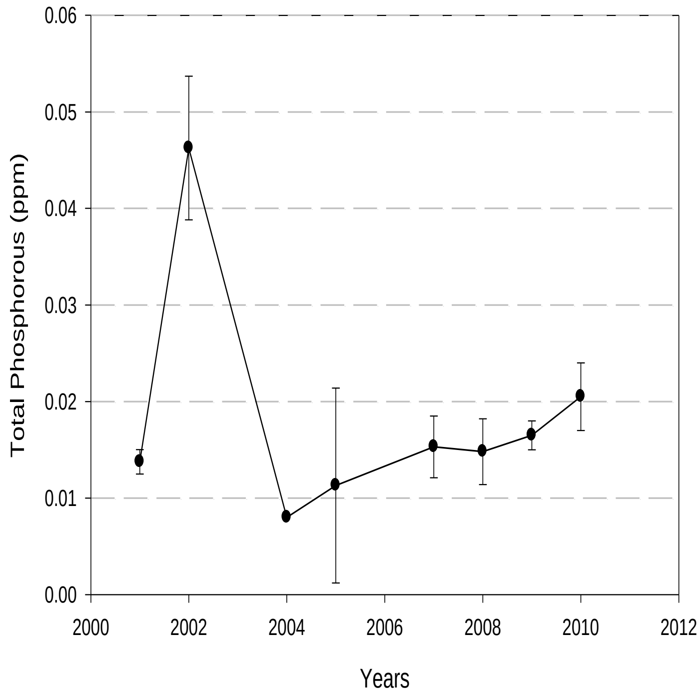
| Source | Lake/Pond Name | Sampling Location | Sampling Date | Secchi (meters) | Nitrate (ppm) | Sulfate (ppm) | Chloride (ppm) | Aluminum (ppm) | Calcium (ppm) |
|---|---|---|---|---|---|---|---|---|---|
| | L Saranac L | Deephole | 6/29/2007 | 3.5000 | 0.1000 | 3.0000 | 10.0000 | 0.0000 | 4.8700 |
| Vol | L Saranac L | Deephole | 7/30/2007 | 3.5000 | 0.1000 | 3.0000 | 10.0000 | 0.0010 | 4.9500 |
| Vol | L Saranac L | Deephole | 10/12/2007 | 3.0000 | 0.1000 | 3.0000 | 12.0000 | 0.0010 | 4.7600 |
| | | | Mean | 3.3333 | 0.1000 | 3.0000 | 10.6667 | 0.0007 | 4.8600 |
| | | | Std Dev | 0.2887 | 0.0000 | 0.0000 | 1.1547 | 0.0006 | 0.0954 |
| | | | | | | | | | |
| AWI | L Saranac L | Epi | 5/27/2008 | 3.2000 | 0.1000 | 3.0000 | 11.0000 | 0.0000 | 5.1200 |
| Vol | L Saranac L | Deephole | 5/27/2008 | 3.0000 | 0.1000 | 3.0000 | 12.0000 | 0.0000 | 5.1400 |
| Vol | L Saranac L | Deephole | 6/25/2008 | | 0.1000 | 4.0000 | 12.0000 | 0.0060 | 3.8700 |
| Vol | L Saranac L | Deephole | 7/27/2008 | | 0.1000 | 1.0000 | 12.0000 | 0.0060 | 4.9800 |
| Vol | L Saranac L | Deephole | 9/22/2008 | | 0.1000 | 3.0000 | 12.0000 | 0.0040 | 4.5700 |
| | | | Mean | 3.0000 | 0.1000 | 2.7500 | 12.0000 | 0.0040 | 4.6400 |
| | | | Std Dev | #DIV/0! | 0.0000 | 1.2583 | 0.0000 | 0.0028 | 0.5667 |
| AWI | L Saranac L | Hypo | 5/27/2008 | x | 0.1000 | 3.0000 | 11.0000 | 0.0010 | 4.9800 |
| | | | | | | | | | |
| Vol | L Saranac L | Deephole | 7/15/2009 | 3.0000 | 0.2000 | 4.0000 | 12.0000 | 0.0050 | 4.0400 |
| Vol | L Saranac L | Deephole | 9/15/2009 | 3.5000 | 0.2000 | 3.0000 | 13.0000 | 0.0040 | 4.4800 |
| | | | Mean | 3.2500 | 0.2000 | 3.5000 | 12.5000 | 0.0045 | 4.2600 |
| | | | Std Dev | 0.3536 | 0.0577 | 0.5774 | 1.0000 | 0.0021 | 0.4703 |
| | | | | | | | | | |
| Vol | L Saranac L | Deephole | 7/12/2010 | | 0.1870 | 4.4300 | 9.2800 | 0.0140 | 5.2800 |
| Vol | L Saranac L | Deephole | 11/7/2010 | 2.5000 | 0.1770 | 4.3600 | 10.1000 | 0.0400 | 5.3700 |
| | | | Mean | 2.5000 | 0.1820 | 4.3950 | 9.6900 | 0.0270 | 5.3250 |
| | | | Std Dev | 1.5178 | 0.0719 | 2.2044 | 5.0339 | 0.0194 | 2.8032 |

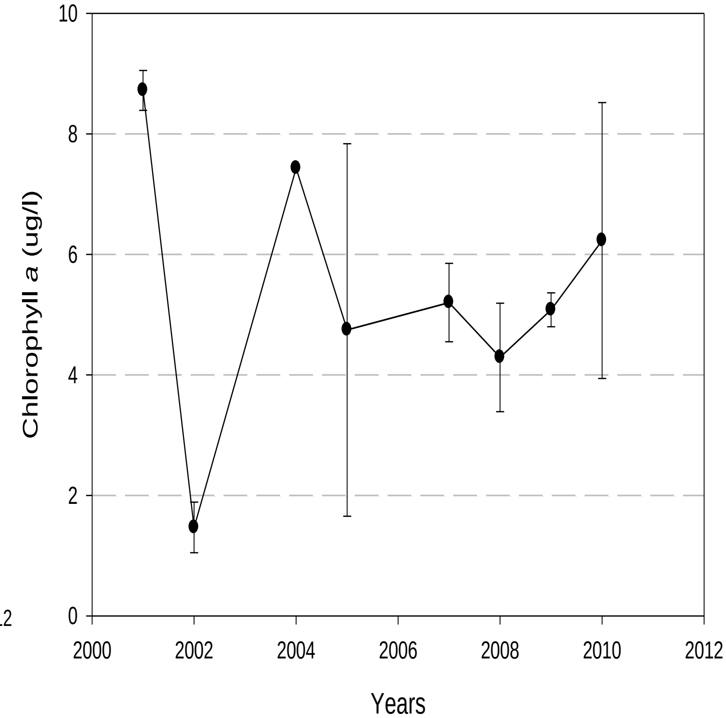

pH (units)
7.5
7.0
6.5
6.0
2000
2002
2004
2006
2008
2010
2012
Years

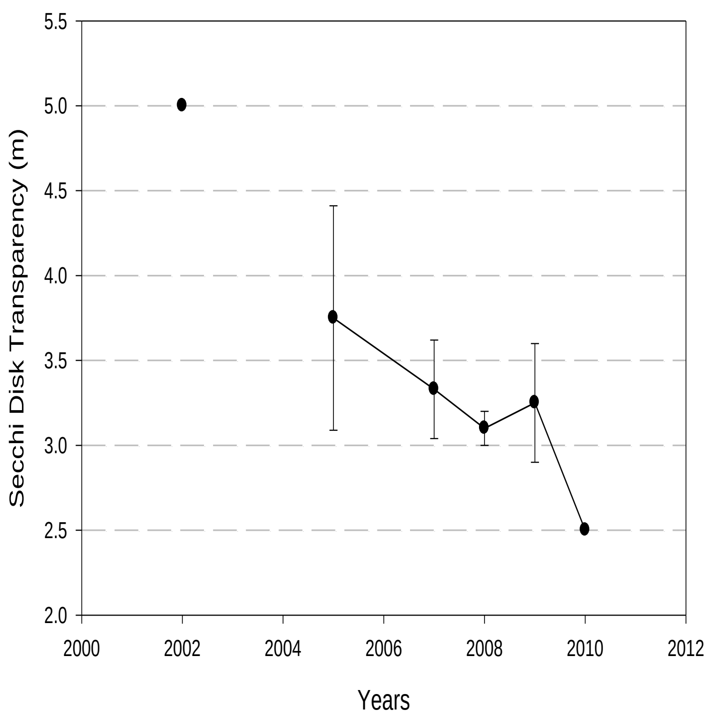

Alkalinity (ppm)
28
26
24
22
20
18
16
14
12
10
8
2000
2002
2004
2006
2008
2010
2012
Years

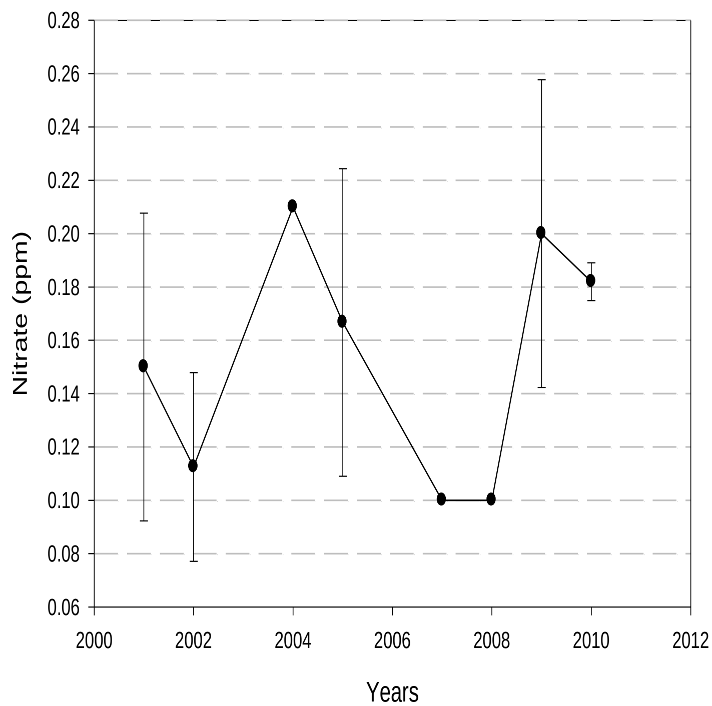

Conductivity (uohms/cm)
100
90
80
70
60
50
40
30
2000
2002
2004
2006
2008
2010
2012
Years

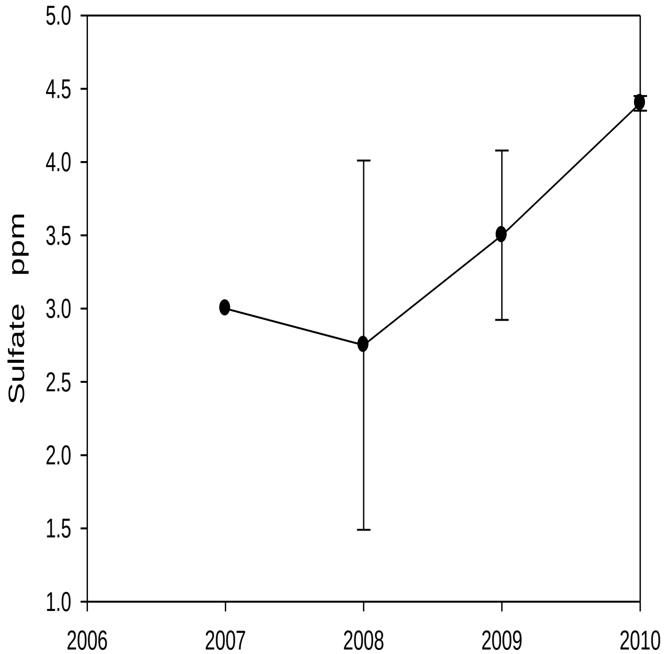

Color (Pt-Co)
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
Years

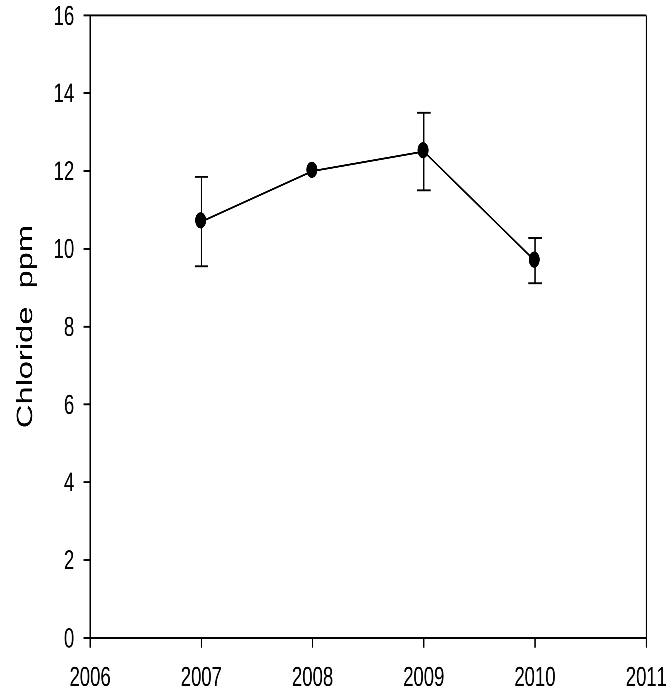

Total Phosphorous (ppm)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
2000
2002
2004
2006
2008
2010
2012
Years

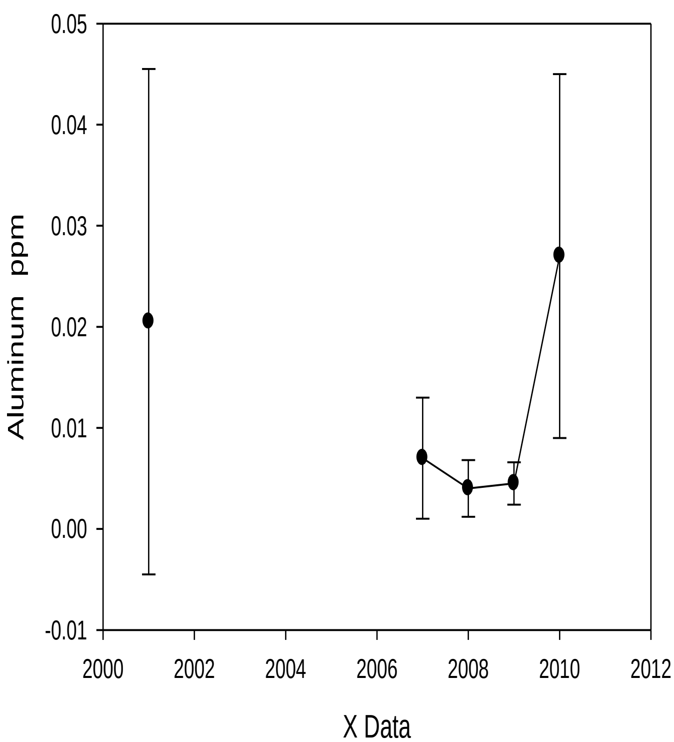

Chlorophyll *a* (ug/l)
0
2
4
6
8
10
2000
2002
2004
2006
2008
2010
2012
Years

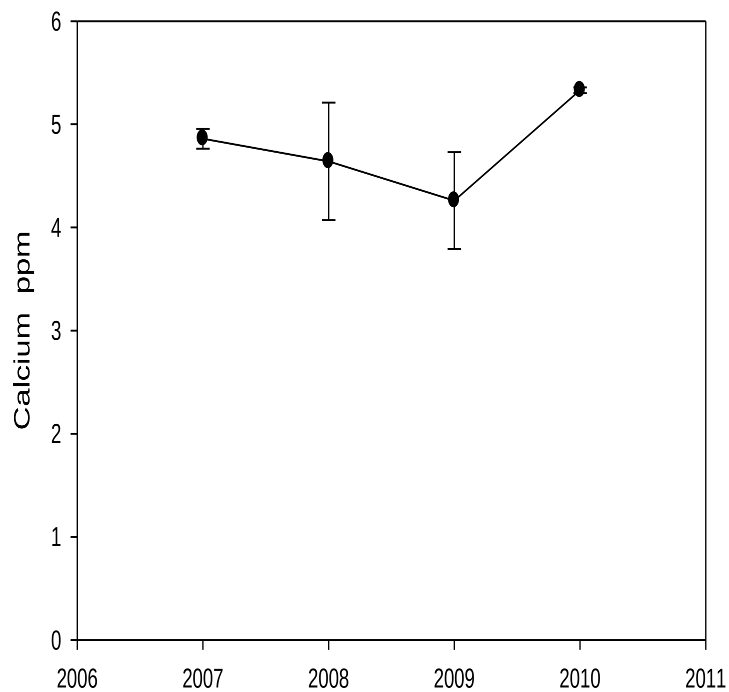

Secchi Disk Transparency (m)
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
2000
2002
2004
2006
2008
2010
2012
Years


Nitrate (ppm)
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20
0.22
0.24
0.26
0.28
2000
2002
2004
2006
2008
2010
2012
Years


Sulfate ppm
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
2006
2007
2008
2009
2010


Chloride ppm
16
14
12
10
8
6
4
2
0
2006
2007
2008
2009
2010
2011


Aluminum ppm
0.05
0.04
0.03
0.02
0.01
0.00
-0.01
2000
2002
2004
2006
2008
2010
2012
X Data


Calcium ppm
6
5
4
3
2
1
0
2006
2007
2008
2009
2010
2011