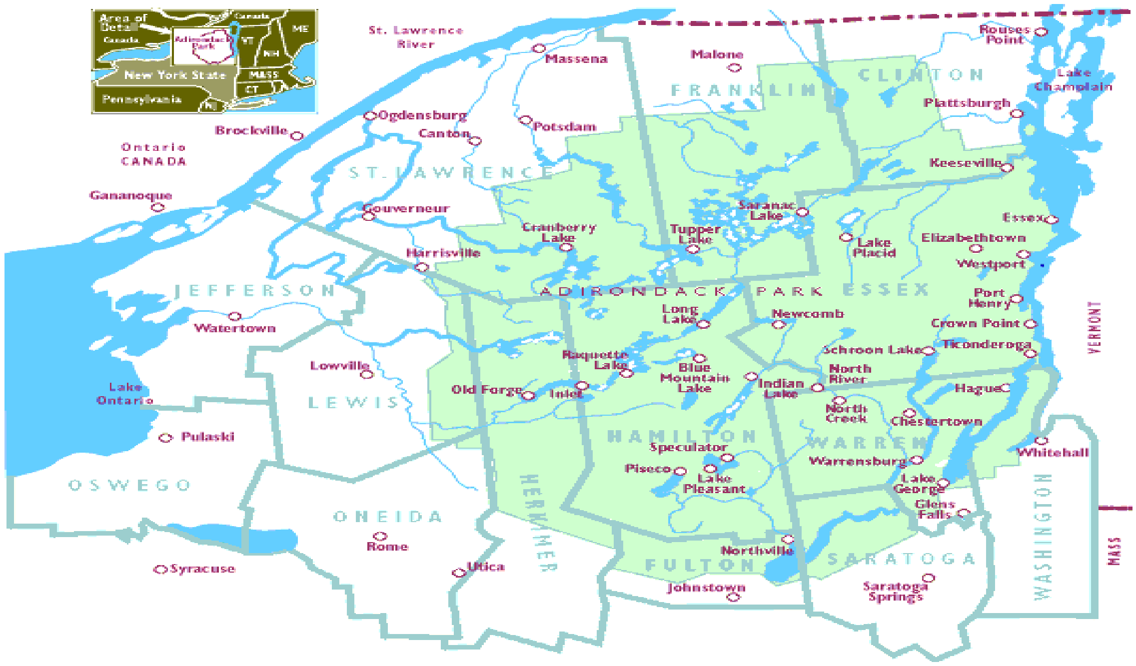
Adirondack Lake Assessment Program 2012



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

Adirondack Lake Assessment Program

Lake Ozonia

Summer 2012

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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' fifteenth year. The program was established to help develop a current database of water quality in Adirondack lakes and ponds. There were 69 participating lakes in the program in 2012.

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 Ozonia was sampled three times by volunteers in 2012. Samples were collected on the following dates: 6/16/12, 8/18/12, and 10/07/12. Results for 2012 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 2012 Adirondack Lake Assessment program, the acidity status of Lake Ozonia is considered to be satisfactory. The pH values are satisfactory and the alkalinity, calcium and CSI values indicate 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 2012 Adirondack Lake Assessment Program, Lake Ozonia is considered to be mesotrophic in nature.

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 Lake Ozonia ranged from 7.42 to 8.20. The average pH was 7.87. Based solely on pH, Lake Ozonia'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 mg/L	Acidified
Alkalinity between 0 and 2 mg/L	Extremely sensitive
Alkalinity between 2 and 10 mg/L	Moderately sensitive
Alkalinity between 10 and 25 mg/L	Low sensitivity
Alkalinity greater than 25 mg/L	Not sensitive

The alkalinity of the upper water of Lake Ozonia ranged from 11.2 mg/L to 12.5 mg/L. The average alkalinity was 11.7 mg/L. These values indicate a low 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 mg/L of calcium are considered to be sensitive to acidification.

The calcium in the upper water of Lake Ozonia was found in 2012 to range from 3.39 mg/L to 4.00 mg/L. The average calcium concentration was found to be 3.67 mg/L. This and past values suggest that Lake Ozonia may currently not be sensitive to acidification.

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

CSI values for Lake Ozonia were found in 2012 to be 2.89. This shows a lake that has a low vulnerability to future 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 0.010 mg/L are associated with oligotrophic (clean, clear water) conditions. Concentrations greater than 0.025 mg/L are associated with eutrophic (nutrient-rich) conditions.

The total phosphorus in the upper water of Lake Ozonia ranged from 0.014 mg/L to 0.024 mg/L. The average concentration was 0.020 mg/L. 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 ug/L are associated with oligotrophic conditions and those greater than 8 ug/L are associated with eutrophic conditions.

The chlorophyll-a concentrations in the upper waters of Lake Ozonia ranged from 4.15 ug/L to 4.87 ug/L. The average concentration was 4.43 ug/L. 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 Lake Ozonia ranged from 3.6 meters to 3.9 meters. The average transparency was 3.77 meters. These values are 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 mg/L in most lakes. Elevated levels of nitrate concentration may be indicative of lake acidification or wastewater pollution.

The nitrate in the upper water of Lake Ozonia ranged from 0.006 mg/L to 0.018 mg/L. The average value was a very low 0.010 mg/L.

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 mg/L. Chloride levels 10 mg/L 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 deicing) and wastewater (usually from faulty septic systems). The most salt impacted waters in the Adirondacks usually have chloride concentrations of 100 mg/L or less.

The chloride in the upper water of Lake Ozonia was found in 2012 to range from 1.03 to 1.21 mg/L. The average chloride concentration was found to be a very low 1.11 mg/L. Values in the past were all very low.

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 Lake Ozonia ranged from 30.7μohms/cm to 36.9 μohms/cm. The average conductivity was a low 34.4 μohms/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 water of Lake Ozonia ranged from 10 Pt-Co to 21 Pt-Co. The average color was 14.3 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 the upper water of Lake Ozonia was found in 2012 to range from 0.099 to 0.129 mg/L. The average aluminum concentration was found to be a very low 0.112 mg/L. This value was always very low in past years.

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 temperatures profiles for Lake Ozonia 2001-2004 are presented in Appendix A. In 2002, the dissolved oxygen was measured early in May, before the lake had time to stratify. Thus, the dissolved oxygen levels remained very consistent from the surface to the bottom. The oxygen level was sufficient for cold-water fish survival in all years of this study.

Summary

Lake Ozonia was determined to be a mesotrophic lake during 2012. Based on the results of the 2012 Adirondack Lake Assessment program, the acidity status of Lake Ozonia is considered to be satisfactory. The pH values are satisfactory and the alkalinity, calcium and CSI values indicate a low sensitivity to acidic inputs.

If we look at the yearly averages for total precipitation in the Adirondacks, the amount of precipitation last year was normal. We had a very dry spring and early summer followed by a very wet late summer and fall. This followed 2011, which was a record year for total precipitation throughout the Adirondack Park. Some of the changes to water quality on Lake Ozonia could have been weather related.

Eleven years of data are sufficient to detect water quality trends, and it is possible to compare the current data with the data collected in 2001-2011. During 2012, the alkalinity, color, chlorophyll-a, nitrate, chloride, and aluminum were all slightly lower than in 2011. Conversely, the pH, conductivity, total phosphorous, Secchi disk transparency, and calcium levels were slightly higher than in 2011.

The very dry spring and early summer, this past year, helped to raise the pH and calcium levels also causing less aluminum to leech out of the soil. This lack of rain meant less dilution of lake water and thus a higher conductivity. Dry conditions also meant fewer nitrates from acid rain and less runoff which meant reduced color levels. The last seven 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 past year these three parameters changed very little but this is a concern that should be investigated further.

Literature Cited

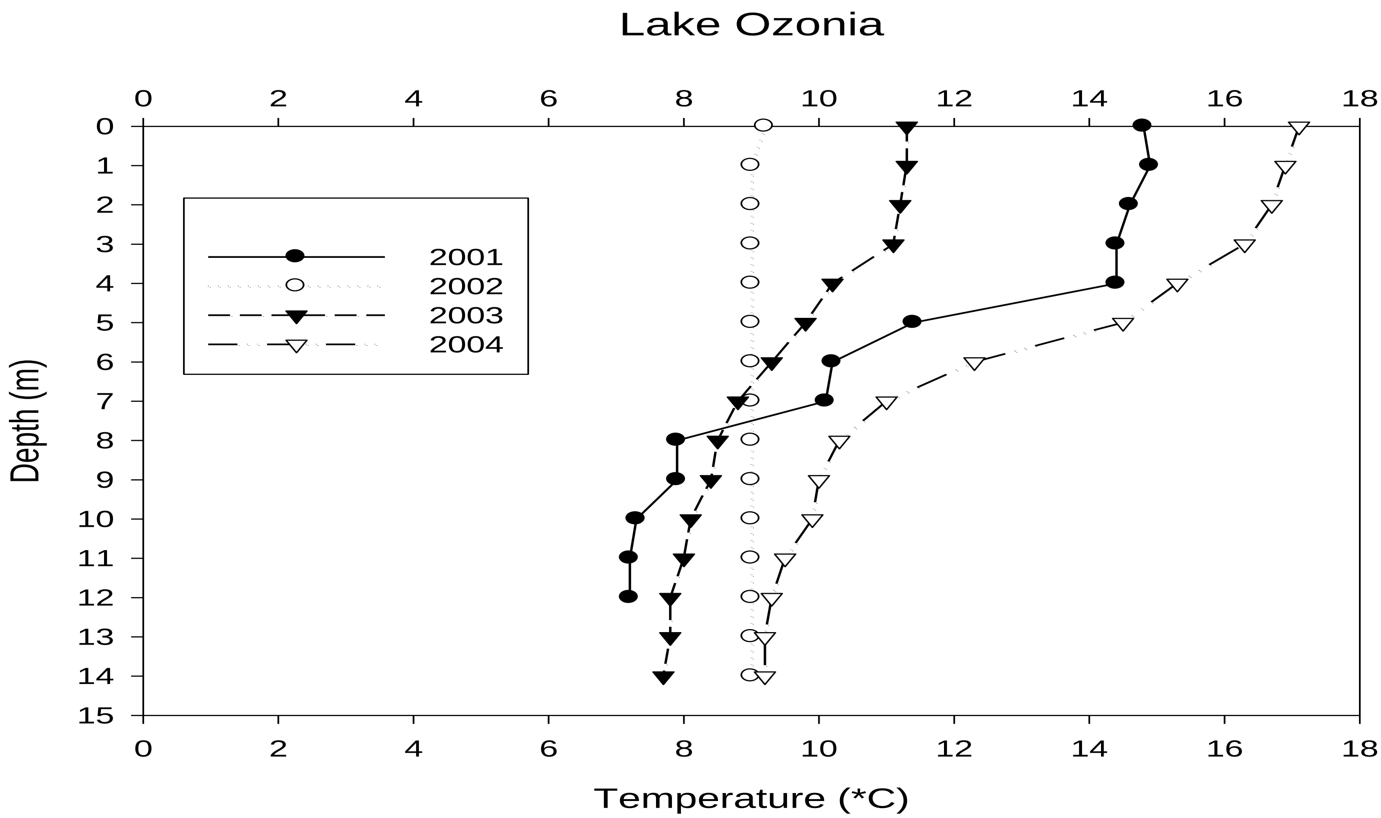
DEC & FOLA. (1990). Diet for a Small Lake: A New Yorker's Guide to Lake Management. New York State Department of Environmental Conservation & The Federation of Lake Associations, Inc.: Albany, New York.

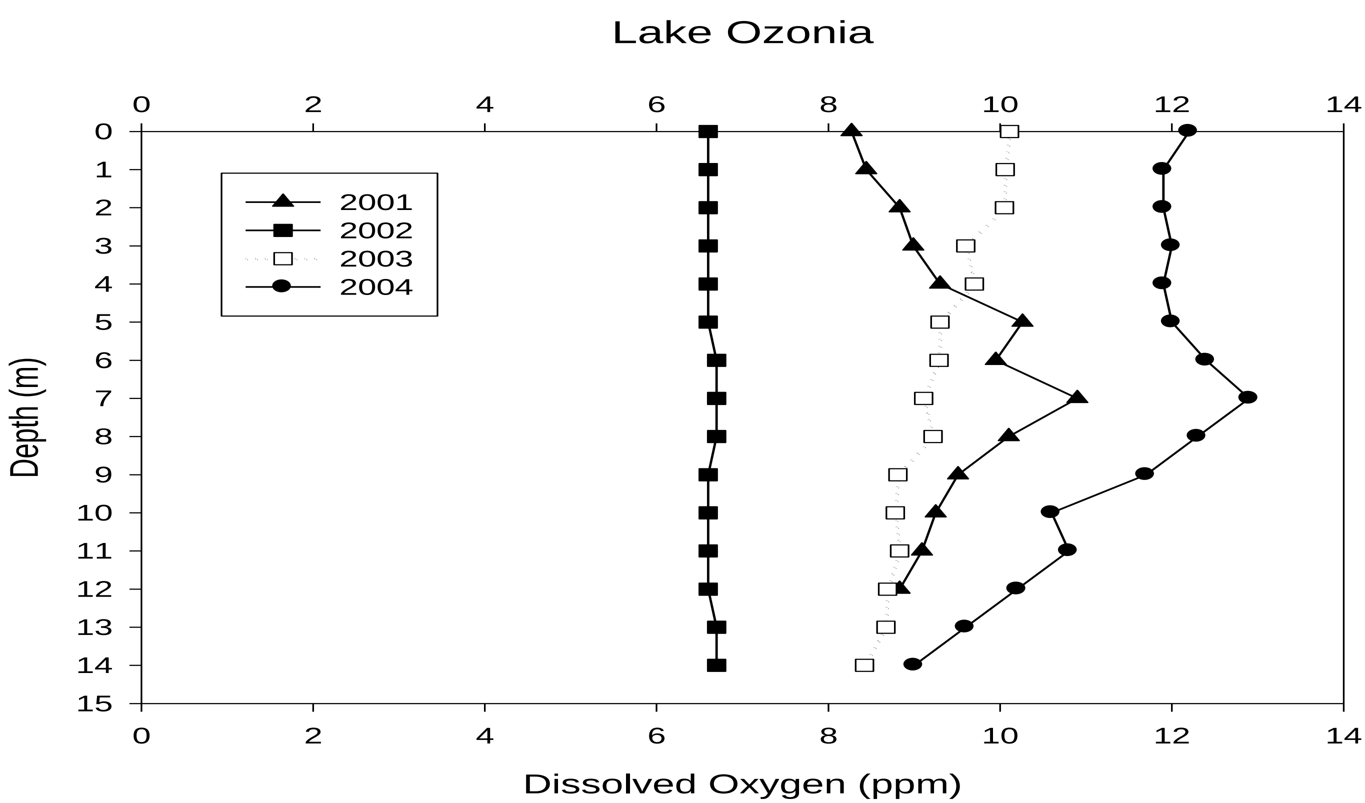
Greenberg, A.E., Eaton, A.D., and Leseri, L.A. (editors). (2005). Standard Methods for the Examination of Water and Wastewater, 21st Edition. American Public Health Association: Washington, D.C.

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 Ozonia
0 2 4 6 8 10 12 14 16 18
2001
2002
2003
2004
Depth (m)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Temperature (*C)

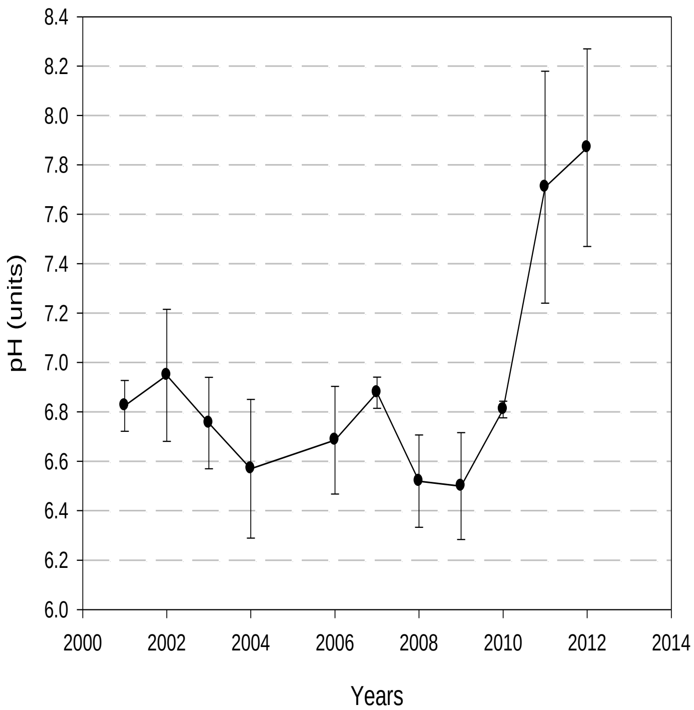

Lake Ozonia
0 2 4 6 8 10 12 14
2001
2002
2003
2004
Depth (m)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Dissolved Oxygen (ppm)

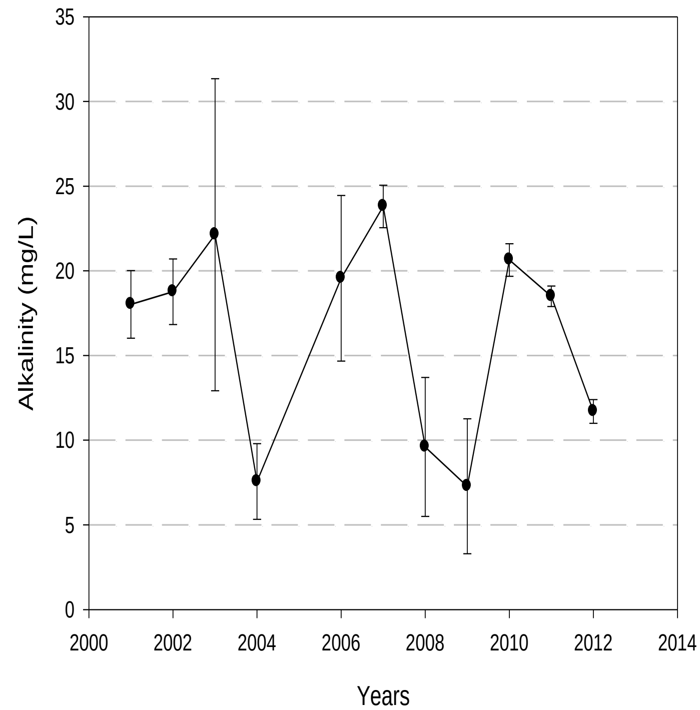
Source	Lake/Pond Name	Sampling Location	Sampling Date	pH (units)	Alkalinity (mg/L)	Conductivity (μohms/cm)	Color (Pt-Co)	Total P (mg/L)	Chl a (μg/l)
AAI	Lake Ozonia	Epilimnion	05/14/01	6.7300	19.2000	35.5000	9.0000	0.0140	6.7000
Vol	Lake Ozonia	Deephole	05/14/01	6.8300	19.6000	35.5000	14.0000	0.0150	6.4000
Vol	Lake Ozonia	Deephole	6/17/2001	6.7600	15.6000	34.4000	54.0000	0.0150	6.9000
Vol	Lake Ozonia	Deephole	7/22/2001	6.8600	18.0000	34.0000	60.0000	0.0110	2.9500
Vol	Lake Ozonia	Deephole	8/19/2001	6.7600	15.6000	21.8000	50.0000	0.0090	1.6900
Vol	Lake Ozonia	Deephole	9/22/2001	7.0100	20.1000	32.0000	36.0000	0.0100	1.9200
AAI	Lake Ozonia	Hypolimnion	05/14/01	6.2000	20.4000	36.2000	31.0000	0.0140	
			MIN	6.7300	15.6000	21.8000	9.0000	0.0090	1.6900
			MAX	7.0100	20.1000	35.5000	60.0000	0.0150	6.9000
			MEAN	6.8250	18.0167	32.2000	37.1667	0.0123	4.4267
			Std Dev	0.1029	1.9964	5.2547	21.4515	0.0027	2.4953
AWI	Lake Ozonia	Epilimnion	5/21/2002	7.1900	19.0000	36.3000	28.0000	0.0100	6.0800
Vol	Lake Ozonia	Deephole	5/25/2002	6.9300	16.8000	30.2000	14.0000	0.0300	9.1500
Vol	Lake Ozonia	Deephole	6/23/2002	6.6500	16.0000	29.2000	15.0000	0.0300	1.2300
Vol	Lake Ozonia	Deephole	7/28/2002	7.2500	20.8000	33.0000	7.0000	0.0400	1.3300
Vol	Lake Ozonia	Deephole	8/31/2002	7.0500	20.0000	33.7000	15.0000	0.0400	1.2300
Vol	Lake Ozonia	Deephole	10/6/2002	6.6200	20.0000	34.1000	11.0000	0.0400	8.0700
			MEAN	6.9483	18.7667	32.7500	15.0000	0.0317	4.5150
			Std Dev	0.2672	1.9367	2.6266	7.0711	0.0117	3.6959
AWI	Lake Ozonia	Hypolimnion	5/21/2002	7.2200	19.8000	33.0000	19.0000	0.0100	
AWI	Lake Ozonia	Epilimnion	5/13/2003	6.5000	20.0000	43.0000	9.0000	0.0120	1.9100
Vol	Lake Ozonia	Deephole	5/18/2003	6.7900	6.0000	29.0000	53.0000	0.0100	1.4400
Vol	Lake Ozonia	Deephole	6/16/2003	6.9600	30.0000	71.2000	39.0000	0.0100	1.5600
Vol	Lake Ozonia	Deephole	7/19/2003	6.9600	32.0000	71.6000	35.0000	0.0160	5.2100
Vol	Lake Ozonia	Deephole	8/23/2003	6.6200	22.0000	53.0000	35.0000	0.0120	2.1400
Vol	Lake Ozonia	Deephole	9/21/2003	6.7000	22.8000	25.4000	30.0000	0.0110	2.0200
			Mean	6.7550	22.1333	48.8667	33.5000	0.0118	2.3800
			Std Dev	0.1852	9.2145	20.0622	14.3353	0.0022	1.4123
AWI	Lake Ozonia	Hypolimnion	5/13/2003	6.5200	27.0000	18.0000	21.0000	0.0140	
AWI	Lake Ozonia	Epilimnion	5/27/2004	6.5900	10.0000	32.0000	0.0000	0.0100	2.0200
Vol	Lake Ozonia	Deephole	6/27/2004	6.9200	10.0000	34.6000	25.0000	0.0070	2.4600
Vol	Lake Ozonia	Deephole	7/25/2004	6.3000	6.0000	34.8000	22.0000	0.0090	3.5100
Vol	Lake Ozonia	Deephole	8/21/2004	6.7600	5.8000	31.4000	18.0000	0.0130	1.8400
Vol	Lake Ozonia	Deephole	9/26/2004	6.2800	6.0000	35.6000	38.0000	0.0120	2.8900
			Mean	6.5700	7.5600	33.6800	20.6000	0.0102	2.5440
			Std Dev	0.2811	2.2289	1.8580	13.7405	0.0024	0.6764
AWI	Lake Ozonia	Hypolimnion	5/27/2004	6.4800	6.0000	33.0000	4.0000	0.0100	
Vol	Lake Ozonia	Deephole	5/29/2006	6.7200	20.8000	45.1000	26.0000	0.0180	5.0200
Vol	Lake Ozonia	Deephole	7/9/2006	6.6200	18.0000	40.2000	21.0000	0.0140	3.0500
Vol	Lake Ozonia	Deephole	7/30/2006	6.9700	24.8000	44.8000	32.0000	0.0100	1.9500
Vol	Lake Ozonia	Deephole	8/26/2006	6.7500	22.2000	45.5000	13.0000	0.0120	2.8700
Vol	Lake Ozonia	Deephole	9/24/2006	6.3700	12.0000	44.9000	34.0000	0.0160	4.1700
			Mean	6.6860	19.5600	44.1000	25.2000	0.0140	3.4120
			Std Dev	0.2180	4.8875	2.1966	8.5264	0.0032	1.1961

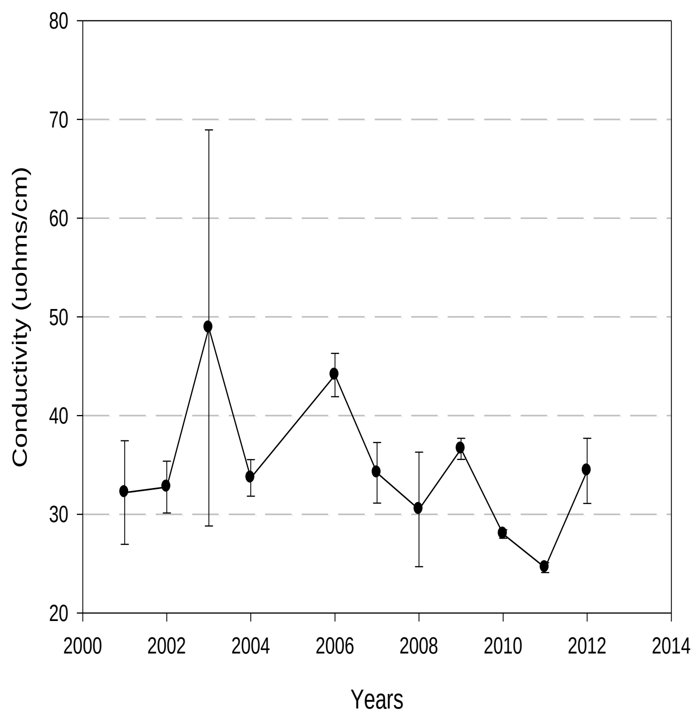
Source	Lake/Pond Name	Sampling Location	Sampling Date	pH (units)	Alkalinity (mg/L)	Conductivity (μohms/cm)	Color (Pt-Co)	Total P (mg/L)	Chl a (μg/l)
Vol	Lake Ozonia	Deephole	5/26/2007	6.8100	22.2000	37.4000	16.0000	0.0080	1.8200
Vol	Lake Ozonia	Deephole	6/25/2007	6.9800	25.2000	30.3000	12.0000	0.0140	3.6700
Vol	Lake Ozonia	Deephole	7/29/2007	6.8800	24.6000	31.7000	7.0000	0.0180	4.4400
Vol	Lake Ozonia	Deephole	8/26/2007	6.8700	24.2000	36.4000	50.0000	0.0130	3.7100
Vol	Lake Ozonia	Deephole	9/22/2007	6.8500	22.8000	35.2000	30.0000	0.0130	3.8600
			Mean	6.8780	23.8000	34.2000	23.0000	0.0132	3.5000
			Std Dev	0.0630	1.2570	3.0635	17.3494	0.0036	0.9885
Vol	Lake Ozonia	Deephole	5/31/2008	6.5200	10.0000	35.0000	31.0000	0.0160	4.8800
Vol	Lake Ozonia	Deephole	6/30/2008	6.5200	10.0000	21.9000	20.0000	0.0170	4.9900
Vol	Lake Ozonia	Deephole	7/27/2008	6.3500	6.0000	35.2000	25.0000	0.0200	5.8700
Vol	Lake Ozonia	Deephole	8/31/2008	6.8300	16.0000	27.2000	23.0000	0.0120	2.8500
Vol	Lake Ozonia	Deephole	10/5/2008	6.4000	6.0000	33.3000	23.0000	0.0180	5.1200
			Mean	6.5240	9.6000	30.5200	24.4000	0.0166	4.7420
			Std Dev	0.1866	4.0988	5.8101	4.0988	0.0030	1.1264
Vol	Lake Ozonia	Deephole	5/24/2009	6.5900	10.8000	35.9000	46.0000	0.0150	3.1000
Vol	Lake Ozonia	Deephole	6/30/2009	6.3600	4.4000	36.9000	89.0000	0.0170	4.2000
Vol	Lake Ozonia	Deephole	7/26/2009	6.3200	4.4000	35.4000	8.0000	0.0120	3.3000
Vol	Lake Ozonia	Deephole	8/24/2009	6.3900	4.4000	36.7000	8.0000	0.0140	3.8000
Vol	Lake Ozonia	Deephole	9/21/2009	6.8400	12.4000	38.2000	29.0000	0.0180	5.2000
			Mean	6.5000	7.2800	36.6200	36.0000	0.0152	3.9200
			Std Dev	0.2167	3.9840	1.0710	33.6378	0.0024	0.8349
Vol	Lake Ozonia	Deephole	5/23/2010	6.7700	19.6000	28.3000	14.0000	0.0150	4.0500
Vol	Lake Ozonia	Deephole	6/25/2010	6.7800	19.6000	28.2000	19.0000	0.0170	4.8200
Vol	Lake Ozonia	Deephole	7/26/2010	6.8300	21.2000	28.0000	15.0000	0.0190	6.0800
Vol	Lake Ozonia	Deephole	8/24/2010	6.8500	21.6000	27.3000	17.0000	0.0120	2.8700
Vol	Lake Ozonia	Deephole	10/18/2010	6.8100	21.2000	28.3000	29.0000	0.0190	6.1100
			Mean	6.8080	20.6400	28.0200	18.8000	0.0164	4.7860
			Std Dev	0.0335	0.9633	0.4207	6.0166	0.0030	1.3821
Vol	Lake Ozonia	Deephole	5/21/2011	8.0500	19.2000	24.7000	52.0000	0.0140	7.8900
Vol	Lake Ozonia	Deephole	7/2/2011	7.9100	18.4000	25.1000	31.0000	0.0320	4.9200
Vol	Lake Ozonia	Deephole	8/5/2011	7.1800	18.0000	24.1000	24.0000	0.0130	3.9800
			Mean	7.7133	18.5333	24.6333	35.6667	0.0197	5.5967
			Std Dev	0.4672	0.6110	0.5033	14.5717	0.0107	2.0409
Vol	Lake Ozonia	Deephole	6/16/2012	8.2000	11.4000	35.7000	21.0000	0.0140	4.8700
Vol	Lake Ozonia	Deephole	8/18/2012	7.9900	11.2000	30.7000	10.0000	0.0220	4.1500
Vol	Lake Ozonia	Deephole	10/7/2012	7.4200	12.5000	36.9000	12.0000	0.0240	4.2700
			Mean	7.8700	11.7000	34.4333	14.3333	0.0200	4.4300
			Std Dev	0.4036	0.7000	3.2884	5.8595	0.0053	0.3857

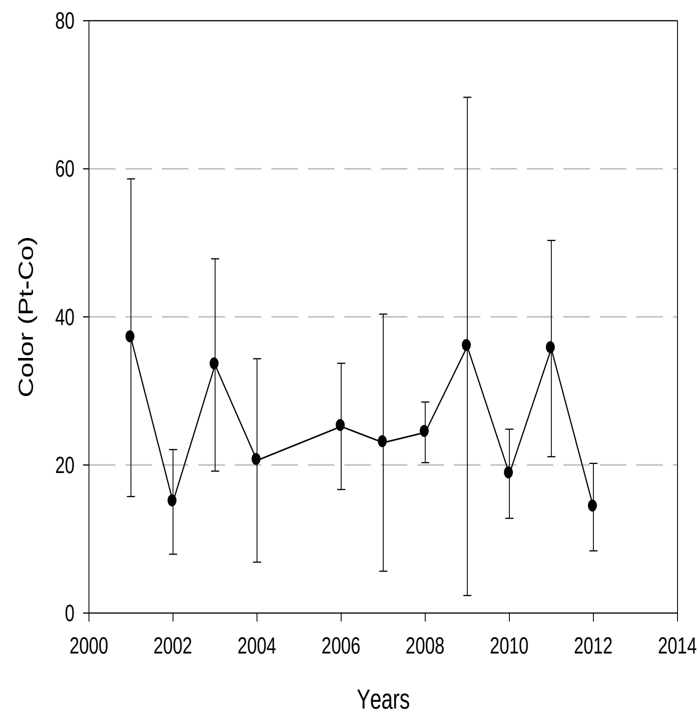
Source	Lake/Pond Name	Sampling Location	Sampling Date	Secchi (meters)	Nitrate (mg/L)	Calcium (mg/L)	Chloride (mg/L)	Aluminum (mg/L)	CSI
AAI	Lake Ozonia	Epilimnion	05/14/01	3.1000	0.0000	4.4800	1.1000	0.0050	2.6400
Vol	Lake Ozonia	Deephole	05/14/01	3.5000	0.0100				
Vol	Lake Ozonia	Deephole	6/17/2001	3.0000	0.4000				
Vol	Lake Ozonia	Deephole	7/22/2001	5.0000	0.4000				
Vol	Lake Ozonia	Deephole	8/19/2001	7.0000	0.4000				
Vol	Lake Ozonia	Deephole	9/22/2001	6.0000	0.5000				
AAI	Lake Ozonia	Hypolimnion	05/14/01		0.0000	4.5200	1.2000	0.0060	3.1400
			MIN	3.0000	0.0000				
			MAX	7.0000	0.5000				
			MEAN	4.6000	0.2850				
			Std Dev	1.6673	0.2203				
	Lake Ozonia	Epilimnion	5/21/2002	3.2000	0.1000	4.4600	0.0000	0.0010	2.1800
Vol	Lake Ozonia	Deephole	5/25/2002	3.0000	0.1000				
Vol	Lake Ozonia	Deephole	6/23/2002	4.0000	0.2000				
Vol	Lake Ozonia	Deephole	7/28/2002	3.7000	0.1000				
Vol	Lake Ozonia	Deephole	8/31/2002	4.0000	0.2000				
Vol	Lake Ozonia	Deephole	10/6/2002	3.0000	0.2000				
			MEAN	3.4833	0.1500				
			Std Dev	0.4750	0.0548				
AWI	Lake Ozonia	Hypolimnion	5/21/2002		0.1000	4.5200	1.2000	0.0010	2.1300
AWI	Lake Ozonia	Epilimnion	5/13/2003	4.0000	0.5000	5.4600	1.0000	0.0060	2.7600
Vol	Lake Ozonia	Deephole	5/18/2003	4.9000	0.9000				
Vol	Lake Ozonia	Deephole	6/16/2003	5.5000	0.7000				
Vol	Lake Ozonia	Deephole	7/19/2003	3.6000	0.4000				
Vol	Lake Ozonia	Deephole	8/23/2003	4.3000	0.6000				
Vol	Lake Ozonia	Deephole	9/21/2003	4.5000	0.5000				
			Mean	4.4667	0.6000				
			Std Dev	0.6713	0.1789				
AWI	Lake Ozonia	Hypolimnion	5/13/2003	4.0000	0.4000	5.6200	1.0000	0.0020	2.5700
AWI	Lake Ozonia	Epilimnion	5/27/2004	5.2000	0.6000	3.9100	0.0000	0.0000	3.1200
Vol	Lake Ozonia	Deephole	6/27/2004	4.6000	0.0000				
Vol	Lake Ozonia	Deephole	7/25/2004	5.5000	0.0000				
Vol	Lake Ozonia	Deephole	8/21/2004	4.3000	0.0000				
Vol	Lake Ozonia	Deephole	9/26/2004	4.6000	0.0000				
			Mean	4.8400	0.1200				
			Std Dev	0.4930	0.2683				
AWI	Lake Ozonia	Hypolimnion	5/27/2004		0.6000	2.8700	0.0000	0.0000	3.6800
Vol	Lake Ozonia	Deephole	5/29/2006	3.3000	0.1000				
Vol	Lake Ozonia	Deephole	7/9/2006	4.2000	0.0000				
Vol	Lake Ozonia	Deephole	7/30/2006	5.2000	0.1000				
Vol	Lake Ozonia	Deephole	8/26/2006	4.4000	0.2000				
Vol	Lake Ozonia	Deephole	9/24/2006	3.3000	0.1000				
			Mean	4.0800	0.1000				
			Std Dev	0.8044	0.0707				

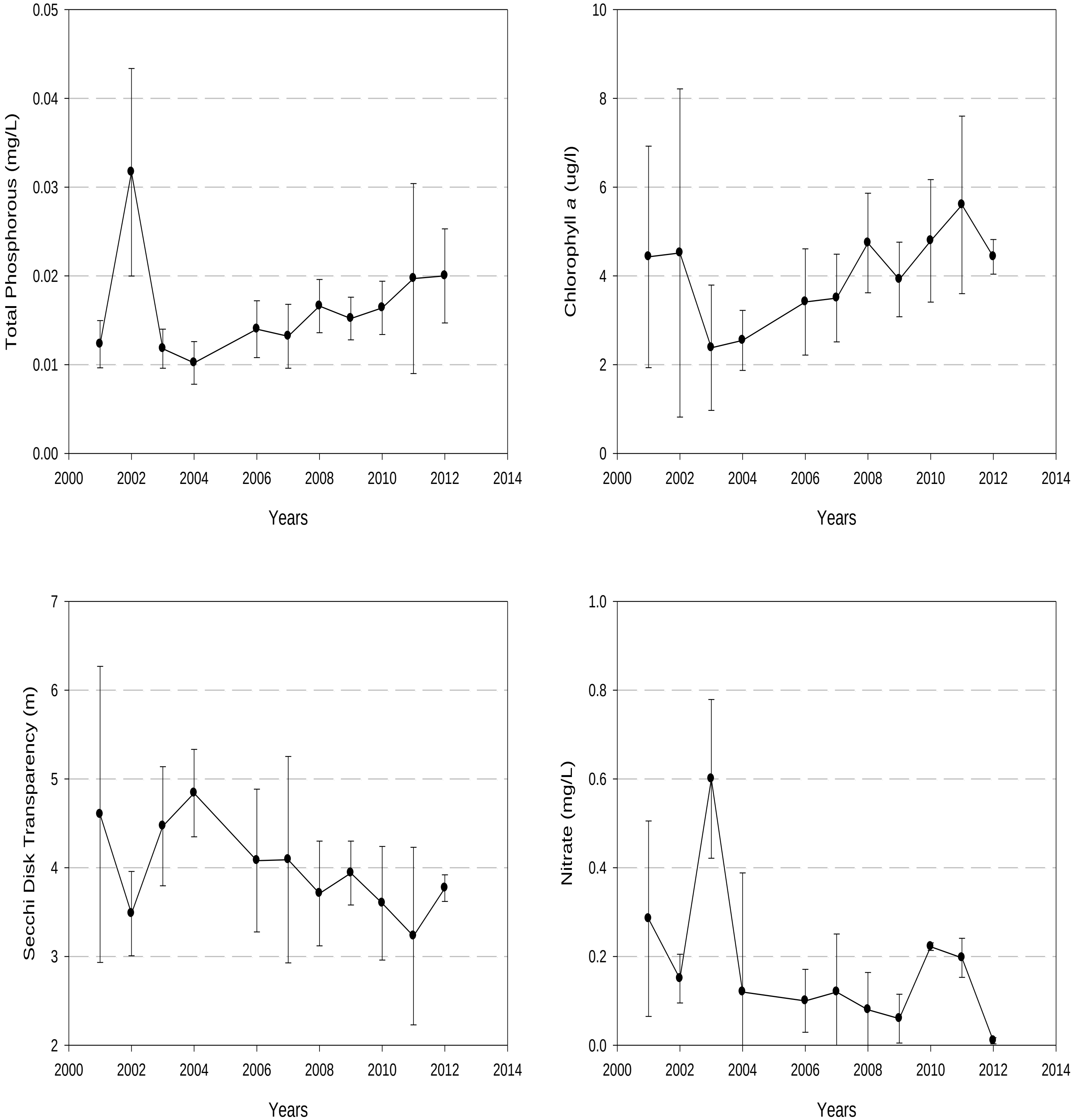
Source	Lake/Pond Name	Sampling Location	Sampling Date	Secchi (meters)	Nitrate (mg/L)	Calcium (mg/L)	Chloride (mg/L)	Aluminum (mg/L)	CSI
Vol	Lake Ozonia	Deephole	5/26/2007	6.1000	0.3000				
Vol	Lake Ozonia	Deephole	6/25/2007	3.7000	0.2000				
Vol	Lake Ozonia	Deephole	7/29/2007	3.1000	0.0000				
Vol	Lake Ozonia	Deephole	8/26/2007	3.7000	0.0000				
Vol	Lake Ozonia	Deephole	9/22/2007	3.8000	0.1000				
			Mean	4.0800	0.1200				
			Std Dev	1.1628	0.1304				
Vol	Lake Ozonia	Deephole	5/31/2008	3.8500	0.2000				
Vol	Lake Ozonia	Deephole	6/30/2008	3.7000	0.0000				
Vol	Lake Ozonia	Deephole	7/27/2008	3.0000	0.1000				
Vol	Lake Ozonia	Deephole	8/31/2008	4.6000	0.1000				
Vol	Lake Ozonia	Deephole	10/5/2008	3.4000	0.0000				
			Mean	3.7100	0.0800				
			Std Dev	0.5941	0.0837				
Vol	Lake Ozonia	Deephole	5/24/2009	4.0000	0.1000	3.3200	1.5000	0.0090	3.2000
Vol	Lake Ozonia	Deephole	6/30/2009	3.8000	0.1000				
Vol	Lake Ozonia	Deephole	7/26/2009	4.3000	0.0000				
Vol	Lake Ozonia	Deephole	8/24/2009	4.2000	0.1000				
Vol	Lake Ozonia	Deephole	9/21/2009	3.4000	0.0000				
			Mean	3.9400	0.0600				
			Std Dev	0.3578	0.0548				
Vol	Lake Ozonia	Deephole	5/23/2010	3.9000	0.2300	4.3800	2.5000	0.0200	
Vol	Lake Ozonia	Deephole	6/25/2010	3.6000	0.2300	4.2800	2.4000	0.0400	
Vol	Lake Ozonia	Deephole	7/26/2010	3.0000	0.2200	4.3100	2.3000	0.0300	
Vol	Lake Ozonia	Deephole	8/24/2010	4.5000	0.2100	4.4900	1.9000	0.0400	
Vol	Lake Ozonia	Deephole	10/18/2010	3.0000	0.2200	4.3800	0.6150	0.0200	
			Mean	3.6000	0.2220	4.3680	1.9430	0.0300	
			Std Dev	0.6364	0.0084	0.0811	0.7765	0.0100	
Vol	Lake Ozonia	Deephole	5/21/2011	2.1000	0.2480	3.3300	2.1500	0.1700	
Vol	Lake Ozonia	Deephole	7/2/2011	3.6000	0.1710	3.7100	1.5000	0.1800	
Vol	Lake Ozonia	Deephole	8/5/2011	4.0000	0.1710	3.3200	1.6000	0.1700	
			Mean	3.2333	0.1967	3.4533	1.7500	0.1733	
			Std Dev	1.0017	0.0445	0.2223	0.3500	0.0058	
Vol	Lake Ozonia	Deephole	6/16/2012	3.6000	0.0180	3.6200	1.1000	0.1290	
Vol	Lake Ozonia	Deephole	8/18/2012	3.9000	0.0060	3.3900	1.0300	0.0990	
Vol	Lake Ozonia	Deephole	10/7/2012	3.8000	0.0070	4.0000	1.2100	0.1080	
			Mean	3.7667	0.0103	3.6700	1.1133	0.1120	2.8900
			Std Dev	0.1528	0.0067	0.3081	0.0907	0.0154	

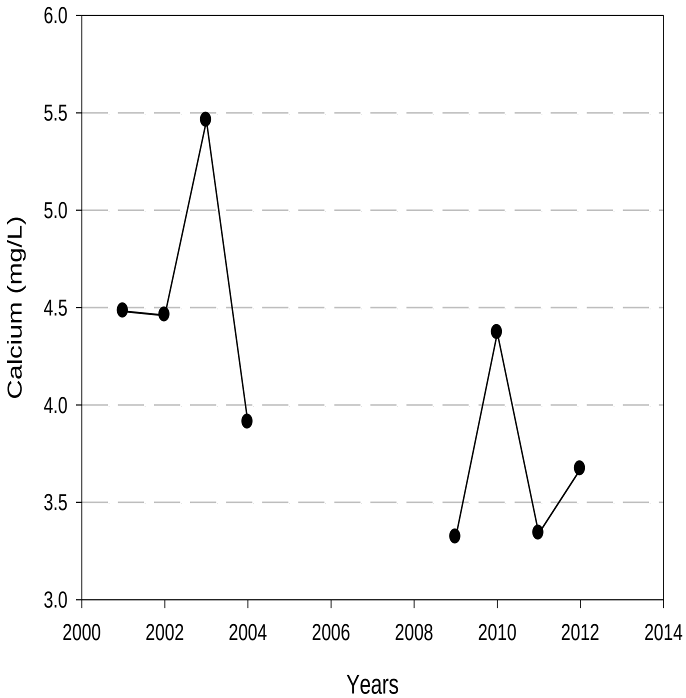

8.4
8.2
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
6.0
pH (units)
2000
2002
2004
2006
2008
2010
2012
2014
Years


35
30
25
20
15
10
5
0
Alkalinity (mg/L)
2000
2002
2004
2006
2008
2010
2012
2014
Years

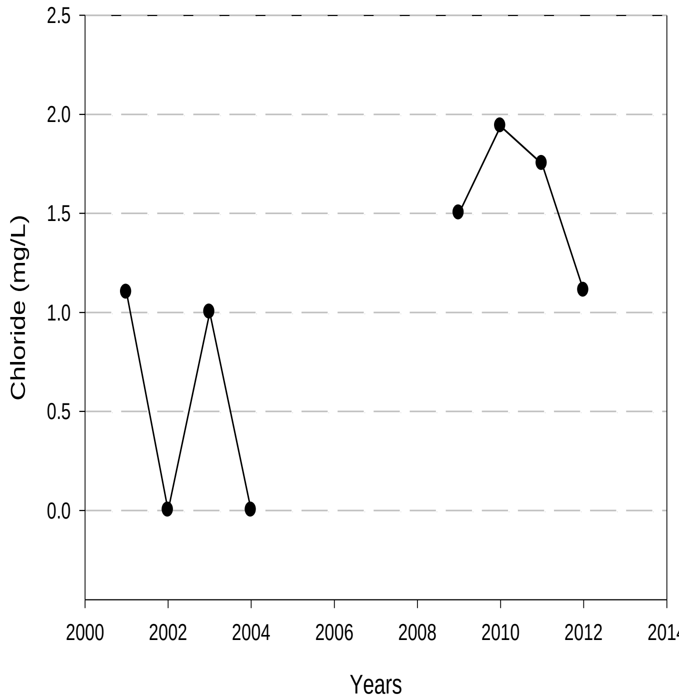

80
70
60
50
40
30
20
Conductivity (uohms/cm)
2000
2002
2004
2006
2008
2010
2012
2014
Years


80
60
40
20
0
Color (Pt-Co)
2000
2002
2004
2006
2008
2010
2012
2014
Years

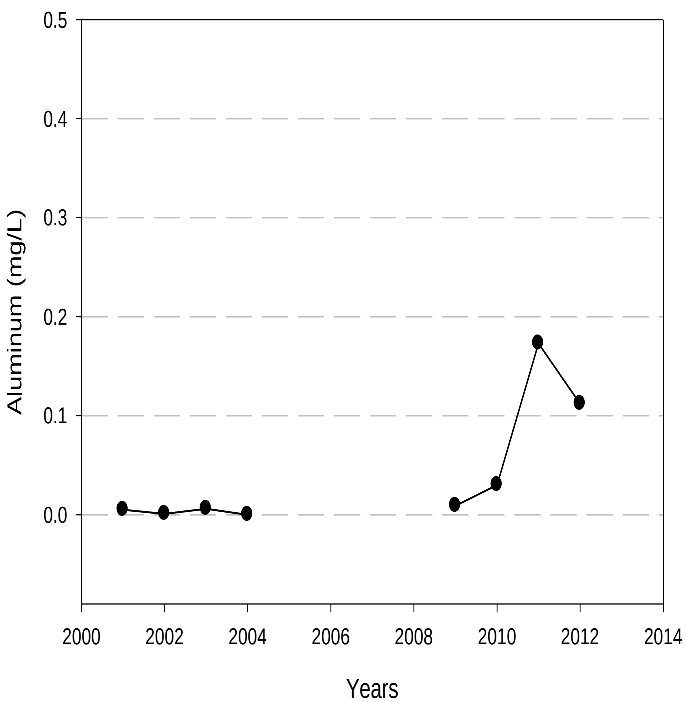

Total Phosphorous (mg/L)
Years
Chlorophyll a (ug/l)
Years
Secchi Disk Transparency (m)
Years
Nitrate (mg/L)
Years



Calcium (mg/L)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2000
2002
2004
2006
2008
2010
2012
2014
Years



Chloride (mg/L)
2.5
2.0
1.5
1.0
0.5
0.0
2000
2002
2004
2006
2008
2010
2012
2014
Years



Aluminum (mg/L)
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
Years