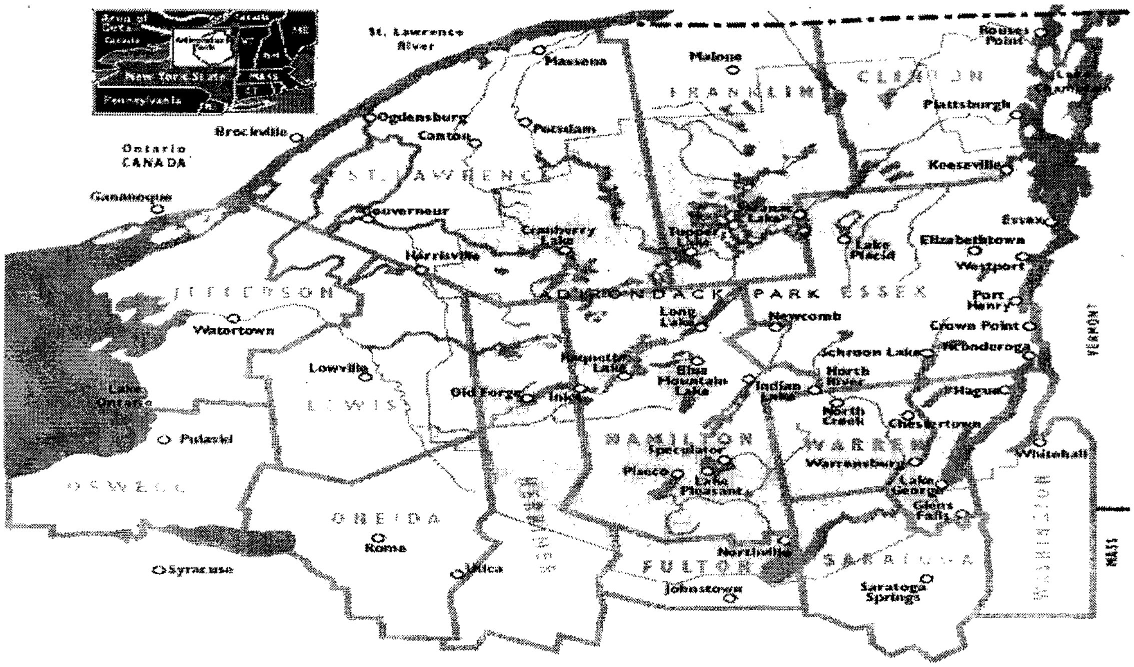
Adirondack Lake Assessment Program
2008



Eleven Years in the program

Cranberry Lake, Loon Lake, Oven Mountain Pond, Blue Mountain Lake, Silver Lake, Eagle Lake

Ten Years in the program

Little Long Lake, Gull Pond, Stony Creek Ponds, Thirteenth Lake, Eli Pond

Nine Years in the program

Austin Pond, Osgood Pond, Middle Saranac Lake, White Lake, Brandreth Lake, Carry Falls Reservior, Trout Lake

Eight Years in the program

Hoel Pond, Great Sacandaga Lake, Balfour 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, Fish Creek Ponds, Rollins Pond

Seven Years in the program

Spitfire Lake, Upper St. Regis, Lower St. Regis, Garnet Lake, Lens Lake, McRoire Lake, Snowshoe Pond, Lake Ozonia, Long Pond, Lower Saranac Lake

Six Years in the program

Raquette Lake, Follensby Clear Pond, Second Pond, Lake Colby, Kiwassa Lake, Canada Lake, Windfall Pond

Five Years in the program

Indian Lake, Big Moose Lake, Schroon Lake, Lake Eaton, Chazy Lake

Four Years in the program

Dug Mountain Pond, Seventh Lake, Abanakee Lake, Moss Lake, Mountain View Lake, Indian Lake, Tupper Lake

Three Years in the program

Sylvia Lake, Fern Lake. Weller Pond, Egg Pond

Two Years in the program

Adirondack Lake, Lower Chateaugay Lake, Upper Chateaugay Lake, Lake Easka, Lake Tekeni, Lincoln Pond

One Year in the program

Paradox Lake, Simon Pond

Adirondack Lake Assessment Program

Lake Colby

Summer 2008
January 2009

Author
Michael De Angelo

Project Participants
Michael De Angelo, Environmental Chemist, Executive Director of the AWI
Kim Caro, Environmental Technician, AWI
Johanna Sorrell, Conservation Director of the RCPA

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:
The Residents' Committee to Protect the Adirondacks
323 Broadway, P.O. Box 1180, Saranac Lake, NY 12983
Phone: 518-891-1002 ext 17

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' eleventh year and continues to grow. The program was established to help develop a current database of water quality in Adirondack lakes and ponds. There were 75 participating lakes in the program in year 2008.

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

Lake Colby was sampled four times by a volunteer in 2008. Samples were collected for the lake on the following dates: 6/27/08, 7/26/08, 9/01/08, and 9/29/08. Results for 2008 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 water body'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 2008 Adirondack Lakes Assessment program, the acidity status of Lake Colby is considered to be satisfactory with no threat from 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 2008 Adirondack Lakes Assessment Program, Lake Colby is considered to be a mesotrophic water body.

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 waters of Lake Colby ranged from 6.98 to 7.68 and averaged 7.29. Based solely on pH, Lake Colby'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 waters of Lake Colby ranged from 42.0 ppm to 66.8 ppm and averaged 51.3 ppm. These values indicate no sensitivity to acidification.

Calcium

Calcium is one of the buffering materials that occur 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 Lake Colby was found to be 7.97 ppm when sampled in June of 2008. This shows us a lake that is not sensitive to further 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 Lake Colby was found to be 1.00 in June of 2008. This shows that Lake Colby 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 Lake Colby ranged from 9 to 19 ppb and they averaged 14.3 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 Lake Colby ranged from 1.96 ppb to 6.25 ppb and averaged 4.12 ppb. 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 also is 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 Lake Colby ranged from 3.0 meters to 5.0 meters and averaged 4.0 meters. This value 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 Lake Colby ranged from 0.0 to 0.2 ppm. The average nitrate for Lake Colby was 0.13 ppm.

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 waters of Lake Colby was ranged from 33 ppm to 42 ppm and the average value was 39 ppm. This level should raise concern as well as levels found in past years.

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 waters of Lake Colby ranged from 169μohms/cm to 216μohms/cm and averaged 191.6μohms/cm. These levels raise concern and are most likely high due to the very high chloride levels.

Color

The color of water is affected by both dissolved materials (e.g., metallic ions, organic acids) and suspended materials (e.g., silt and plant pigments). 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 Lake Colby ranged from 11 Pt-Co to 19 Pt-Co and averaged 15.3 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 Lake Colby was found to be 0.000 ppm in June 2008.

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 Lake Colby for 2008 were not measured due to lack of a site visit by AWI staff.

Summary

Lake Colby was a moderately productive mesotrophic lake during 2008. Based on the results of the 2008 Adirondack Lakes Assessment program, the acidity status of Lake Colby is considered to be satisfactory with no threat from further acidic inputs.

Six years of data is sufficient to begin to detect water quality trends. In 2008, the pH, alkalinity, conductivity, color, nitrate and Secchi disk transparency levels decreased as compared to 2007 levels. Conversely, the total phosphorous and chlorophyll-a levels all increased as compared to levels in 2007. This is the exact opposite of last year. The lake looked healthy and did not experience an algae bloom during the 2008 sampling period. The total phosphorous levels were higher for 2008 but about average and this led to more algae growth as shown by the increased chlorophyll a levels and this led to decreased Secchi disk transparency readings for 2008.

The 2007 summer season was a relatively dry one and this led to less runoff from the surrounding watershed and this was a big benefit and helped improve the water quality of Lake Colby. 2008 was the opposite, a very wet summer, and the opposite was seen for Lake Colby. Road salt continues to be a problem for Lake Colby as shown by the high conductivity and chloride levels but they were a little lower the last three years.

Little Colby Pond was sampled for the first time on two occasions in 2008. The pH and alkalinity were very similar to that of Lake Colby. The other parameters show a pond that has worse water quality than Lake Colby. The conductivity, color, total phosphorous, chlorophyll-a, and chloride were much higher for Little Colby over Lake Colby.

Literature Cited

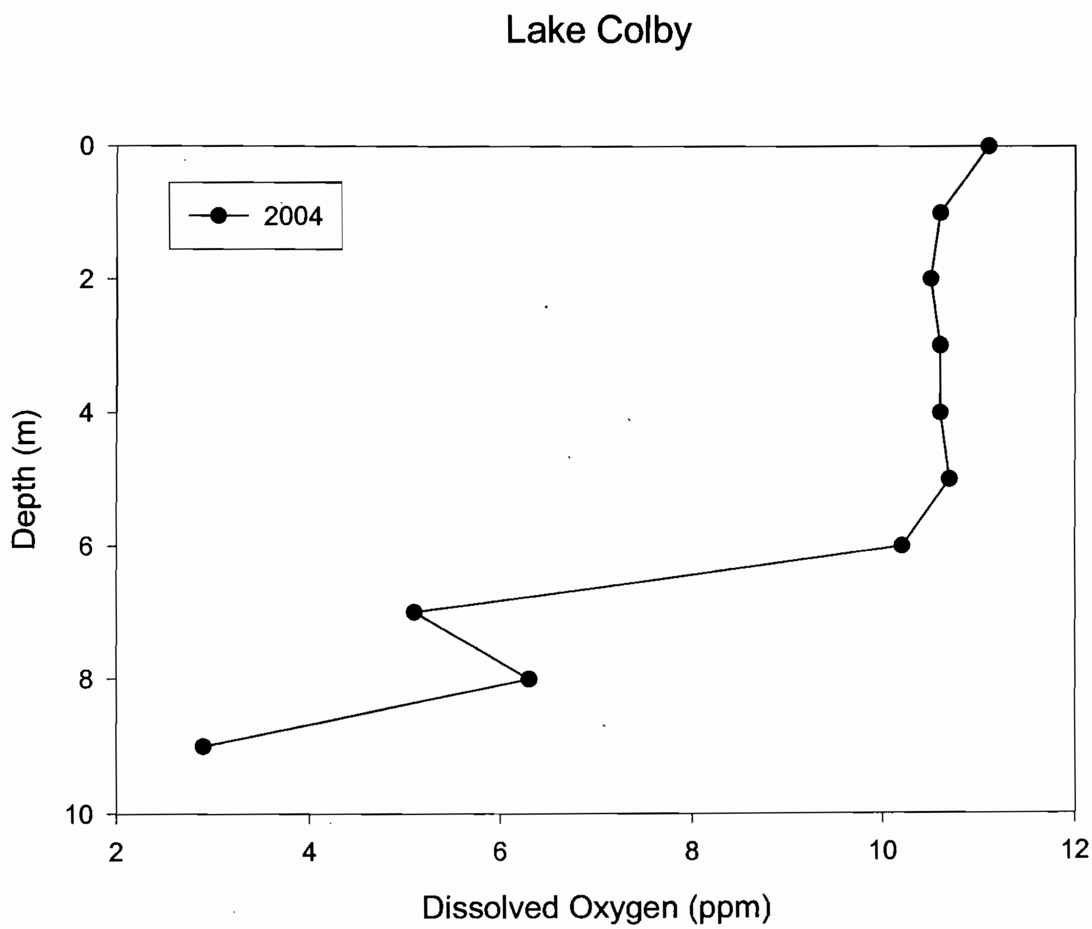
DEC & FOLA. (1990). Diet for a Small Lake: A New Yorker's Guide to Lake Management.
New York State Department of Environmental Conservation & The Federation of Lake Associations, Inc.: Albany, New York.

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.

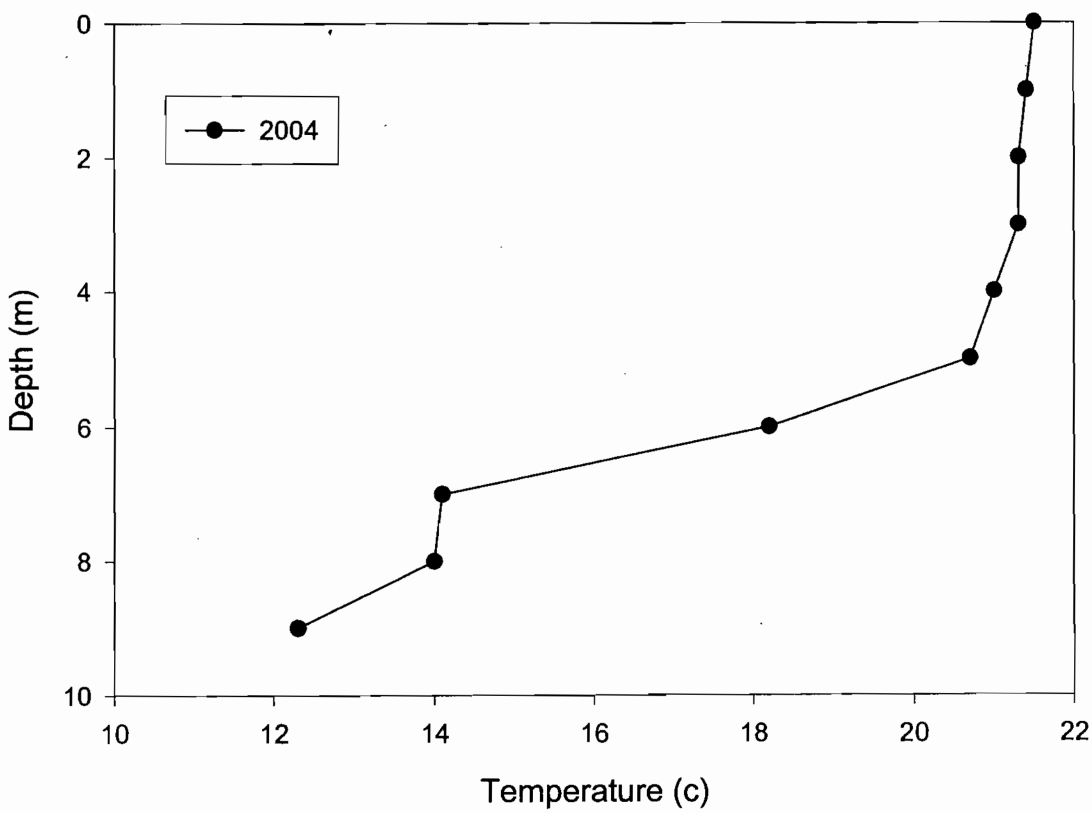
Potter, W. (1982). *The Effects of Air Pollution and Acid Rain on Fish, Wildlife and Their Habitats – Lakes*. Technical Report FWS/OBS – 80/50.4. United States Fish and Wildlife Service, Biological Services Program: Washington, D.C.

Appendix A

Water Quality Data

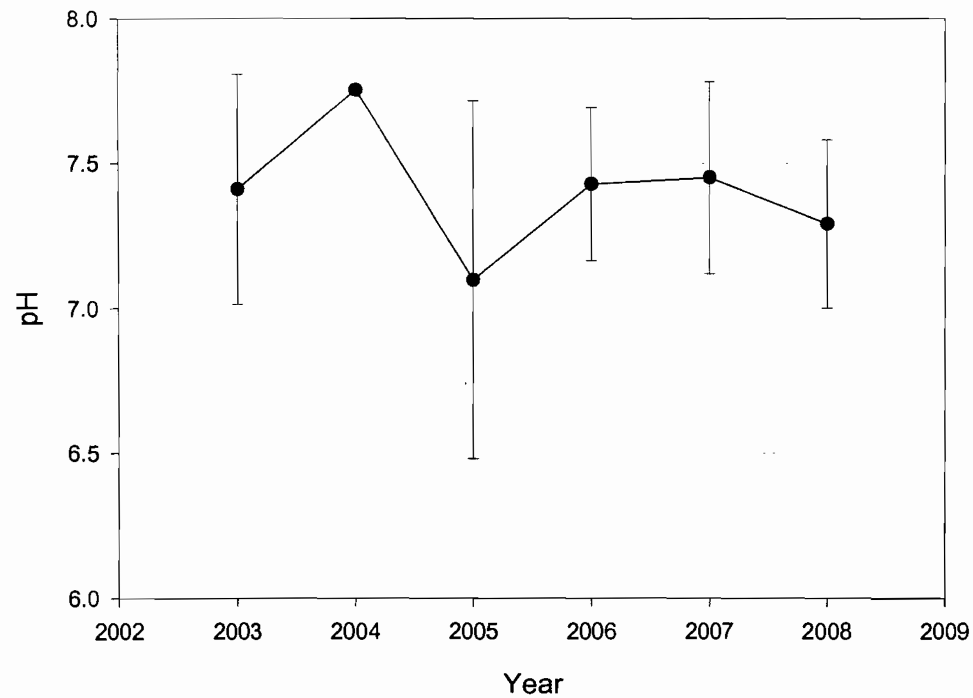

Lake Colby
2004
Depth (m)
0
2
4
6
8
10
2
4
6
8
10
12
Dissolved Oxygen (ppm)

Lake Colby

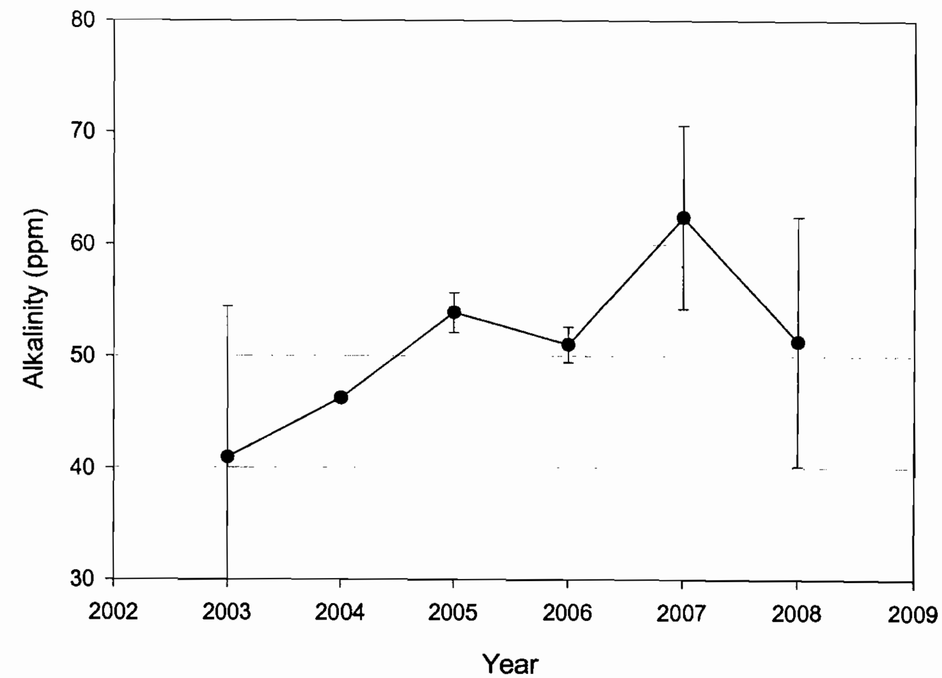


AWI	Lake Colby	Deephole	8/7/2003	7.8700	52.4000	171.1000	10.0000	0.0130
Vol	Lake Colby	Deephole	9/6/2003	7.2100	44.4000	240.0000	49.0000	0.0130
Vol	Lake Colby	Deephole	10/8/2003	7.1600	26.0000	259.0000	10.0000	0.0140
			Mean	7.4133	40.9333	223.3667	23.0000	0.0133
			Std Dev	0.3963	13.5371	46.2504	22.5167	0.0006
Vol	Lake Colby	Brook	8/7/2003	7.2000	318.0000	1720.0000		0.0520
Vol	Lake Colby	Brook	10/8/2003	6.8900	98.0000	2120.0000		0.0640
AWI	Lake Colby	Epilimnion	8/18/2004	7.7500	46.2000	234.0000	17.0000	0.0140
AWI	Lake Colby	Hypolimnion	8/18/2004	7.1300	54.0000	241.0000	45.0000	0.0190
Vol	Lake Colby	Brook	4/1/2004	7.1200	44.0000	337.0000		0.0600
Vol	Lake Colby	Brook	4/19/2004	7.0000	50.0000	466.0000		0.0500
Vol	Lake Colby	Brook	5/5/2004	7.2100	54.0000	497.0000	26.0000	0.0300
Vol	Lake Colby	Deephole	6/30/2005	7.5300	52.0000	220.0000	21.0000	0.0120
Vol	Lake Colby	Deephole	7/30/2005	7.3700	55.6000	240.0000	11.0000	0.0120
AWI	Lake Colby	Dip	11/8/2005	6.3900	54.0000	196.9000	50.0000	0.0120
			Mean	7.0967	53.8667	218.9667	27.3333	0.0120
			Std Dev	0.6172	1.8037	21.5686	20.2567	0.0000
Vol	Lake Colby	Brook	6/30/2005	6.9400	122.8000	430.0000	96.0000	0.0220
Vol	Lake Colby	Brook	7/30/2005	7.4200	148.4000	663.0000	68.0000	0.0720
AWI	Lake Colby	Brook	11/8/2005	6.3200	108.4000	631.0000	114.0000	0.0080
			Mean	6.8933	126.5333	574.6667	92.6667	0.0340
			Std Dev	0.5515	20.2596	126.3025	23.1805	0.0336
AWI	Lake Colby	Deephole	5/10/2006	7.2800	52.2000	225.0000	14.0000	0.0170
AWI	Lake Colby	Deephole	7/15/2006	7.7300	51.6000	189.8000	10.0000	0.0160
AWI	Lake Colby	Deephole	8/26/2006	7.2700	49.2000	195.0000	10.0000	0.0160
			Mean	7.4267	51.0000	203.2667	11.3333	0.0163
			Std Dev	0.2627	1.5875	19.0004	2.3094	0.0006
Vol	Lake Colby	Deephole	5/19/2007	7.0300	51.2000	218.0000	29.0000	0.0140
Vol	Lake Colby	Deephole	6/28/2007	7.3700	63.6000	222.0000	15.0000	0.0090
Vol	Lake Colby	Deephole	8/1/2007	7.2900	57.8000	178.0000	35.0000	0.0110
Vol	Lake Colby	Deephole	9/2/2007	7.7800	72.4000	190.1000	23.0000	0.0090
Vol	Lake Colby	Deephole	9/25/2007	7.7700	66.8000	221.0000	34.0000	0.0160
			Mean	7.4480	62.3600	205.8200	27.2000	0.0118
			Std Dev	0.3239	8.1761	20.3817	8.3187	0.0031
Vol	Lake Colby	Brook	3/27/2007	7.1300	76.4000	385.0000	34.0000	0.0520
Vol	Lake Colby	Trestle	7/11/2007	7.3400	64.8000	238.0000	32.0000	0.0220
			Mean	7.2350	70.6000	311.5000	33.0000	0.0370
			Std Dev	0.1485	8.2024	103.9447	1.4142	0.0212
Vol	Lake Colby	Deephole	6/27/2008	7.6800	66.8000	216.0000	19.0000	0.0190
Vol	Lake Colby	Deephole	7/26/2008	7.2800	44.4000	169.0000	12.0000	0.0180
Vol	Lake Colby	Deephole	9/1/2008	6.9800	42.0000	210.0000	11.0000	0.0110
Vol	Lake Colby	Deephole	9/29/2009	7.2300	52.0000	171.4000	19.0000	0.0090
			Mean	7.2925	51.3000	191.6000	15.2500	0.0143
			Std Dev	0.2898	11.1780	24.8510	4.3493	0.0050
Vol	Little Colby	Deephole	7/26/2008	7.7400	58.8000	214.0000	21.0000	0.0220
Vol	Little Colby	Deephole	9/29/2008	7.4400	48.8000	224.0000	23.0000	0.0210
			Mean	7.5900	53.8000	219.0000	22.0000	0.0215
			Std Dev	0.2121	7.0711	7.0711	1.4142	0.0007

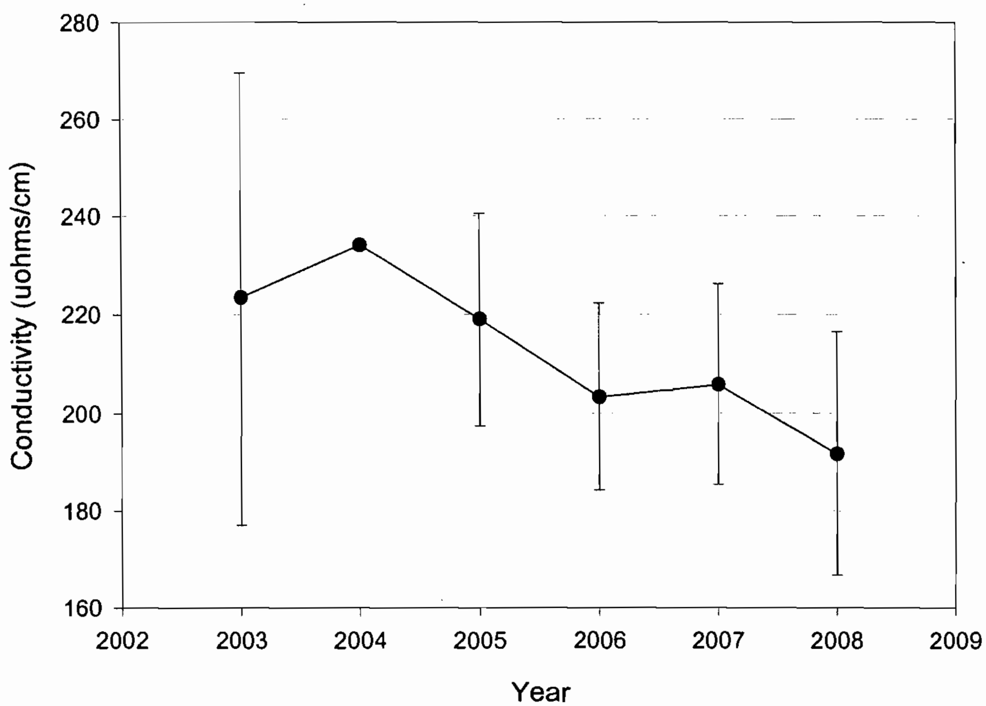
Sample Date	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8/7/2003	2.5000	6.5000	0.0000					
9/6/2003	1.4300	5.6000	0.2000					
10/8/2003	5.5100		0.5000					
Mean	3.1467	6.0500	0.2333					
Std Dev	2.1155	0.6364	0.2517					
8/7/2003			0.3000		469.0000			
10/8/2003			1.5000		719.0000			
8/18/2004	2.9500	4.3000	0.0000	8.8700	63.0000	0.0000	0.9385	low
8/18/2004			0.0000	9.2500	64.0000	0.0000	1.4725	low
4/1/2004			0.9000		112.0000			
4/19/2004			0.6000		92.0000			
5/5/2004			0.3000		161.0000			
6/30/2005	1.9700	5.0000	0.1000		47.0000			
7/30/2005	3.0200	4.3000	0.1000		49.0000			
11/8/2005	5.0220		0.2000		90.0000			
Mean	3.3373	4.6500	0.1333		62.0000			
Std Dev	1.5505	0.4950	0.0577		24.2693			
6/30/2005	5.4500		0.4000		93.0000			
7/30/2005	6.1700		0.2000		206.0000			
11/8/2005	23.0790		0.6000		177.0000			
Mean	11.5663		0.4000		158.6667			
Std Dev	9.9768		0.2000		58.6884			
5/10/2006	13.7000	2.5000	0.0000	7.7200	46.0000	0.0000	1.4157	low
7/15/2006	5.8700	3.5000	0.1000					
8/26/2006	6.0200	3.5000	0.1000					
Mean	8.5300	3.1667	0.0667					
Std Dev	4.4780	0.5774	0.0577					
5/19/2007	3.8900	3.0000	0.2000	7.4700	41.0000	0.0000	1.6710	
6/28/2007	2.2300	5.5000	0.1000		41.0000			
8/1/2007	2.7800	4.5000	0.1000		32.0000			
9/2/2007	1.9600	5.0000	0.4000					
9/25/2007	5.2800	3.5000	0.2000					
Mean	3.2280	4.3000	0.2000					
Std Dev	1.3651	1.0368	0.1225					
3/27/2007			0.3000		92.0000			
7/11/2007	2.9500		0.2000		48.0000			
Mean	2.9500		0.2500					
Std Dev			0.0707					
6/27/2008	6.1400	3.0000	0.0000	7.9700	41.0000	0.0000	1.0000	low
7/26/2008	6.2500	3.0000	0.1000		33.0000			
9/1/2008	2.1300	5.0000	0.2000		40.0000			
9/29/2008	1.9600	5.0000	0.2000		42.0000			
Mean	4.1200	4.0000	0.1250		39.0000			
Std Dev	2.3974	1.1547	0.0957		4.0825			
7/26/2008	7.7900	2.0000	0.0000					
9/29/2008			0.2000		50.0000	0.0080		
Mean	7.7900	2.0000	0.1000					
Std Dev	#DIV/0!	#DIV/0!	0.1414					



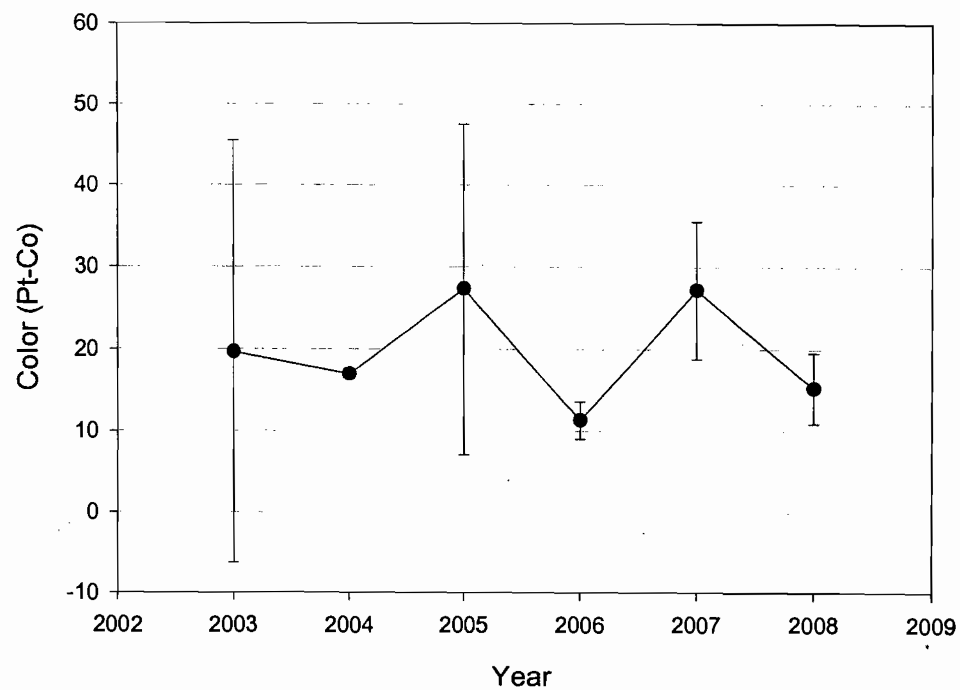
pH
8.0
7.5
7.0
6.5
6.0
2002
2003
2004
2005
2006
2007
2008
2009
Year



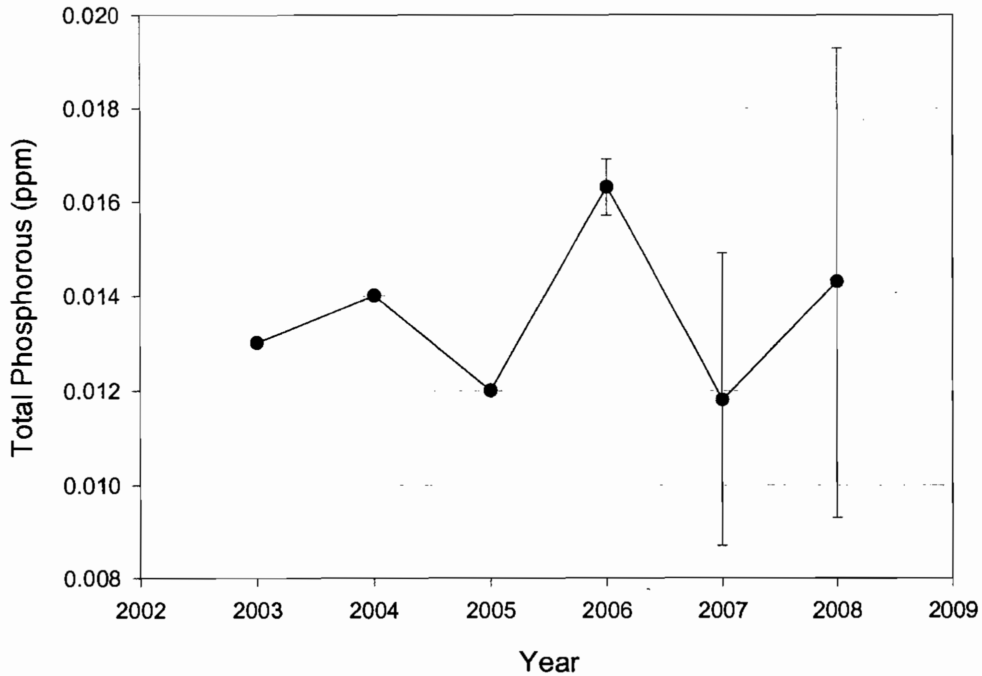
Alkalinity (ppm)
80
70
60
50
40
30
2002
2003
2004
2005
2006
2007
2008
2009
Year

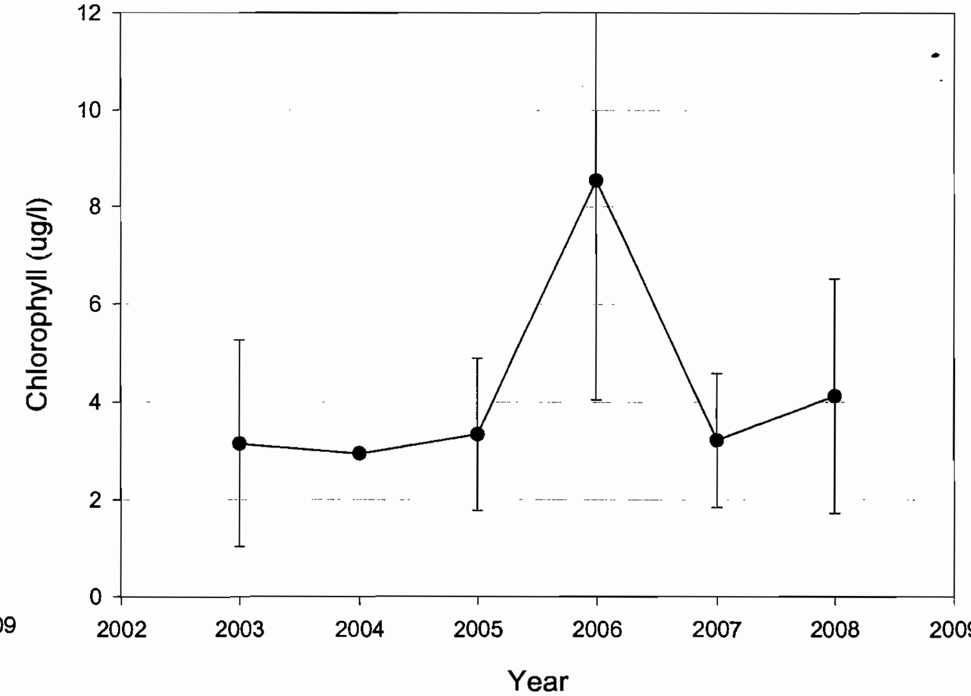


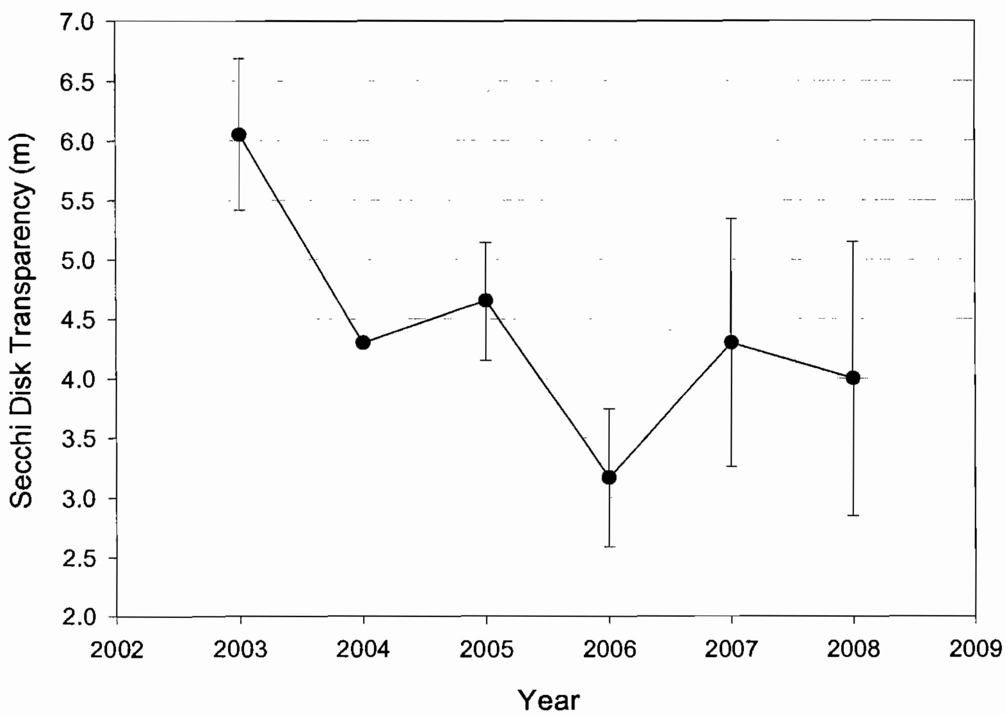
Conductivity (uohms/cm)
280
260
240
220
200
180
160
2002
2003
2004
2005
2006
2007
2008
2009
Year

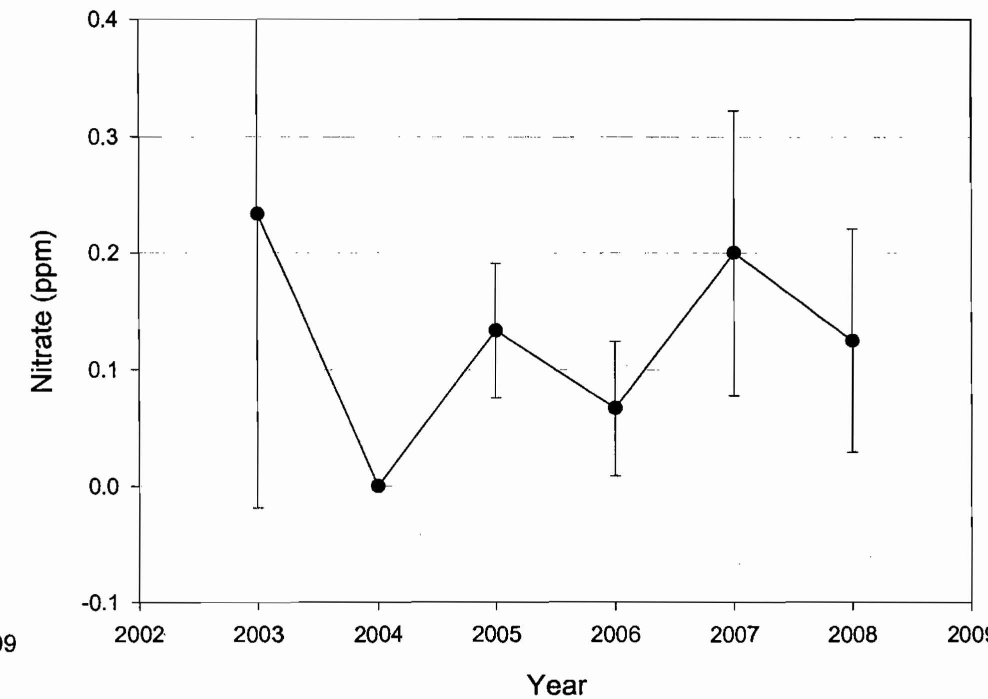


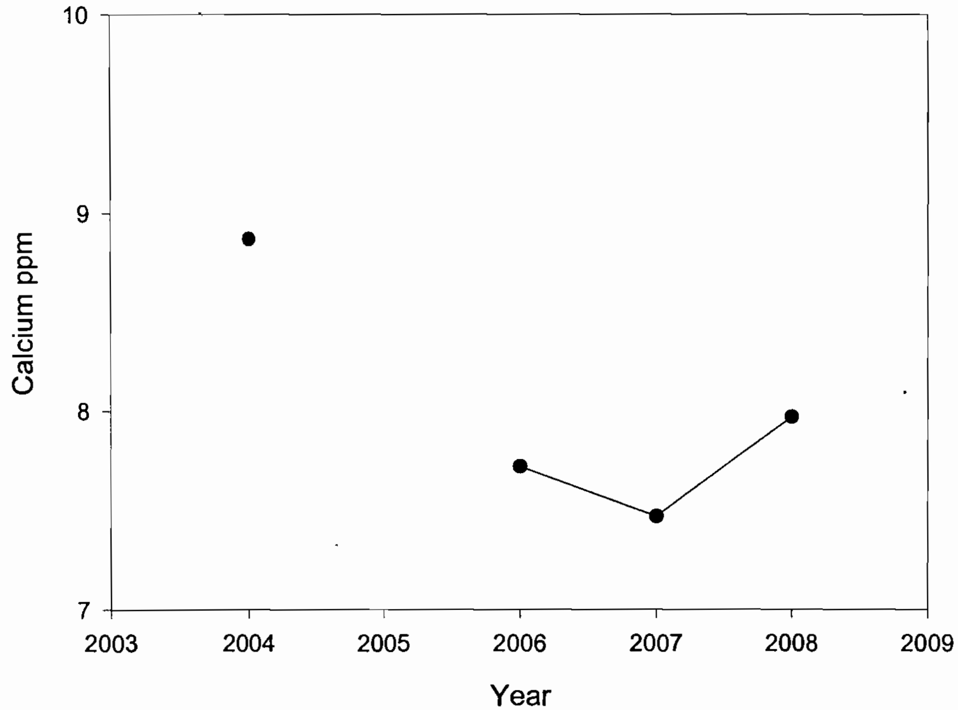
Color (Pt-Co)
60
50
40
30
20
10
0
-10
2002
2003
2004
2005
2006
2007
2008
2009
Year

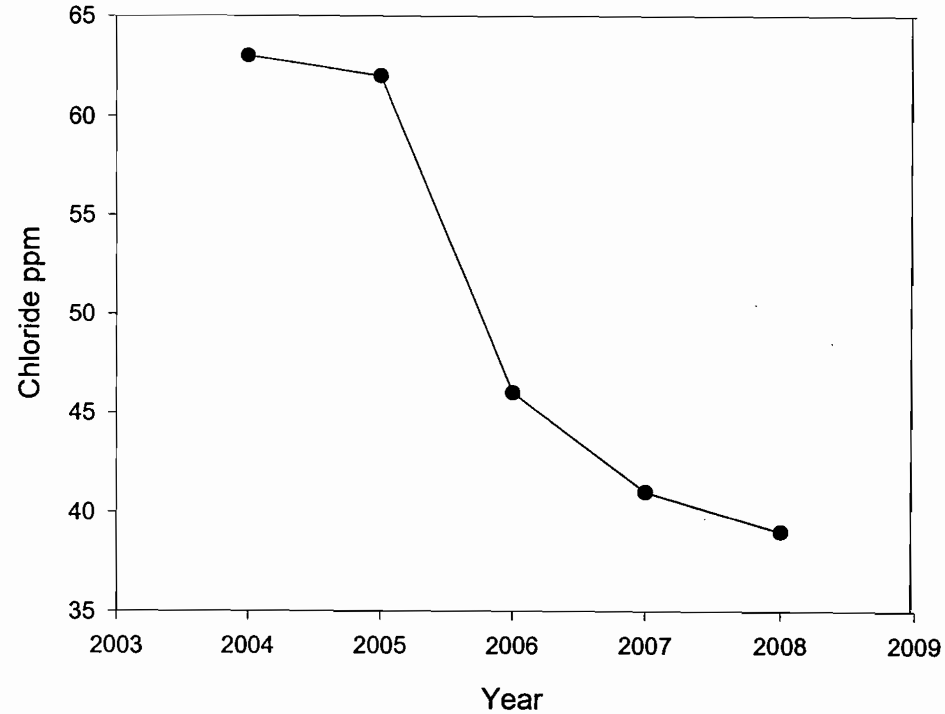

Total Phosphorous (ppm)
0.020
0.018
0.016
0.014
0.012
0.010
0.008
2002
2003
2004
2005
2006
2007
2008
2009
Year

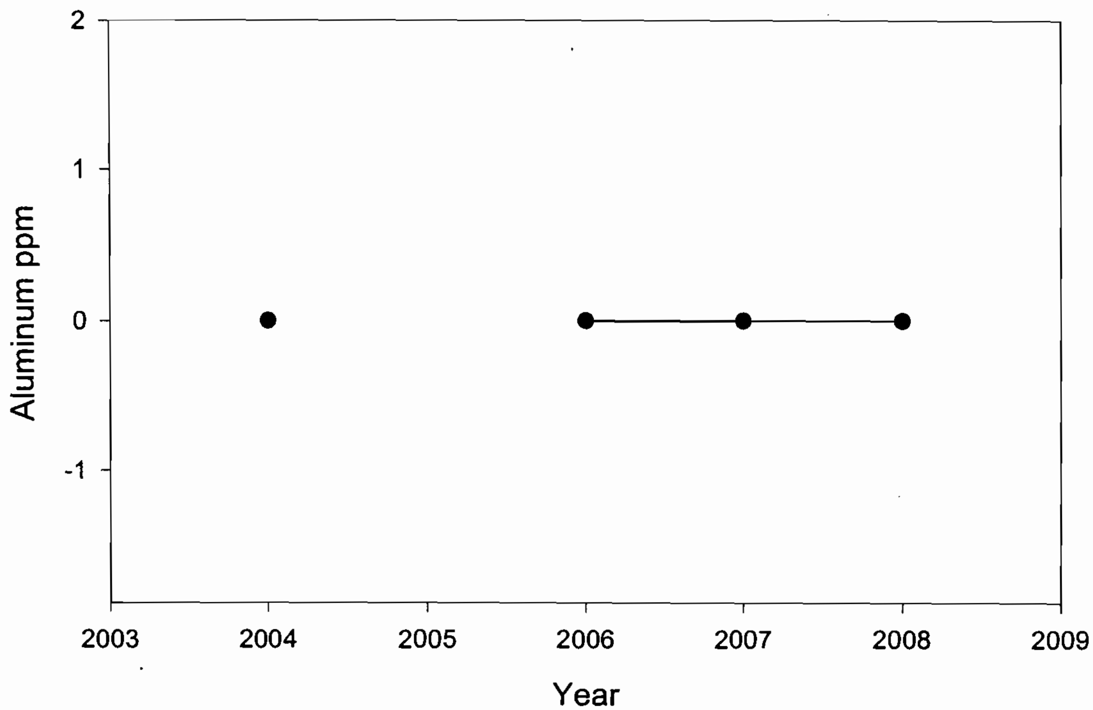

Chlorophyll (ug/l)
12
10
8
6
4
2
0
2002
2003
2004
2005
2006
2007
2008
2009
Year

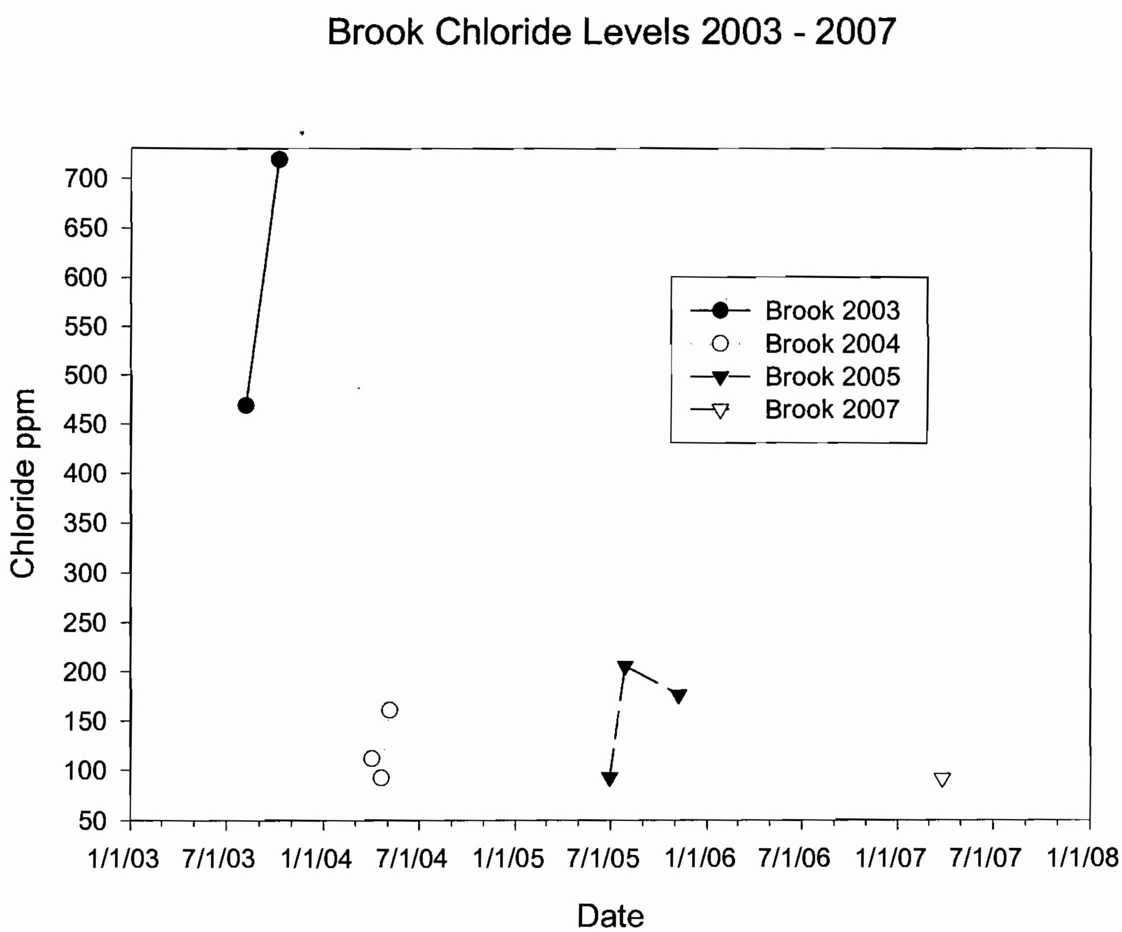

Secchi Disk Transparency (m)
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
2002
2003
2004
2005
2006
2007
2008
2009
Year


Nitrate (ppm)
0.4
0.3
0.2
0.1
0.0
-0.1
2002
2003
2004
2005
2006
2007
2008
2009
Year


Calcium ppm
10
9
8
7
2003
2004
2005
2006
2007
2008
2009
Year


Chloride ppm
65
60
55
50
45
40
35
2003
2004
2005
2006
2007
2008
2009
Year


Aluminum ppm
2
1
0
-1
2003
2004
2005
2006
2007
2008
2009
Year


Brook Chloride Levels 2003 - 2007
Chloride ppm
700
650
600
550
500
450
400
350
300
250
200
150
100
50
1/1/03
7/1/03
1/1/04
7/1/04
1/1/05
7/1/05
1/1/06
7/1/06
1/1/07
7/1/07
1/1/08
Date
Brook 2003
Brook 2004
Brook 2005
Brook 2007