New York State Energy Research and Development Authority

The Adirondack Long-Term Monitoring Lakes: A Compendium of Site Descriptions, Recent Chemistry and Selected Research Information

Final Report

August 2011

nyserda Energy. Innovation. Solutions.

NYSERDA's Promise to New Yorkers:

New Yorkers can count on NYSERDA for objective, reliable, energy-related solutions delivered by accessible, dedicated professionals.

Our Mission: Advance innovative energy solutions in ways that improve New York's economy and environment.

Our Vision: Serve as a catalyst—advancing energy innovation and technology, transforming New York's economy, and empowering people to choose clean and efficient energy as part of their everyday lives.

Our Core Values: Objectivity, integrity, public service, and innovation.

Our Portfolios

NYSERDA programs are organized into five portfolios, each representing a complementary group of offerings with common areas of energy-related focus and objectives.

Energy Efficiency & Renewable Programs

Helping New York to achieve its aggressive clean energy goals – including programs for consumers (commercial, municipal, institutional, industrial, residential, and transportation), renewable power suppliers, and programs designed to support market transformation.

Energy Technology Innovation & Business Development

Helping to stimulate a vibrant innovation ecosystem and a clean energy economy in New York – including programs to support product research, development, and demonstrations, clean-energy business development, and the knowledge-based community at the Saratoga Technology + Energy Park.

Energy Education and Workforce Development

Helping to build a generation of New Yorkers ready to lead and work in a clean energy economy – including consumer behavior, K-12 energy education programs, and workforce development and training programs for existing and emerging technologies.

Energy and the Environment

Helping to assess and mitigate the environmental impacts of energy production and use – including environmental research and development, regional initiatives to improve environmental sustainability, and West Valley Site Management.

Energy Data, Planning and Policy

Helping to ensure that policy-makers and consumers have objective and reliable information to make informed energy decisions – including State Energy Planning, policy analysis to support the Low-Carbon Fuel Standard and Regional Greenhouse Gas Initiative, nuclear policy coordination, and a range of energy data reporting including *Patterns and Trends*.

THE ADIRONDACK LONG-TERM MONITORING LAKES: A COMPENDIUM OF SITE DESCRIPTIONS, RECENT CHEMISTRY AND SELECTED RESEARCH INFORMATION

Final Report

Prepared for the

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

Albany, NY
www.nyserda.org

Gregory Lampman
Project Manager

Prepared by:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Karen Roy

ADIRONDACK LAKES SURVEY CORPORATION
Nathan Houck, Pamela Hyde, Michael Cantwell, and Jeffery Brown

NYSERDA Report 11-12 | NYSERDA 4915 | August 2011

Acknowledgements

Support for this work was provided by the New York State Energy Research and Development Authority, and the New York State Department of Environmental Conservation, as part of the Adirondack Long Term Monitoring (ALTM) work conducted by the Adirondack Lakes Survey Corporation. The ALTM work is partially supported by the U.S. Environmental Protection Agency and the U.S. Geological Survey. This report has not been reviewed by the sponsoring or supporting agencies and therefore no official endorsement should be inferred nor construed to represent their practices and policies.

We are grateful to the United Kingdom Acid Waters Monitoring Network http://awmn.defra.gov.uk for their superb organization of site details that helped frame our efforts. K. Civerolo , C. T. Driscoll, H. A. Simonin, M. Mitchell, and M. Watson provided very helpful comments with early format and contents. Special thanks to G. Lampman for his efforts to finalize the project. The following ALSC staff members provided review assistance throughout the numerous drafts: Susan Capone, Robert Fiorentino, and Matthew Kelting. And special thanks to Monica Schmidt for the tireless hours she spent editing the manuscript.

Contents

Acknowledgements ii
Lakes by Name..................... v
Introduction..................... vi
Common References..................... ix
List of Abbreviations & Units..................... x

Lake identification no.	Watershed	Lake name	Page No.
020058	Lake Champlain	Little Hope Pond	1
020059	Lake Champlain	Big Hope Pond	5
020126	Lake Champlain	Little Echo Pond	11
020138	Lake Champlain	East Copperas Pond	17
020143	Lake Champlain	Middle Pond	21
020188	Lake Champlain	Sunday Pond	27
020197	Lake Champlain	Sochia Pond	33
020233	Lake Champlain	Owen Pond	37
020264	Lake Champlain	Heart Lake	43
020265	Lake Champlain	Marcy Dam Pond	49
030171	St. Lawrence	Grass Pond	53
030172	St. Lawrence	Little Clear Pond	57
030255 & 030256	St. Lawrence	Black Pond & Black Pond Stream	63
040186	Oswegatchie-Black	Loon Hollow Pond	69
040210	Oswegatchie-Black	Willys Lake	73
40576	Oswegatchie-Black	Woods Lake	77
040704	Oswegatchie-Black	Middle Settlement Lake	83
040706	Oswegatchie-Black	Grass Pond	89
040707	Oswegatchie-Black	Middle Branch Lake	95
040739	Oswegatchie-Black	Lake Rondaxe	101
040746	Oswegatchie-Black	Moss Lake	109
040747 & 040747A	Oswegatchie-Black	Cascade Lake & Cascade Lake Stream	115
040748	Oswegatchie-Black	Bubb Lake & Bubb Lake Stream	121
040750	Oswegatchie-Black	Dart Lake	129
040750A	Oswegatchie-Black	Windfall Pond	137
040752	Oswegatchie-Black	Big Moose Lake	143
040753	Oswegatchie-Black	West Pond & West Pond Stream	151
040754	Oswegatchie-Black	Squash Pond & Squash Pond Stream	159
040777	Oswegatchie-Black	Constable Pond & Constable Pond Stream	165
040826	Oswegatchie-Black	Limekiln Lake	173
040850	Oswegatchie-Black	Squaw Lake	179
040852	Oswegatchie-Black	Indian Lake	185
040874	Oswegatchie-Black	Brook Trout Lake	191
040887	Oswegatchie-Black	Lost Pond	197
040905	Oswegatchie-Black	Barnes Lake	201
041004	Oswegatchie-Black	South Lake	205

Lake Identification No.	Watershed	Lake Name	Page No.
041007	Oswegatchie-Black	North Lake	211
050215	Upper Hudson	Willis Lake	217
050259	Upper Hudson	Jockeybush Lake	223
050458	Upper Hudson	Clear Pond	229
050577	Upper Hudson	Nate Pond	235
050649	Upper Hudson	Long Pond	241
050669	Upper Hudson	Carry Pond	245
050684	Upper Hudson	Arbutus Lake	251
050706	Upper Hudson	Lake Colden	257
050707	Upper Hudson	Avalanche Lake	261
060182	Raquette	Little Simon Pond	267
060313	Raquette	Sagamore Lake	273
060315A	Raquette	Raquette Lake Reservoir	279
060329	Raquette	Queer Lake	283
070728 & 070729	Mohawk-Hudson	Otter Lake & Otter Lake Stream	289
070859	Mohawk-Hudson	G Lake	293

Lakes by Name

Arbutus Lake 050684 251
Avalanche Lake 050707 261
Barnes Lake 040905 201
Big Hope Pond 020059 5
Big Moose Lake 040752 143
Black Pond 030256 & Black Pond Stream 030255 63
Brook Trout Lake 040874 191
Bubb Lake & Bubb Lake Stream 040748 121
Carry Pond 050669 245
Cascade Lake 040747 & Cascade Lake Stream 040747A 115
Clear Pond 050458 229
Common References viii
Constable Pond & Constalbe Pond Stream 040777 165
Dart Lake 040750 129
East Copperas Pond 020138 17
G Lake 070859 293
Grass Pond 030171 53
Grass Pond 040706 89
Heart Lake 020264 43
Indian Lake 040852 185
Jockeybush Lake 050259 223
Lake Colden 050706 257
Lake Rondaxe 040739 101
Limekiln Lake 040826 173
Little Clear Pond 030172 57
Little Echo Pond 020126 11
Little Hope Pond 020058 1
Little Simon Pond 060182 267
Long Pond 050649 241
Loon Hollow Pond 040186 69
Lost Pond 040887 197
Marcy Dam Pond 020265 49
Middle Branch Lake 040707 95
Middle Pond 020143 21
Middle Settlement Lake 040704 83
Moss Lake 040746 109
Nate Pond 050577 235
North Lake 041007 211
Otter Lake 070729 & Otter Lake Stream 070728 289
Owen Pond 020233 37
Queer Lake 060329 283
Raquette Lake Reservoir 060315A 279
Sagamore Lake 060313 273
Sochia Pond 020197 33
South Lake 041004 205
Squash Pond & Squash Pond Stream 040754 159
Squaw Lake 040850 179
Sunday Pond 020188 27
West Pond & West Pond Stream 040753 151
Willis Lake 050215 217
Willys Lake 040210 73
Windfall Pond & Windfall Pond Stream 040750A 137
Woods Lake 040576 77

Abstract

The Adirondack Lakes Survey Corporation (ALSC) and the New York State Department of Environmental Conservation (NYSDEC) have compiled a compendium of site descriptions, recent lake chemistry, and selected research information of the fifty-two Adirondack Long Term Monitoring (ALTM) waters. This compilation is distributed free to the public on CDROM and via the web at www.adirondacklakessurvey.org in Adobe PDF format. For each of the fifty-two lakes sampled, descriptions of the geomorphology, recent chemistry, results of historical and recent aquatic biota and fish surveys, intensive studies and research programs, and watershed and land/cover use overviews are provided in an easy-to-use desk reference format. The work is organized by watershed and supplemented with maps and tables that complete the overview for each ALTM water. This work was designed to offer the public, researchers and policy makers an easy reference to the current research and chemistry at the diverse sites represented by the ALTM across the Adirondack Park.

Introduction

This report is a compilation of selected attributes and information that describe the 52 ALTM lakes. The attributes and level of detail are calculated to orient the user to each monitoring site and acquaint the user with the research activity within each watershed. The report is intended for general audiences with a working knowledge of acid rain effects. Nevertheless, the more technical reader may use the report to compare and contrast ALTM sites and cross reference selected intensive research efforts conducted at those and others over the past two decades.

Since the onset of ALTM monitoring, many chemical trend analyses have been conducted and published that refer to the ALTM waters. These analyses are listed on the Common References page. The reader will find additional references specific to each site at the end of each narrative.

This volume only contains descriptions of the 52 ALTM sites. A second report/volume, to be released in the future, will provide additional background information and metadata for each of the attributes and summaries provided.

The ALTM

The Adirondack Long Term Monitoring (ALTM) program was initiated by C.T. Driscoll (Syracuse University) and others to evaluate monthly chemistry of Adirondack lakes. The initial 17 lakes were selected from the Regionalization of the Integrated Lake Watershed Acidification study (Driscoll, C. T. and van Dreason, R.1993). Shortly thereafter, an intensive chemical and biological survey of nearly 1,500 lakes within the Adirondack Park was undertaken by the Adirondack Lakes Survey Corporation (ALSC) and others. This survey was conducted from 1984 through 1987. At the completion of a comprehensive interpretive analyses of the ALSC survey (Baker, J. P. et al. 1990), the ALTM was expanded to 52 lakes to provide a better representation of lakes across the region. Monthly sampling of the 52 lakes began in June 1992.

Lake identification numbers

The New York State Department of Environmental Conservation (NYSDEC) developed an eight character code to uniquely identify all ponded waters within the state. Ponded waters include lakes, reservoirs, ponds, or other non-flowing waterbodies (Swart, J. M. and Bloomfield, J. A. 1985). The first two numbers of the code represent the New York State Biological Survey Volume code, the next four digits define the pond number, and the last two place holders are character qualifiers. New York State has a total of 16 Biological Survey Volume codes, each defines a unique drainage area, six of which are located in the Adirondack ecological zone. The codes applicable to the Adirondacks are found in Table 1.

Table 1. Biological Survey Volume Codes (BSV) in the Adirondacks.

BSV	Drainage
02	Lake Champlain
03	St. Lawrence
04	Oswegatchie-Black
05	Upper Hudson
06	Raquette
07	Mohawk-Hudson

Figure 1 shows the location of the 52 ALTM waters and the six major drainage basins of the Adirondack Park that correspond to the Biological Survey codes and the first two digits of the pond identification numbers. For interpretive purposes, within the Adirondack region the St.Lawrence (03) and Raquette (06) are often combined as one i.e. St. Lawrence-Raquette due to the relatively small areal contribution of the St. Lawrence (Baker, J. P. et al. 1990). Figure 2 identifies the classification criteria applied to the original ALS lakes.

Maps & Tables

Watershed maps are derived from the National Elevation Dataset (NED) 1/3 Arc Second digital product, 10 meter accuracy, developed by the U.S. Geological Survey. The horizontal datum is NAD83. Bathymetric maps, unless otherwise indicated, are produced from field work conducted during the 1984 – 1987 ALTM survey. Chemistry and fish netting/stocking information are from the digital records maintained by the ALSC.

References

Baker, J.P., Gherini, S.A., Christensen, S.W., Munson, R.K., Driscoll, C.T., Newton, R.M., Gallagher, J.M., Reckhow, K.H., and Schofield, C.L. 1990. Adirondack Lakes Survey: An Interpretive Analysis of Fish Communities and Water Chemistry, 1984-1987. Adirondack Lakes Survey Corporation, Ray Brook NY.

Swart, J.M. and Bloomfield, J.A. 1985.Characteristics of New York State Lakes: Gazetteer of Lakes, Ponds and Reservoirs. New York State Department of Environmental Conservation, Albany NY.

Figure 1. ALTM lake and drainage basin locations.

Lake Classifications

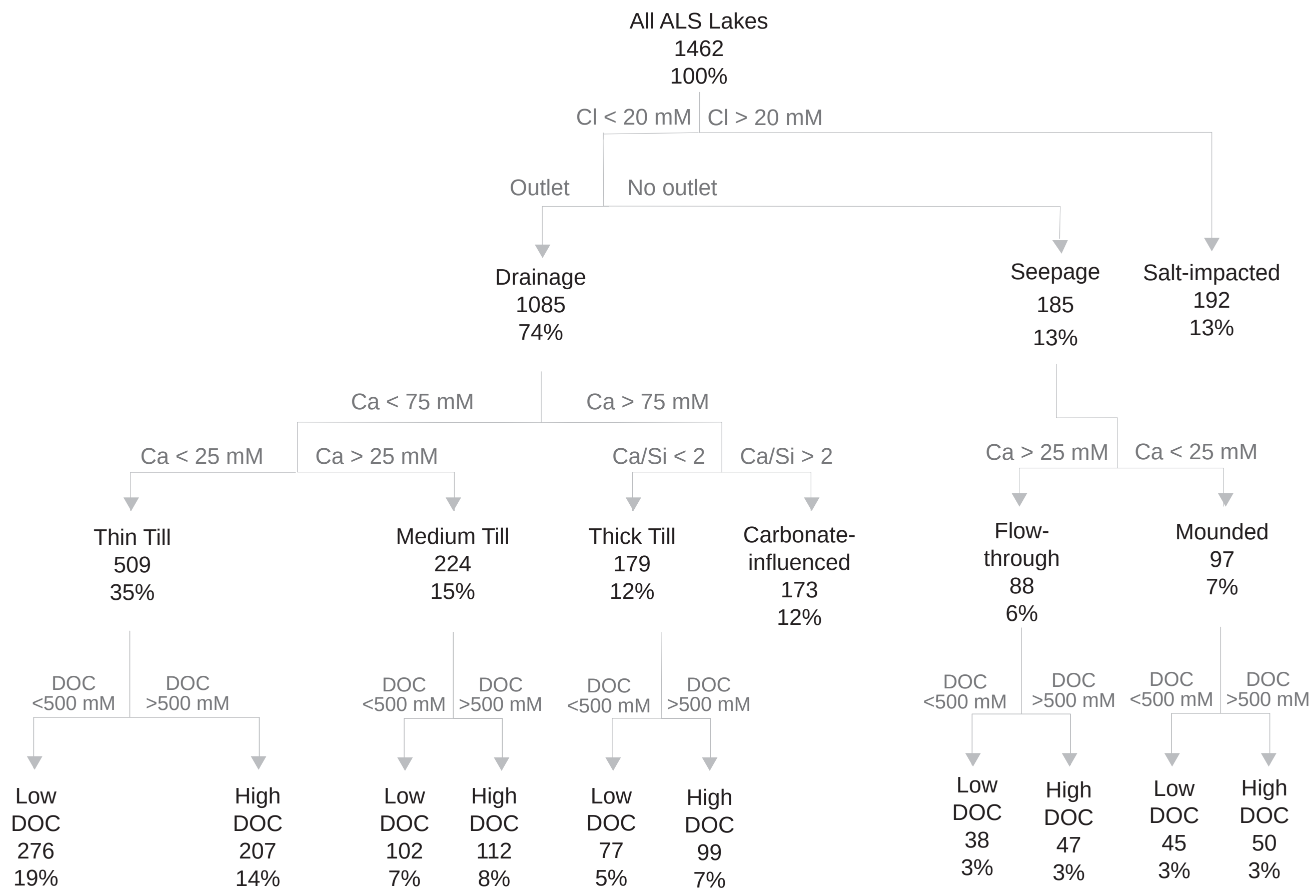


Figure 2. Flow chart of the sequence in which classification criteria were applied to the original ALS lakes. Each entry shows the total number of lakes in that class and the percentage of the total that class represents. Seven lakes were not classified as they did not meet quality assurance criteria. Lakes with missing parameters were not sub-classified.

From: Newton and Driscoll, “Classification of ALSC lakes”, in Baker et al. 1990 Adirondack Lakes Survey: An Interpretive Analysis of Fish Communities and Water Chemistry. 1984-87. Adirondack Lakes Survey Corporation, Ray Brook, NY (www.adirondacklakessurvey.org/charts/classflow.htm).

Common References

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Postek,K.M., Kretser,W.A., and Raynal,D.J. 1995. Long-term trends in the chemistry of precipitation and lake water in the Adirondack region of New York, USA. Water, Air, and Soil Pollution 85: 583-588.

Driscoll,C.T., Newton,R.M., Gubala,C.P., Baker,J.P., and Christensen,S.W. 1991. Adirondack Mountains. In Acidic Deposition and Aquatic Ecosystems: Regional Case Studies. Edited by D.F.Charles. Springer-Verlag, New York, NY pp. 133-211.

Driscoll,C.T. and Van Dreason,R. 1993. Seasonal and long-term temporal patterns in the chemistry of Adirondack lakes. Water, Air, and Soil Pollution 67: 319-344.

Driscoll,C.T., Postek,K.M., Mateti,D., Sequeira,K., Aber,J.D., Kretser,W.A., Mitchell,M.J., and Raynal,D.J. 1998. The response of lake water in the Adirondack region of New York to changes in acidic deposition. Environmental Science & Policy 1: 185-198.

Driscoll,C.T., Driscoll,K.M., Roy,K.M., and Mitchell,M.J. 2003. Chemical response of lakes in the Adirondack region of New York to declines in acidic deposition. Environmental Science & Technology 37: 2036-2042.

Driscoll,C.T., Driscoll,K.M., Roy,K.M., and Dukett,J. 2007. Changes in the chemistry of lakes in the Adirondack region of New York following declines in acidic deposition. Applied Geochemistry 1181-1188.

Jenkins,J., Roy,K., Driscoll,C., and Buerkett,C. 2007. Acid Rain and the Adirondacks: An Environmental History. Cornell University Press, Ithaca NY and London UK.

Kahl,J.S., Stoddard,J.L., Paulsen,S.G., Birnbaum,R., Deviney,F.A., Webb,J.R., DeWalle,D.R., Sharpe,W., Driscoll,C.T., Herlihy,A.T., Kellogg,J.H., Murdoch,P.S., Roy,K., Webster,K.E., and Urquhart,N.S. 2004. Have U.S. surface waters responded to the 1990 Clean Air Act Amendments? Environmental Science & Technology 38: 484A-490A.

Stoddard,J.L., Jeffries,D.S., Lükewille,A., Clair,T.A., Dillon,P.J., Driscoll,C.T., Forsius,M., Johannessen,M., Kahl,J.S., Kellogg,J.H., Kemp,A., Mannio,J., Monteith,D.T., Murdoch,P.S., Patrick,S., Rebsdorf,A., Skjelkvåle,B.L., Stainton,M.P., Traaen,T., van Dam,H., Webster,K.E., Wieting,J., and Wilander,A. 1999. Regional trends in aquatic recovery from acidification in North America and Europe. Nature 401: 575-578.

Stoddard, J. L., Kahl, J. S., Deviney, F. A., DeWalle, D. R., Driscoll, C. T., Herlihy, A. T., Kellogg, J. H., Murdoch, P. S., Webb, J. R., and Webster, K. E. 2003. Response of surface water chemistry to the Clean Air Act Amendments of 1990. United States Environmental Protection Agency No. EPA620/R-03/001.

Glossary of Terms

$\mu eq\ L^{-1}$	microequivalent per liter
$\mu g\ kg^{-1}$	microgram per kilogram
$\mu g\ m^{-2}$	microgram per square meter
$\mu mol\ C\ L^{-1}$	micromole carbon per liter
$\mu mol\ L^{-1}$	micromole per liter
$\mu S\ cm^{-1}$	microsiemens per centimeter
ACLP	Adirondack Cooperative Loon Project
AEAP	Adirondack Effects Assessment Program
AERP	Adirondack Episodic Response Project
AIREQPH	air equilibrated pH
ALIM	inorganically complexed aluminum
ALOM	organically complexed aluminum
ALS	Adirondack Lakes Survey (1980s)
ALSC	Adirondack Lakes Survey Corporation
ALTD	total dissolved aluminum
ALTM	Adirondack Long Term Monitoring Program
AMMP	Adirondack Manipulation and Modeling Project
ANC	Acid Neutralizing Capacity
APA	Adirondack Park Agency
C_A	summed concentration of acid anions
C^{2+}	calcium ion
CASTNET	Clean Air Status and Trends Network
C_B	summed concentration of base cations
Cl^-	chloride ion
DDRP	Direct/Delayed Response Project
DIC	Dissolved Inorganic Carbon
DOC	Dissolved Organic Carbon
ELS	Eastern Lakes Survey
EMAP	Environmental Monitoring and Assessment Program
EPA	Environmental Protection Agency (U.S.)
eq	equivalent
$eq\ ha^{-1}\ yr^{-1}$	equivalent per hectare per year
$eq\ L^{-1}$	equivalent per liter
ERP	Episodic Response Project
F^-	flouride ion
g	grams
GIS	Geographic Information System
H^-	hydrogen ion
ha	hectare
Hg	elemental mercury

ILWAS	Integrated Lake-Watershed Acidification Study
K^+	potassium ion
kg	kilogram
LABPH	laboratory pH
LAMP	Lakes Acidification Mitigation Project
LTD	lower than detectable
LTM	Long Term Monitoring Program
m	meter
MDN	Mercury Deposition Network
$MeHg^+$	methyl mercury
mg L^{-1}	milligrams per liter
mg L^{-1}-C	milligrams per liter as carbon
mg m^{-3}	milligrams per cubic meter
Mg^{2+}	magnesium ion
mm	millimeter
NA	not available
Na^+	sodium ion
NADP	National Atmospheric Deposition Program
NAPAP	National Acid Precipitation Assessment Program
NBMR	North Branch Moose River Project
NH_4^+	ammonium ion
NO_3^-	nitrate ion
NOAA	National Oceanic and Atmospheric Administration
NSA	Natural Spawning Adequate
NTN	National Trends Network
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSERDA	New York State Energy Research and Development Authority
pH	negative logarithm of hydrogen ion concentration
PIRLA	Paleoliminological Investigation of Recent Lake Acidification Study
Pt Co	platinum cobalt
RILWAS	Regional Integrated Lake-Watershed Acidification Study
SCONDUCT	specific conductivity
SiO_2	silica
SO_2	sulfur dioxide
SO_4^{2-}	sulfate ion
SUNY-ESF	State University of New York College of Environmental Sciences and Forestry
TIME	Temporally Integrated Monitoring of Ecosystems
TRUECOLOR	color defined on the platinum cobalt scale
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

Little Hope Pond 020058

Lat. 44° 30' 57'' N   Long. 074° 07' 31'' W

Lake: Little Hope Pond lies in the Lake Champlain watershed at 517 m. The 2.8 ha headwater lake is within a group of kettle hole ponds near the Saranac River. In 1984, the ALS found a single inlet on the western shore and an outlet (ALSC 1985). In September 2008, ALSC field crew verified an outlet draining under Kushaqua Road into Big Hope Pond (020059) (Figure 1). Little Hope Pond reaches a maximum depth of 6.2 m (Figure 2).

Little Hope Pond is classified as a medium till chain drainage lake, with high dissolved organic carbon. The lake is considered to be moderately sensitive to acidification. The ALTM program began monitoring the lake in June 1992.

Lake chemistry: Little Hope Pond was sampled during the ALS on 18 Jul 1984 finding: Lab pH 5.00, ANC -27.7 µeq L^{-1}, SO_4^{2-} 105.77 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 108.79 µeq L^{-1}, Mg^{2+} 41.97 µeq L^{-1}, DOC 13.2 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent water chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 22 May 1984, a dip-net survey by the ALS identified the following Insecta: Ephemeroptera Leptophlebiidae and Ephemerellidae; Odonata Corduliidae; and Diptera Chironomidae and Unspecified. No macrophyte data are available (ALSC 1985).

Fisheries: NYS DEC stocked the pond with brook trout from 1938 to 1976. After the pond was reclaimed in 2000, stocking resumed (ALSC 2003). Refer to Tables 3 and 4 for fish stocking and netting histories.

Intensive Studies: McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed. Little Hope Pond was one of 36 ALTM lakes evaluated by Momen and Zehr during 1994 examining lake-water chemistry and terrestrial characteristics with the existing watershed classifications (Momen, B. and Zehr, J. P. 1998). Ito evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998-2000 (Ito, M. et al. 2005).

Figure 1. Catchment

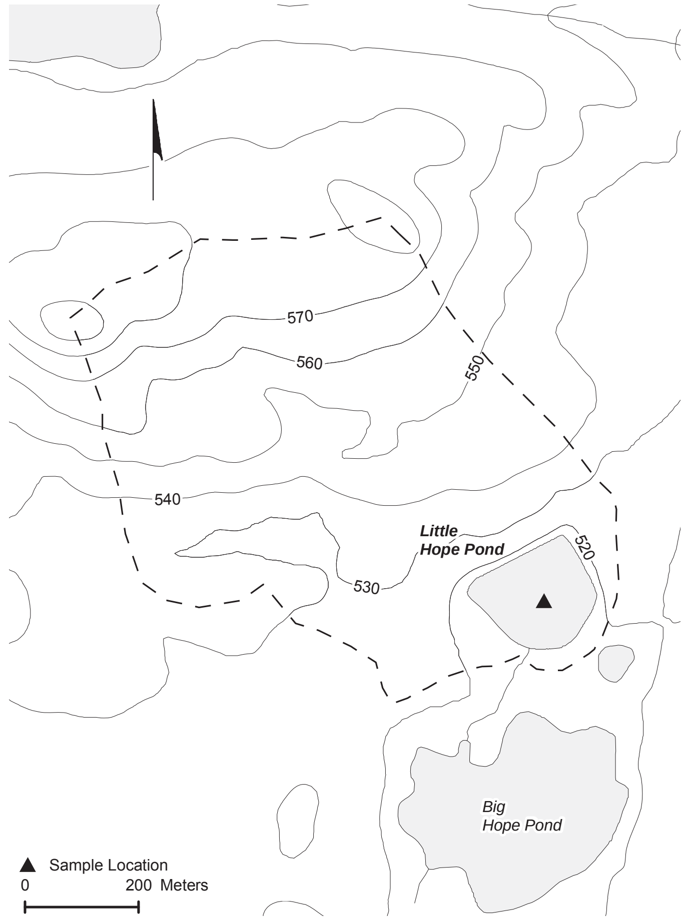
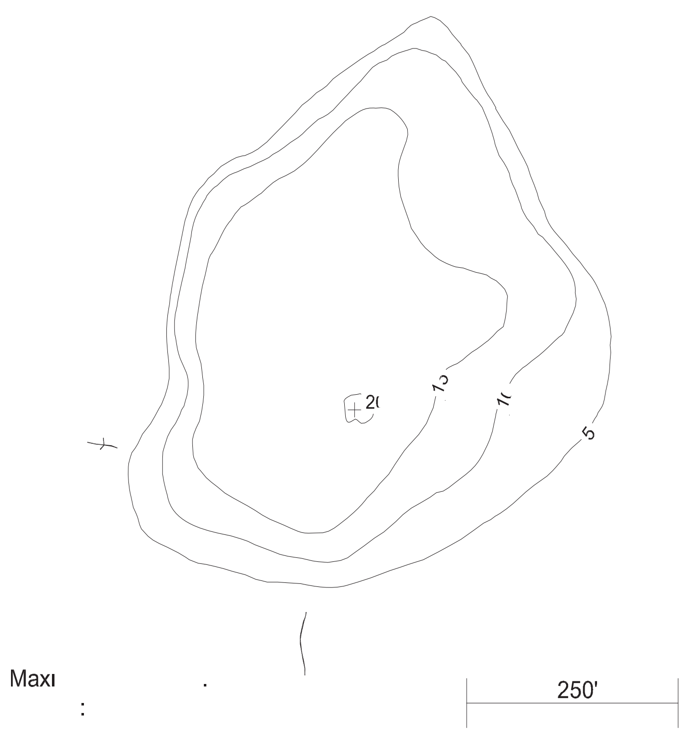


Figure 2. Bathymetry



Deposition: The nearest NADP deposition monitoring site is 24 km southeast at Whiteface Mountain. The nearest NYSDEC wet deposition monitoring site is 13 km southwest at Paul Smiths.

Watershed: Little Hope Pond lies on charnockite, granitic and quartz syenite gneiss bedrock and is overlain by kame deposits (APA 2001). The highest elevation in the watershed is 580 m. The maximum relief is 63 m. In 1984, the ALS found the shoal water substrate comprised of 75% organic and 25% muck/silt (ALSC 1985).

Land cover/use: In 1984, half of the watershed was covered in deciduous-conifer mixed forest, 40% coniferous forest, and 10% shrub/sapling mix. The immediate shoreline was characterized as 60% wetland, 25% deciduous conifer mixed forest and 15% shrub sapling mix. A bog fringe borders the pond (ALSC 1985). Total wetland area is 6.34 ha or 12% of the watershed. The predominant wetland type is forested needle-leaf evergreen (APA 2001). Little Hope Pond and its watershed are located entirely within the Debar Mountain Wild Forest. A road runs along the southeastern shore of the pond.

Table 1. Lake Chemistry

020058			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	67.87	109.51	86.94	17.38	63.85	45.84	µeq L^{-1}
NO_3^-	-0.40	10.00	2.68	0.00	7.74	1.30	µeq L^{-1}
Cl^-	7.62	20.03	11.73	7.69	10.40	9.13	µeq L^{-1}
F^-	3.37	4.37	3.86	1.39	4.64	3.64	µeq L^{-1}
ANC	7.16	38.21	22.30	23.49	79.22	55.15	µeq L^{-1}
DIC	59.11	257.26	122.94	43.29	203.14	123.39	µmol L^{-1} -C
DOC	757.63	1205.88	1013.41	282.32	983.00	821.82	µmol L^{-1} -C
SiO_2	10.49	112.84	61.04	21.14	110.84	81.03	µmol L^{-1}
Ca^{2+}	66.87	136.24	101.80	33.93	150.71	93.76	µeq L^{-1}
Mg^{2+}	30.45	55.13	42.17	13.17	46.04	38.54	µeq L^{-1}
Na^+	19.57	36.10	26.32	12.18	30.88	25.69	µeq L^{-1}
K^+	7.93	14.58	10.21	3.33	7.16	5.77	µeq L^{-1}
NH_4^+	-0.22	7.48	2.82	-1.05	5.54	1.44	µeq L^{-1}
AL_TD	2.30	9.82	7.83	2.08	8.75	6.30	µmol L^{-1}
AL_TM	2.65	8.71	5.93	2.15	4.23	3.21	µmol L^{-1}
AL_OM	0.82	6.37	4.71	1.96	3.30	2.86	µmol L^{-1}
AL_IM	0.00	3.04	1.31	0.02	1.56	0.35	µmol L^{-1}
LABPH	4.90	5.74	5.28	5.56	6.36	5.92	
AIREQPH	4.96	6.04	5.46	6.21	6.86	6.45	
TRUECOLOR	80	140	112	45	180	139	Pt Co
SCONDUCT	18.02	27.57	21.65	8.54	20.87	17.26	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	517 m
Maximum depth	6.2 m
Mean depth	3.5 m
Volume	$10.0 \times 10^4 m^3$
Surface area	2.8 ha
Watershed area	53.6 ha
Watershed ratio	0.05
Hydraulic retention time (year)	0.29
Watershed	Lake Champlain
County, Town	Franklin, Franklin
USGS Quadrangle	Debar Mountain
Land use classification	Debar Mountain Wild Forest

Figure 3. Chemistry Time Series

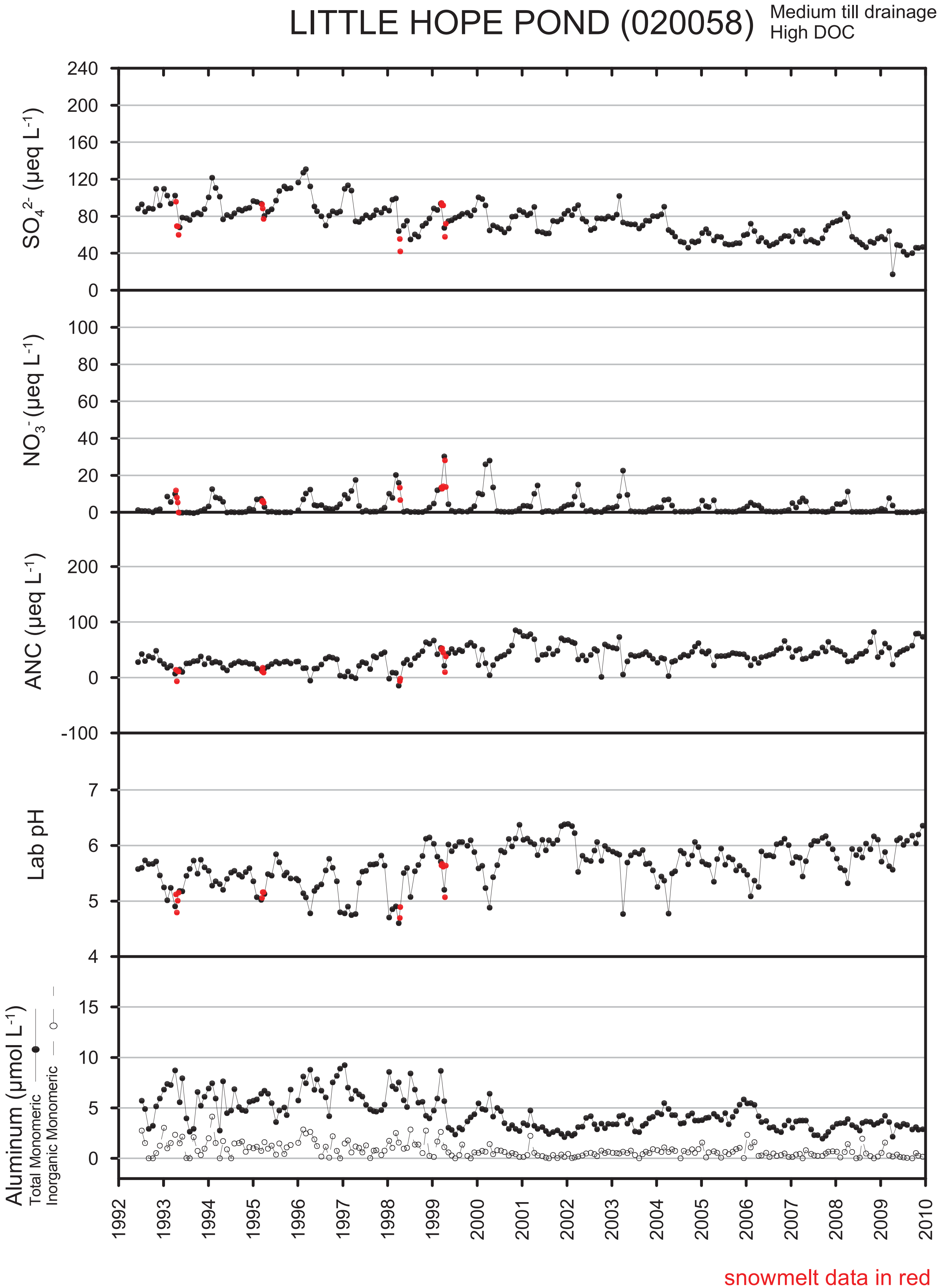


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
2001	Brook trout	140	20
2002	Brook trout	150	13
2003	Brook trout	120	14
2004	Brook trout	140	13
2005	Brook trout	150	20
2006	Brook trout	150	20

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-95	Golden shiner	31	71	188	420	265
May-95	N. redbelly dace	18	62	110	110	18
May-95	White sucker	24	192	355	5312	24
May-95	Brown bullhead	46	75	175	938	54
May-95	Pumpkinseed	21	53	85	111	21
May-84	Pumpkinseed	3	65	70	15	3
May-84	Golden shiner	10	87	118	114	17
May-84	Brown bullhead	10	94	120	132	85
May-84	N. redbelly dace	1	-	-	-	1

Watershed disturbance: The 1916 fire protection source data reveal 100% of the watershed as virgin and second growth green timber with no slash. The watershed was unaffected by the November 1950 blowdown and 1995 microburst storms (APA 2001). The watershed experienced heavy to extreme damage from the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K.M. 2005. Factors Affecting Acid Neutralizing Capacity in the Adirondack Region of New York: a Solute Mass Balance Approach. Environmental Science & Technology 39: 4076-4081.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology 41: 5191-5197.

Momen,B. and Zehr,J.P. 1998. Watershed classification by discriminant analyses of lakewater-chemistry and terrestrial characteristics. Ecological Applications 8: 497-507.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Big Hope Pond 020059

Lat. 44° 30' 43" N Long. 074° 07' 30" W

Lake: Big Hope Pond lies in the Lake Champlain watershed at 517 m. The 8.9 ha pond is within a group of kettle-hole ponds near the Saranac River and receives drainage from Little Hope Pond (020058). In 1984, the ALS found an inlet with negligible flow, as well as an outlet. In September 2008, ALSC field crew found an inlet from Little Hope Pond and an outlet to the southwest (Figure 1) that had previously been indicated as an inlet during the 1984 ALS (Figure 2). The lake reaches a maximum depth of 11.6 meters.

Big Hope Pond is classified as a medium till drainage lake, with high dissolved organic carbon. The lake is considered to be moderately sensitive to acidification. The ALTM program began monitoring the lake in June 1992.

Lake chemistry: Big Hope Pond was sampled during the ALS on 18 Jul 1984 finding: Lab pH 5.74, ANC 26.2 µeq L^{-1}, SO_4^{2-} 108.47 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 100.31 µeq L^{-1}, Mg^{2+} 42.79 µeq L^{-1}, DOC 7.0 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are found in Figure 3.

Aquatic biota: On 23 May 1984, a dip-net survey by the ALS collected the following Insecta: Odonata Coenagriidae, Libellulidae and Aeshnidae; and Trichoptera Limnephilidae. No macrophytes were recorded during a survey on 22 May 1984 (ALSC 1985). During July 1984, the NYS DEC Biota Project survey found: chlorophyll a at 4.7 µg L^{-1}; total phosphorus of 22 µg L^{-1}; and a Secchi depth of 2.5 m. The phytoplankton community was dominated by Merismopedia tenuissima. Keratella taurocephala was the dominant rotifer and Diaptomus minutus was the dominant crustacean zooplankton (Sutherland J. 1989).

Fisheries: NYS DEC managed Big Hope Pond for brook trout from 1937 to 1965. The pond was reclaimed in 2000 and stocked with brook trout (ALSC 2003). Refer to Tables 3 & 4 for fish stocking and netting histories.

Intensive studies: Big Hope Pond was surveyed in 1984 as part of the NYSDEC Biota Project (Sutherland J. 1989). Big Hope Pond was sampled by EPA's Environmental Monitoring and

Figure 1. Catchment

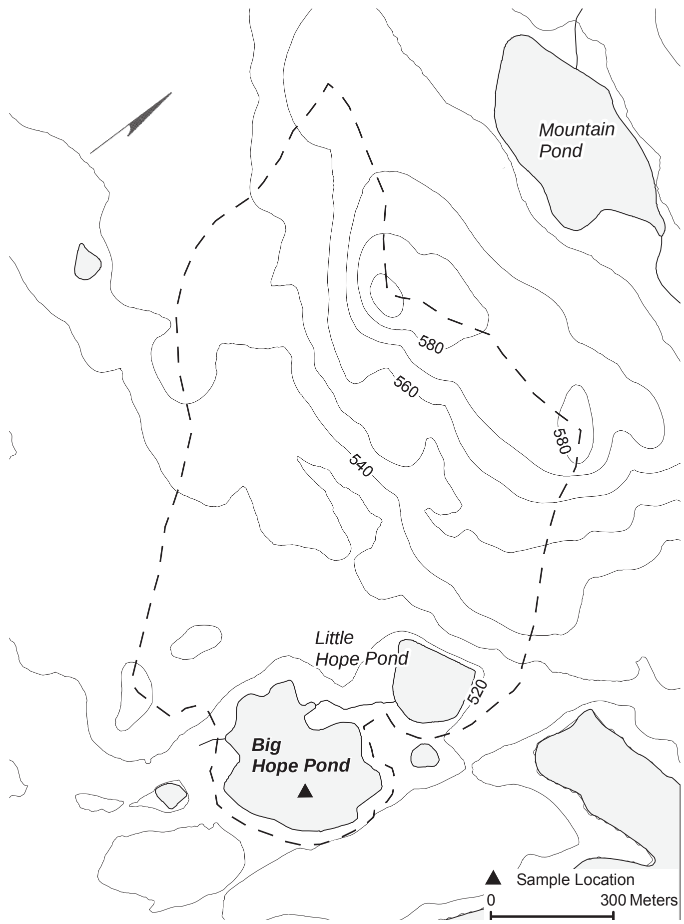
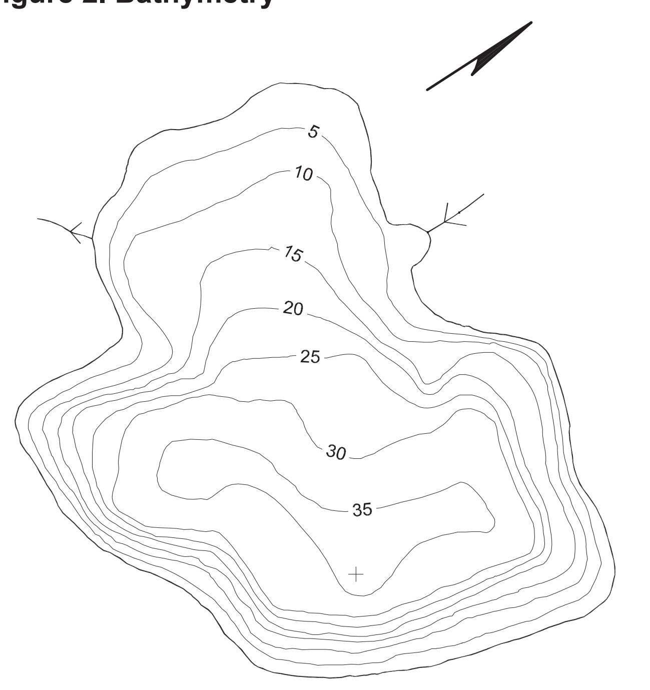


Figure 2. Bathymetry



Maximum Depth (+): 38 ft
Source: ALSC 1984

Assessment Program (EMAP) in 1991, 1995, and 1997. Since 1999, the lake is sampled annually by the ALSC as part of the Temporally Integrated Monitoring of Ecosystems (TIME) project (Stoddard et al. 2003). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Deposition: The nearest NYSDEC deposition monitoring site is 13 km southwest at Paul Smiths. The nearest NADP wet deposition monitor site is 25 km southeast at Whiteface Mountain.

Watershed: The bedrock underlying Big Hope Pond and its watershed is charnockite, granitic and quarti syenite gneiss. The rock is overlain by kame deposits (APA 2001). The highest elevation in the watershed is 580 m. The maximum relief is 63 m. In 1984, the ALS found the shoal water substrate to be comprised of 50% boulder/gravel; 30% organic and 20% muck/silt (ALSC 1985).

Land cover/use: In 1984, eighty percent of the watershed was covered in coniferous forest, while the remaining 20% contained deciduous-coniferous mixed forest. The immediate shoreline characteristics were comprised of 80% wetland, 10% coniferous forest and 10% shrub-sapling mixed vegetation (ALSC 1985). Total wetland area is 13.7 ha and comprises 21 % of the watershed. The predominant wetland type is classified as forested needle-leaved evergreen (Roy K. M. et al. 1996). The lake and its watershed occur within the Debar Mountain Wild Forest. A road runs along the western shore and an old railroad grade runs along the eastern shore.

Watershed disturbance: The 1916 fire protection map shows a majority of the watershed as virgin and second growth green timber with no slash with a very small portion to the north as logged for softwoods only. The watershed was unaffected by the November 1950 blow down and July 1995 microburst storms (APA 2001). The watershed experienced heavy to extreme damage from the January 1998 ice storm (NYSDEC 1998).

Table 1. Lake Chemistry

020059			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	72.66	118.26	89.34	45.01	62.85	52.68	µeq L^{-1}
NO_3^-	-0.40	8.71	2.42	0.00	5.58	1.17	µeq L^{-1}
Cl^-	30.18	49.64	41.32	21.37	28.37	25.79	µeq L^{-1}
F^-	2.58	3.68	3.16	2.79	3.76	3.33	µeq L^{-1}
ANC	18.13	39.80	29.14	52.61	71.78	61.36	µeq L^{-1}
DIC	14.99	160.68	70.77	49.95	145.70	97.85	µmol L^{-1} -C
DOC	570.80	836.89	637.51	586.87	745.64	679.22	µmol L^{-1} -C
SiO_2	3.83	36.61	20.44	16.66	53.59	35.49	µmol L^{-1}
Ca^{2+}	77.35	135.24	96.98	87.83	146.71	102.57	µeq L^{-1}
Mg^{2+}	34.56	59.25	43.54	37.85	47.29	43.56	µeq L^{-1}
Na^+	36.10	56.98	45.27	30.88	39.35	36.27	µeq L^{-1}
K^+	8.70	16.11	10.96	5.63	7.42	6.65	µeq L^{-1}
NH_4^+	-1.00	5.60	2.92	-0.94	3.10	0.56	µeq L^{-1}
AL_TD	2.48	5.00	4.29	1.96	5.63	3.75	µmol L^{-1}
AL_TM	0.78	10.44	3.55	1.93	2.63	2.25	µmol L^{-1}
AL_OM	0.65	7.53	2.30	1.82	2.52	2.15	µmol L^{-1}
AL_IM	0.00	3.17	1.29	0.00	0.70	0.13	µmol L^{-1}
LABPH	5.53	6.23	5.87	5.89	6.67	6.21	
AIREQPH	5.90	6.43	6.15	6.58	6.82	6.71	
TRUECOLOR	30	60	45	70	90.00	79	Pt Co
SCONDUCT	20.81	28.51	23.25	18.69	21.77	20.07	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	517 m
Maximum depth	11.5 m
Mean depth	5.8 m
Volume	51.6 x 10^4 m^3
Surface area	8.9 ha
Watershed area	119.2 ha
Watershed ratio	0.07
Hydraulic retention time (year)	0.68
Watershed	Lake Champlain
County, Town	Franklin, Franklin
USGS Quadrangle	Debar Mountain
Land use classification	Debar Mountain Wild Forest

Figure 3. Chemistry Time Series

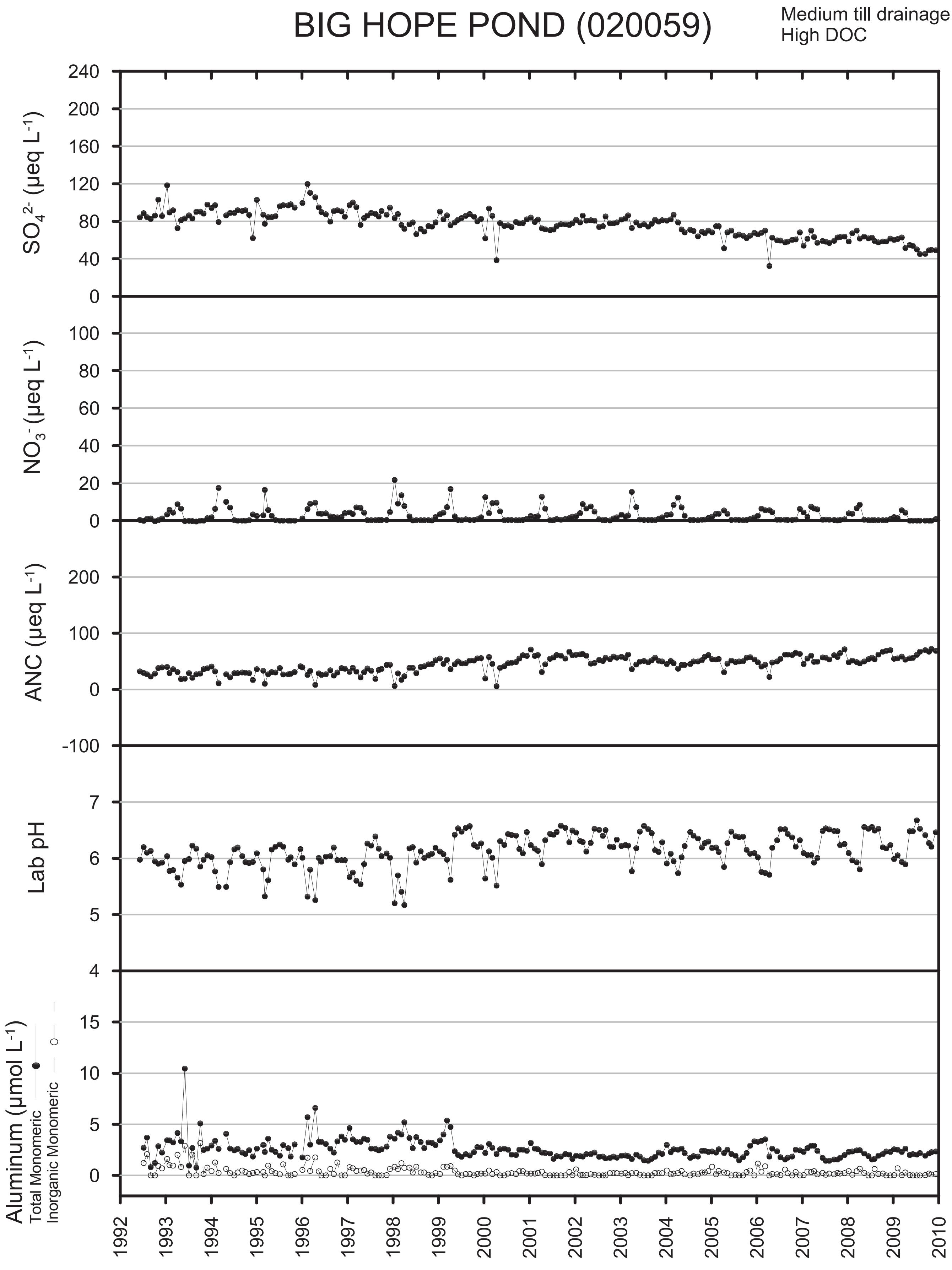


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1981	Splake	1100	8
1982	Splake	1080	24
1983	Splake	1200	36
1984	Splake	1200	18
1985	Splake	200	16
1986	Splake	140	10
1987	Splake	130	8
1988	Splake	200	13
1989	Splake	260	21
1990	Brown trout	350	65
1991	Brown trout	330	41
1992	Brown trout	400	65
1993	Brown trout	380	34
1994	Brown trout	380	36
1995	Brown trout	350	40
1996	Brown trout	340	75
1997	Brown trout	380	109
1998	Brown trout	380	72
1999	Brown trout	290	39
2000	Brown trout	380	95
2001	Rainbow trout	400	60
2001	Brook trout	1500	28
2002	Brook trout	1100	23
2003	Brook trout	1100	9
2004	Brook trout	1100	50
2005	Brook trout	1100	35
2006	Brook trout	1210	69

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-1994	Brown trout	28	196	350	4720	28
May-1994	Golden shiner	38	74	146	373	350
May-1994	N. redbelly dace	3	61	100	17	3
May-1994	White sucker	30	118	363	4411	368
May-1994	Brown bullhead	29	75	164	450	66
May-1994	Pumpkinseed	13	52	85	33	13
May-1994	Common shiner	1	145	145	31	1
May-1984	Brook trout	1	215	215	95	1
May-1984	Lake trout	1	600	600	2000	1
May-1984	Splake	18	182	263	1895	18
May-1984	Golden shiner	10	95	112	117	27
May-1984	White sucker	11	187	392	1835	62
May-1984	Brown bullhead	10	100	255	705	25
May-1984	Pumpkinseed	12	60	90	69	12

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology **41**: 5191-5197.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Stoddard, J. L., Kahl, J. S., Deviney, F. A., DeWalle, D. R., Driscoll, C. T., Herlihy, A. T., Kellogg, J. H., Murdoch, P. S., Webb, J. R., and Webster, K. E. 2003. Response of Surface Water Chemistry to the Clean Air Act Amendments of 1990. United States Environmental Protection Agency No. EPA620/R-03/001.

Sutherland, J. W. 1989. Field Surveys of the Biota and Selected Water Chemistry Parameters in 50 Adirondack Mountain Lakes. New York State Department of Environmental Conservation Final Report, Albany, NY.

This page intentionally left blank.

Little Echo Pond 020126

Lat. 44° 18' 20" N Long. 074° 21' 27" W

Lake: Little Echo Pond lies in the Lake Champlain watershed at 482 m. This 0.8 ha lake is the smallest in the ALTM program. It has no inlets or outlets (Figure 1) and is one of seven seepage lakes in the ALTM program. The lake reaches a maximum depth of 4.6 m (Figure 2).

Little Echo Pond is a classified as a mounded seepage lake with high dissolved organic carbon. The lake is considered sensitive to acidification. This is one of the original ALTM lakes monitored on a monthly basis since June 1982. Spring melt weekly sampling has been ongoing since 2002.

Lake chemistry: Little Echo Pond was not surveyed by the ALS, but was sampled as part of the ELS (1A1-107) on 12 Oct 1984 finding: Closed pH 4.18, ANC -63.2 µeq L^{-1}, SO_4^{2-} 67.9 µeq L^{-1}, NO_3^- 1.1 µeq L^{-1}, Ca^{2+} 36.6 µeq L^{-1}, Mg^{2+} 13.8 µeq L^{-1}, DOC 14.28 mg L^{-1}-C (Kanciruk, P. et al. 1986). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 12 Oct 1984, the ELS I classified the lake as mixed (i.e., the difference between surface and bottom temperatures less than 4º C). Secchi depth was 0.6 m and total phosphorus was 11.1 µg L^{-1} (Kanciruk, P. et al. 1986).

Fisheries: NYSDEC stocked the pond with brook trout through the 1970s (ALSC 2003). Little Echo Pond was not surveyed during the ALS in 1984-87. The ALSC surveyed the pond on 28 May 1998 and caught no fish.

Intensive studies: Diatom stratigraphies were developed from sediment cores in the late 1980s (Charles, D. F. et al. 1990). Little Echo Pond was studied under RILWAS in 1985 (Driscoll, C. T. and Newton, R. M. 1985). Historical rates of mercury deposition were analyzed using sediment cores from 1982-1983 (Lorey, P. and Driscoll, C. T. 1999) and again in 1998 (Raynal, D. J. et al. 2004). Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995). Bukaveckas and Robbins-Forbes (2000) characterized the attenuation of photosynthetic radiation in relation to lake chemistry in this lake as

Figure 1. Catchment

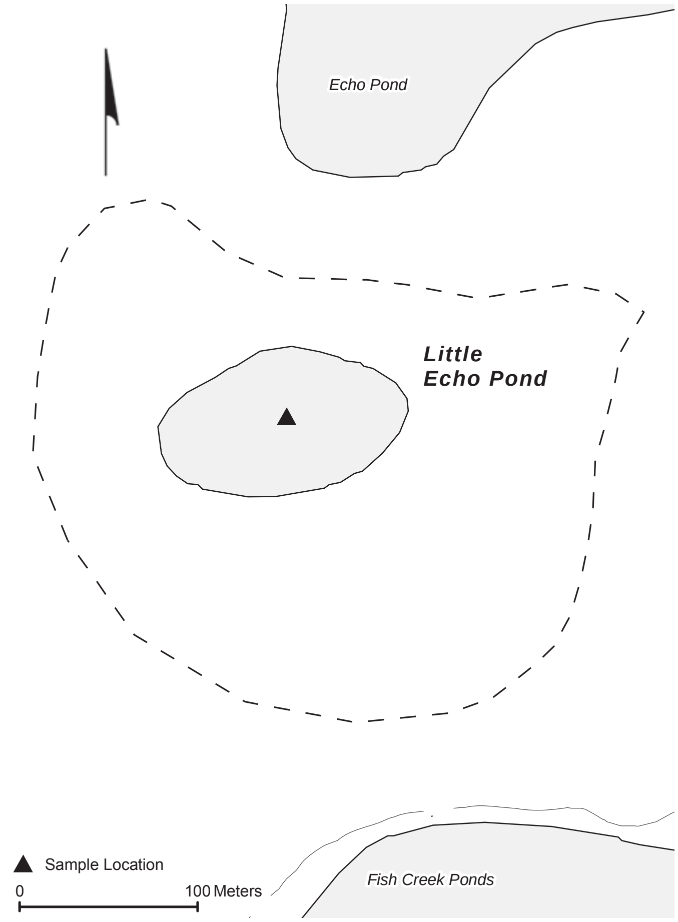
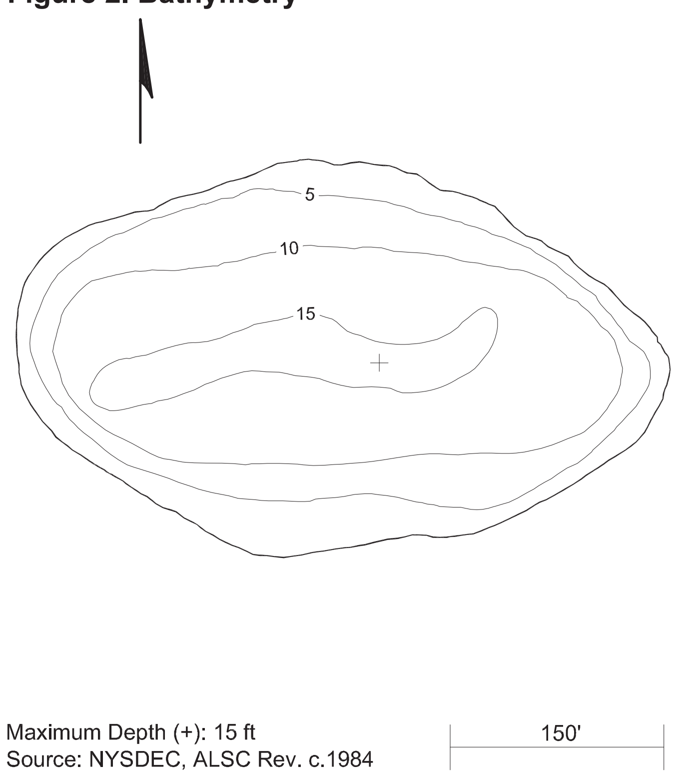


Figure 2. Bathymetry



part of a regional survey (Bukaveckas, P. A. and Robbins-Forbes, M. 2000). Ito and others (2006) evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 – 2000 (Ito, M. et al. 2006). Saunders and others (2000) conducted enclosure experiments in this lake during the summers of 1990 and 1991 to examine nutrient and grazer regulation of phytoplankton (Saunders, P. A. et al. 2000).

Deposition: The nearest NADP deposition monitoring site is 37 km east at Whiteface Mountain. The nearest NYSDEC wet deposition monitoring site is 17 km northeast at Paul Smiths.

Watershed: The bedrock underlying Little Echo and its 1 ha watershed is metanorthosite and anorthositic gneiss. Surficial geology source data show rock overlain by lascustrine quartz sand (APA 2001). The watershed is relatively flat with no detectable change in relief from the topographical source data. The lake lies in a group of other kettle-hole type ponds in the area.

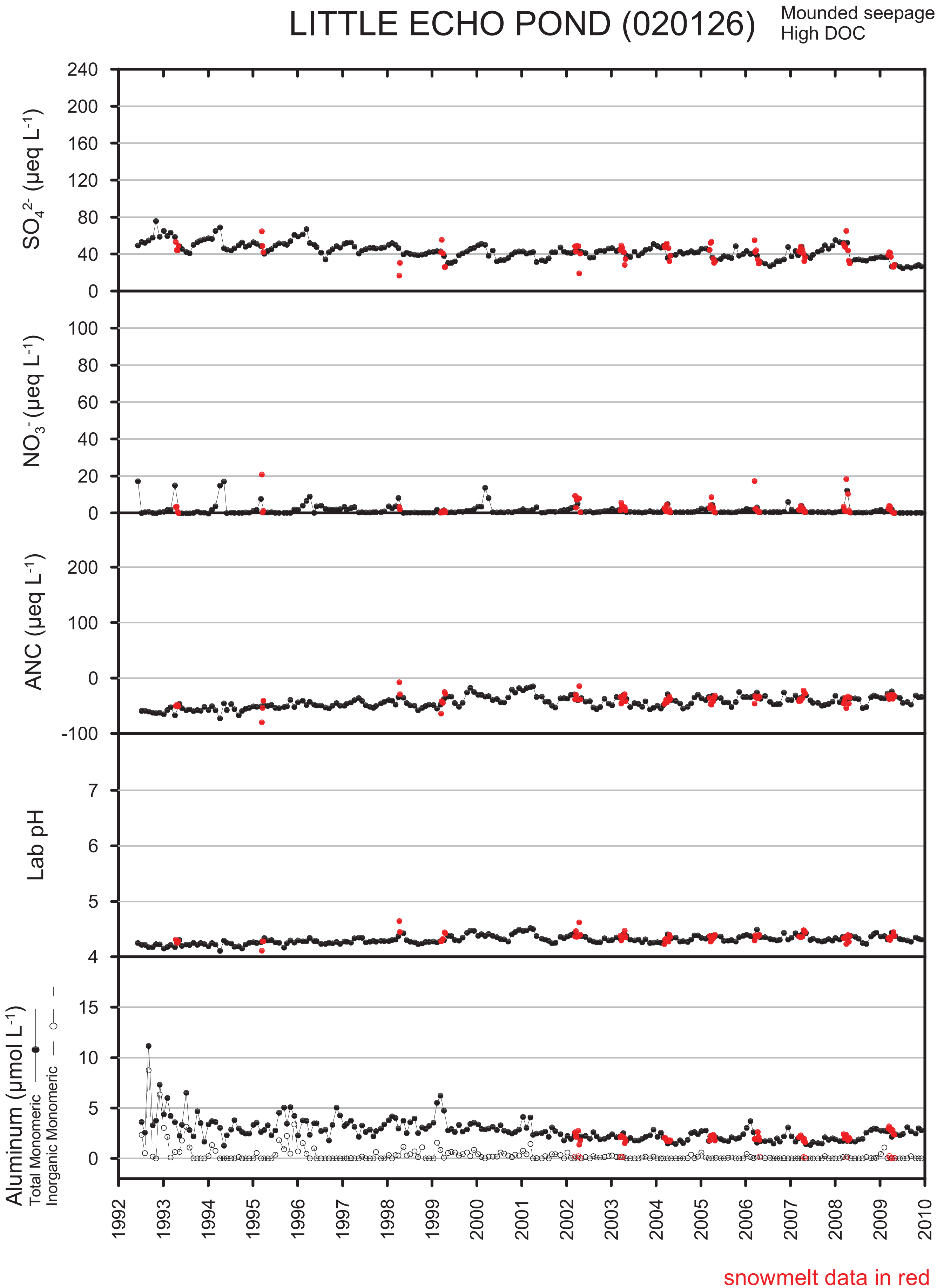
Table 1. Lake Chemistry

020126			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	40.81	65.17	53.06	24.53	36.81	29.03	µeq L^{-1}
NO_3^-	-0.24	14.84	1.57	0.00	1.98	0.47	µeq L^{-1}
Cl^-	6.77	14.67	9.14	8.73	13.45	10.66	µeq L^{-1}
F^-	0.32	1.21	0.93	0.58	1.14	0.82	µeq L^{-1}
ANC	-67.19	-46.41	-57.20	-48.09	-24.11	-35.83	µeq L^{-1}
DIC	57.45	198.15	125.58	51.62	287.23	162.31	µmol L^{-1} -C
DOC	843.97	1431.09	1217.97	949.04	1570.48	1338.83	µmol L^{-1} -C
SiO_2	-0.67	20.80	5.58	1.74	26.99	14.49	µmol L^{-1}
Ca^{2+}	19.46	44.91	30.86	20.70	50.40	30.45	µeq L^{-1}
Mg^{2+}	17.28	27.16	22.29	21.03	31.74	26.71	µeq L^{-1}
Na^+	3.91	11.31	7.29	8.26	10.87	9.60	µeq L^{-1}
K^+	1.79	8.18	5.56	2.24	5.63	4.06	µeq L^{-1}
NH_4^+	-0.33	6.43	1.87	-0.67	14.80	5.01	µeq L^{-1}
AL_TD	1.74	3.08	2.33	1.37	3.48	2.58	µmol L^{-1}
AL_TM	1.68	6.50	3.77	2.15	3.09	2.62	µmol L^{-1}
AL_OM	1.33	4.97	2.95	1.67	3.47	2.60	µmol L^{-1}
AL_IM	0.00	3.13	1.05	0.00	1.07	0.15	µmol L^{-1}
LABPH	4.15	4.30	4.21	4.27	4.43	4.33	
AIREQPH	4.12	4.29	4.21	4.26	4.51	4.37	
TRUECOLOR	110	200	154	180	400	305	Pt Co
SCONDUCT	24.54	33.95	29.23	19.09	27.17	24.72	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	482 m
Maximum depth	4.6 m
Mean depth	2.9 m
Volume	2.3 x 10^4 m^3
Surface area	0.8 ha
Watershed area	1.0 ha
Watershed ratio	1.0
Hydraulic retention time (year)	NA
Watershed	Lake Champlain
County, Town	Franklin, Santa Clara
USGS Quadrangle	Upper Saranac Lake
Land use classification	Saranac Lakes Intensive Use Area

Figure 3. Chemistry Time Series



Land cover/use: The watershed is primarily forested. The predominant terrestrial vegetation is conifer-bog with mixed woods (Charles, D. F. et al. 1990). Little Echo Pond and its watershed occur within the Saranac Lakes Intensive Use area. The pond lies within the NYSDEC Fish Creek Campground. A foot trail connects the shoreline to a snowmobile trail on the western side of the pond.

Watershed disturbance: The 1916 fire protection source data reveal 100% of the watershed as virgin and second growth green timber with no slash. The watershed was unaffected by the November 1950 blowdown and July 1995 microburst storms (APA 2001). The watershed experienced light damage from the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Bukaveckas,P.A. and Robbins-Forbes,M. 2000. Role of dissolved organic carbon in the attenuation of photosynthetically active and ultraviolet radiation in Adirondack lakes. Freshwater Biology 43: 339-354.

Charles,D.F., Binford,M.W., Furlong,E.T., Hites,R.A., Mitchell,M.J., Norton,S.A., Oldfield,F., Paterson,M.J., Smol,J.P., Uutala,A.J., White,J.R., Whitehead,D.R., and Wiese,R.J. 1990. Paleoecological investigation of recent lake acidification in the Adirondack Mountains, N.Y. Journal of Paleolimnology 3: 195-241.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack Lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

Kanciruk, P., Eilers, J. M., McCord, R. A., Landers, D. H., Brakke, D. F., and Linthurst, R. A. 1986. Characteristics of Lakes in the Eastern United States: Volume III. Data Compendium of Site Characteristics and Chemical Variables. U.S. Environmental Protection Agency No. EPA/600/4-86/007c.

Lorey,P. and Driscoll,C.T. 1999. Historical trends of mercury deposition in Adirondack Lakes. Environmental Science & Technology 33: 718-722.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of Atmospheric Deposition of Sulfur, Nitrogen, and Mercury on Adirondack Ecosystems. New York State Energy Research and Development Authority No. Final 04-03.

Saunders,P.A., Bukaveckas,P.A., and Shaw,W.H. 2000. Differences in nutrient limitation and grazer suppression of phytoplankton in seepage and drainage lakes of the Adirondack region, NY, U.S.A. Freshwater Biology 43: 391-407.

This page intentionally left blank.

East Copperas Pond 020138

Lat. 44° 18' 43" N Long. 074° 22' 20" W

Lake: East Copperas Pond lies in the Lake Champlain watershed at 480 m. This 3.6 ha drainage lake has no apparent inlets. Its outlet flows 50 m downstream into Copperas Pond and into Fish Creek Ponds and Upper Saranac Lake (Figure 1). The lake lies in a group of other kettle-hole ponds in the area. The lake has a maximum depth of 6.4 m (Figure 2). Field notes from 1984 indicate a fixed wooden fish barrier dam present on the outlet (ALSC 1985). By 2000, the barrier dam had completely deteriorated.

East Copperas Pond is classified as a thin till drainage lake with high dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. Spring melt weekly sampling has been ongoing since 2000.

Lake chemistry: The ALS sampled East Copperas Pond on 19 July 1984 finding: Lab pH 4.50, ANC -28.9 µeq L^{-1}, SO_4^{2-} 52.47 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 32.44 µeq L^{-1}, Mg^{2+} 9.05 µeq L^{-1}, DOC 8.8 mg L^{-1} -C (ALSC 1985). Table 1 summarizes recent ALTM chemistry taken at the outlet. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 16 May 1984, a dip-net survey by the ALS identified the following Insecta: Odonata Corduliidae and Trichoptera Limnephilidae. No aquatic macrophyte data are available. A thermocline was detected between 2.0 and 3.5 m on 19 July 1984 (ALSC 1985).

Fisheries: NYS DEC stocked brook trout and rainbow trout annually from 1959-1964 and limed the lake annually from 1959 to 1962. They treated the lake with rotenone in July 1964 and began stocking brook trout in 1965. In 1986, the stocking was discontinued (ALSC 2003). Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: East Copperas Pond was one of 31 small, unproductive Adirondack regional lakes studied for aquatic vegetation relationships with environmental factors (Jackson, S. T. and Charles, D. F. 1988). It was one of 36 ALTM lakes evaluated by Momen and Zehr (1998) during 1994 examining lake-water chemistry and terrestrial characteristics with the existing watershed classifications (Momen, B. and Zehr, J. P. 1998). Bukaveckas and Robbins-Forbes (2000) characterized the attenuation of

Figure 1. Catchment

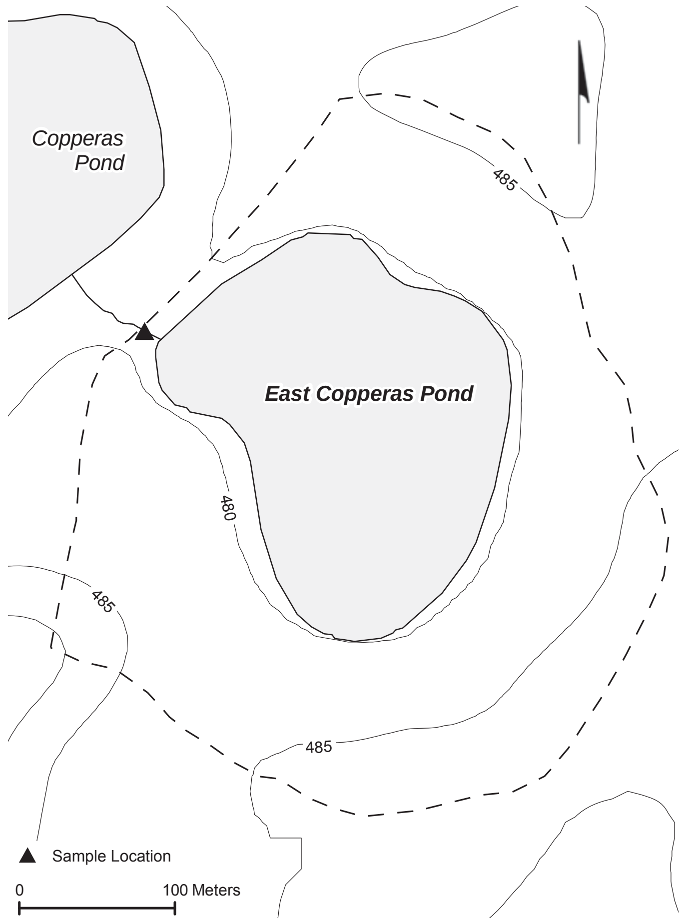
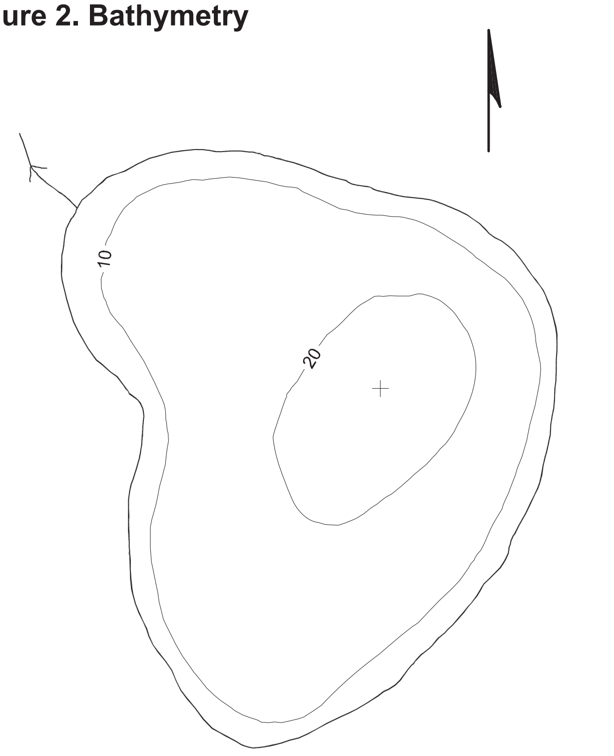


Figure 2. Bathymetry



Maximum Depth (+): 21 ft
Source: NYSDEC 1954, ALSC Rec'd c.1984

photosynthetic radiation in relation to lake chemistry in this lake as part of a regional survey (Bukaveckas, P. A. and Robbins-Forbes, M. 2000). Ito et al 2006 evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 – 2000 (Ito, M. et al. 2006). In 2003, this lake watershed was part of a 36 lake-watershed regional survey of foliar nitrogen gradients in the Adirondack Park (McNeil, B. E. et al. 2007).

Deposition: The nearest NADP deposition monitoring site is 38 km east at Whiteface Mountain. The nearest NYSDEC wet deposition monitoring site is 17 km northeast at Paul Smiths.

Watershed: East Copperas Pond is underlain by metanorthosite and anorthositic gneiss that is overlain by outwash sand and gravel (APA 2001). The watershed is relatively flat with a maximum relief of 6 m. In 1984, the ALS characterized the shoal water substrate as 80% muck/silt and 20% organic (ALSC 1985).

Table 1. Lake Chemistry

020138			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	28.52	53.51	42.61	23.35	33.27	26.80	µeq L^{-1}
NO_3^-	-0.40	10.32	2.43	0.00	5.96	0.99	µeq L^{-1}
Cl^-	4.80	18.62	8.27	4.30	17.17	6.45	µeq L^{-1}
F^-	0.63	1.21	0.93	0.55	1.56	0.93	µeq L^{-1}
ANC	-36.14	-2.71	-23.31	-49.79	4.03	-16.73	µeq L^{-1}
DIC	21.65	206.47	91.58	17.48	210.07	122.27	µmol L^{-1} -C
DOC	455.49	1102.06	800.35	838.39	1218.29	968.09	µmol L^{-1} -C
SiO_2	-1.17	49.76	17.99	1.70	29.77	17.58	µmol L^{-1}
Ca^{2+}	20.96	61.38	34.97	24.61	44.41	30.71	µeq L^{-1}
Mg^{2+}	6.58	15.63	11.59	9.25	11.40	10.13	µeq L^{-1}
Na^+	3.04	16.96	6.74	4.78	14.79	6.21	µeq L^{-1}
K^+	1.02	17.14	9.34	6.51	9.21	7.94	µeq L^{-1}
NH_4^+	0.28	29.16	6.18	-0.22	32.06	12.48	µeq L^{-1}
AL_TD	0.59	3.82	1.80	1.52	3.26	2.28	µmol L^{-1}
AL_TM	1.93	5.23	3.60	2.20	3.33	2.60	µmol L^{-1}
AL_OM	0.63	5.03	2.39	2.03	2.89	2.42	µmol L^{-1}
AL_IM	0.00	4.60	1.40	0.00	0.78	0.21	µmol L^{-1}
LABPH	4.37	4.96	4.52	4.21	4.83	4.53	
AIREQPH	4.40	5.02	4.54	4.30	4.90	4.58	
TRUECOLOR	45	120	76	120.00	180	155	Pt Co
SCONDUCT	10.35	24.29	18.90	15.46	24.85	18.10	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	480 m
Maximum depth	6.4 m
Mean depth	4.1 m
Volume	14.8×10^4 m^3
Surface area	3.6 ha
Watershed area	13.0 ha
Watershed ratio	0.28
Hydraulic retention time (year)	1.78
Watershed	Lake Champlain
County, Town	Franklin, Santa Clara
USGS Quadrangle	Upper Saranac Lake
Land use classification	Saranac Lake Wild Forest

Figure 3. Chemistry Time Series

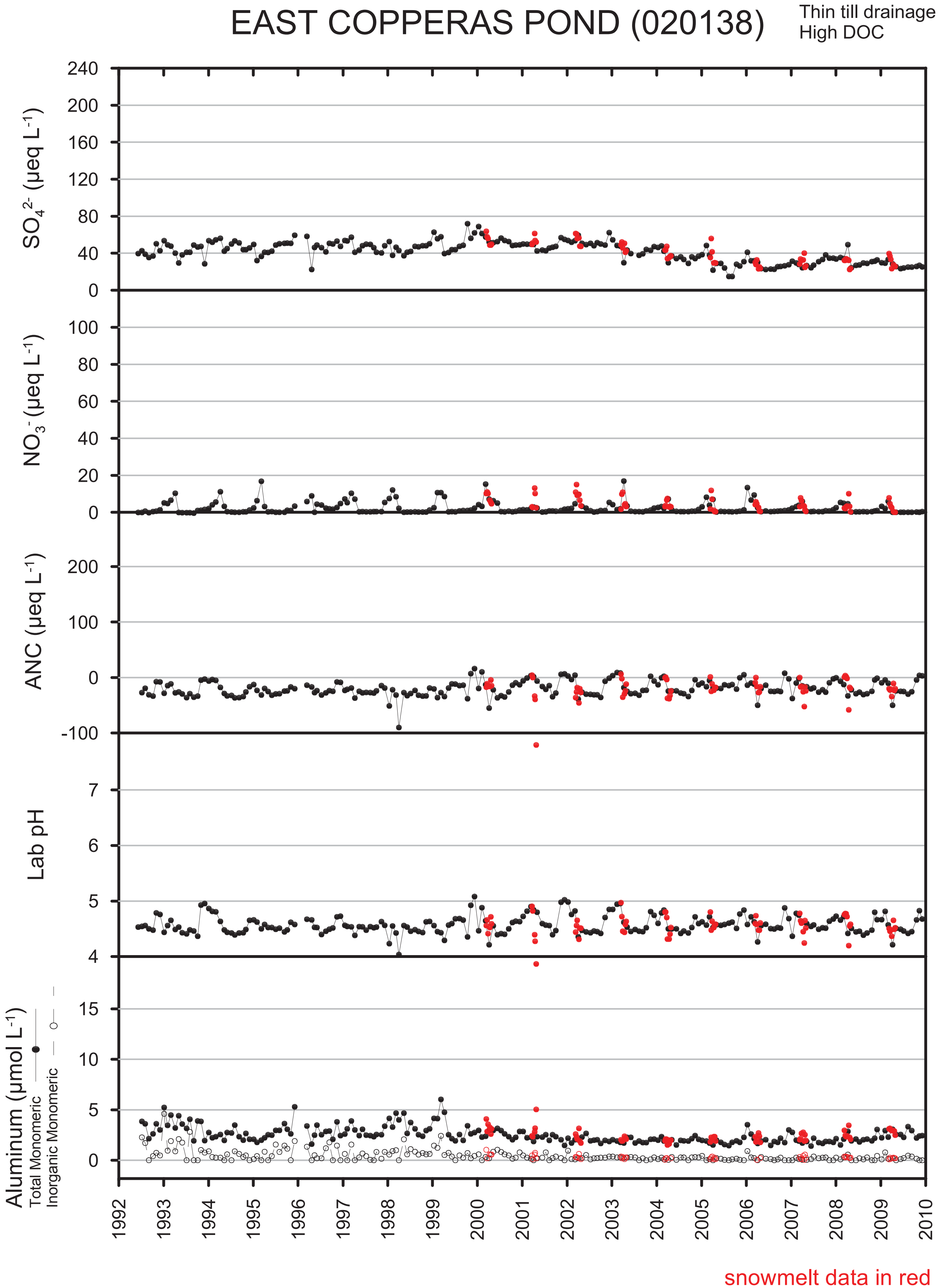


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	420	6
1981	Brook trout	360	8
1982	Brook trout	400	3
1983	Brook trout	400	15
1984	Brook trout	296	3
1985	Brook trout	440	10

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-98	Central mudminnow	30	87	115	301	53
May-84	Central mudminnow	4	76	105	26	4

Land cover/use: In 1984, the ALS described the watershed as 80% coniferous forest and 20% deciduous-coniferous mixed forest. Coniferous forest predominates the immediate shoreline. A fringe of bog shrub-scrub abuts the shoreline near the outlet (ALSC 1985). The pond and watershed are in the Saranac Lake Wild Forest. There is no development in the watershed.

Watershed disturbance: The 1916 fire protection source data reveal 100% of the watershed as virgin and second growth green timber with no slash. The watershed was unaffected by the November 1950 blowdown and July 1995 microburst storms (APA 2001). The watershed experienced light damage from the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Bukaveckas,P.A. and Robbins-Forbes,M. 2000. Role of dissolved organic carbon in the attenuation of photosynthetically active and ultraviolet radiation in Adirondack lakes. Freshwater Biology 43: 339-354.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

Jackson,S.T. and Charles,D.F. 1988. Aquatic macrophytes in Adirondack (New York) lakes: Patterns of species composition in relation to environment. Canadian Journal of Botany 66: 1449-1460.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology 41: 5191-5197.

Momen,B. and Zehr,J.P. 1998. Watershed classification by discriminant analyses of lakewater-chemistry and terrestrial characteristics. Ecological Applications 8: 497-507.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Middle Pond 020143

Lat. 44° 20' 13" N   Long. 074° 22' 19" W

Lake: Middle Pond lies within the Lake Champlain watershed at 483 m. Two inlets flow into the 24.3 ha headwater lake from the north (Figure 1). The outlet is a relatively wide marshy channel flowing into Floodwood Pond. Middle Pond reaches a maximum depth of 3.3 m (Figure 2).

Middle Pond is classified as a carbonate influenced drainage pond. The lake is not considered sensitive to acidification. The ALTM program began monitoring the pond in June 1992. Spring melt weekly sampling has been ongoing since 2000.

Lake chemistry: Middle Pond was sampled during the ALS on 27 Jul 1984 finding: Lab pH 6.61, ANC 86.5 μeq L^{-1}, SO_4^{2-} 149.49 μeq L^{-1}, NO_3^- LTD, Ca^{2+} 167.67 μeq L^{-1}, Mg^{2+} 50.20 μeq L^{-1}, DOC 6.1 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent ALTM chemistry taken at the outlet. Monthly plots of the major analytes appear in Figure 3.

Aquatic biota: On 16 May 1984, a dip-net survey by the ALS identified the following Insecta: Odonata Libellulidae, Corduliidae, and Coenagriidae; Trichoptera Limnephilidae; Ephemeroptera Leptophlebiidae and Siphlonuridae; Coleoptera Gyrinidae; and Diptera Unspecified. Also found were Crustacea Isopoda Unspecified. No macrophyte data available (ALSC 1985). The lake was isothermal on 27 Jul 1984 (ALSC 1985).

Fisheries: Middle Pond was stocked with brown trout in 1895 (ALSC 1985). Refer to Table 3 for recent netting history.

Intensive studies: Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Sullivan and others (1996) evaluated landscape changes with sediment records. Bukaveckas and Robbins-Forbes (2000) characterized the attenuation of photosynthetic radiation in relation to lake chemistry in this lake as part of a regional survey (Bukaveckas, P. A. and Robbins-Forbes, M. 2000). Ito et al 2006 evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998-2000 (Ito, M. et al. 2006). Middle Pond was one of 25 Adirondack lakes studied by the Mercury Response Project to evaluate mercury in fish (Schoch, N. et

Figure 1. Catchment

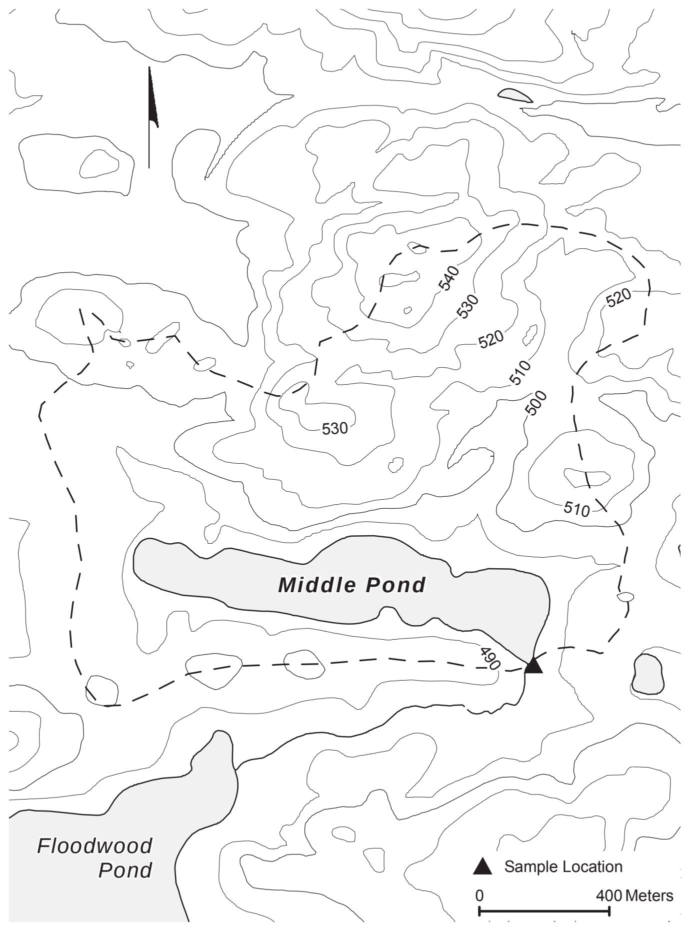
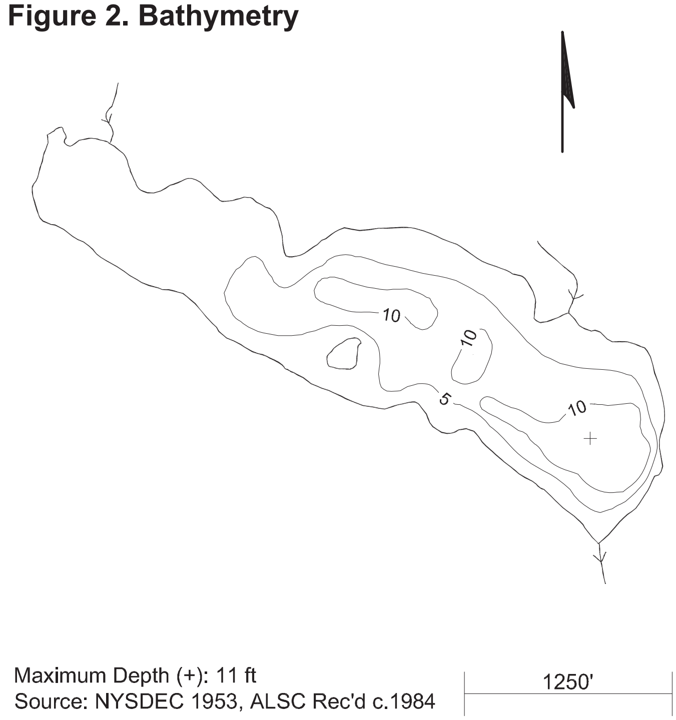


Figure 2. Bathymetry



al. 2007). The lake was originally sampled on 17 Sep 1992 and resurveyed on 22 Aug 2005 (Dittman, J. A. and Driscoll, C. T. 2009). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Deposition: The nearest NADP deposition monitoring site is 38 km east at Whiteface Mountain. The nearest NYSDEC wet deposition monitoring site is 15 km northeast at Paul Smiths.

Watershed: Middle Pond and its watershed lie on metanorthosite and anorthositic gneiss. Surficial outwash sand and gravel overlay 45% of the watershed, and 55% is overlain by till (APA 2001). The highest elevation in the watershed is 550 m. The maximum relief is 67 m. In 1984, the ALS found the shoal water substrate comprised of 90% sand/gravel/rubble and 10% organic matter (ALSC 1985).

Land cover/use: In 1984, coniferous forest covered 50% of the watershed, while the remaining cover was 40% deciduous forest and 10% deciduous-coniferous mixed forest. The immediate shoreline vegetation was a mix of 40% deciduous forest, 40% deciduous-conifer forest, 15% sand gravel beach/rock ledge and 5% shrub saplings. Bog shrub-scrub fringe appears along half of the shoreline near the northwestern inlet (ALSC 1985). Middle Pond and its watershed are in the Saranac Lakes Wild Forest. A campsite is located on the north shore of the lake and Floodwood Road runs along the lake's north shore. There are two separate foot trails that provide access to the pond. One trail on the eastern shoreline is a carry that meets the pond north of the outlet. The secondary foot trail skirts the western shoreline and extends to several other ponds in the area.

Table 1. Lake Chemistry

020143			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	89.73	140.74	110.95	70.45	88.67	77.00	µeq L^{-1}
NO_3^-	-0.24	14.97	5.00	0.00	11.98	2.70	µeq L^{-1}
Cl^-	10.72	16.92	13.23	8.19	15.39	12.09	µeq L^{-1}
F^-	1.63	2.11	1.82	1.60	2.22	1.90	µeq L^{-1}
ANC	71.43	155.51	102.57	81.83	134.83	106.48	µeq L^{-1}
DIC	81.59	477.89	214.59	99.91	379.65	191.79	µmol L^{-1} -C
DOC	346.68	698.77	495.09	338.69	485.60	421.45	µmol L^{-1} -C
SiO_2	48.93	160.27	76.64	21.68	124.16	57.33	µmol L^{-1}
Ca^{2+}	126.25	208.59	158.44	116.77	193.12	136.67	µeq L^{-1}
Mg^{2+}	35.38	56.78	47.80	32.92	47.62	41.95	µeq L^{-1}
Na^+	31.32	49.15	36.97	30.45	42.63	38.23	µeq L^{-1}
K^+	2.81	12.79	8.91	3.47	8.44	6.49	µeq L^{-1}
NH_4^+	-0.78	17.35	4.42	-1.09	10.87	2.06	µeq L^{-1}
AL_TD	-0.30	5.04	2.42	0.46	4.37	1.96	µmol L^{-1}
AL_TM	0.63	4.93	2.71	1.45	2.48	1.89	µmol L^{-1}
AL_OM	0.11	2.89	1.29	1.41	2.45	1.88	µmol L^{-1}
AL_IM	0.04	3.43	1.42	0.00	1.04	0.11	µmol L^{-1}
LABPH	5.77	6.85	6.33	6.05	6.92	6.42	
AIREQPH	6.73	7.80	6.99	6.93	7.27	7.09	
TRUECOLOR	35	55	45	40	55	44	Pt Co
SCONDUCT	23.29	33.78	27.41	21.58	28.36	24.08	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	483 m
Maximum depth	3.3 m
Mean depth	1.5 m
Volume	36.9 x 10^4 m^3
Surface area	24.3 ha
Watershed area	187.1 ha
Watershed ratio	0.13
Hydraulic retention time (year)	0.31
Watershed	Lake Champlain
County, Town	Franklin, Santa Clara
USGS Quadrangle	Upper Saranac Lake
Land use classification	Saranac Lakes Wild Forest

Figure 3. Chemistry Time Series

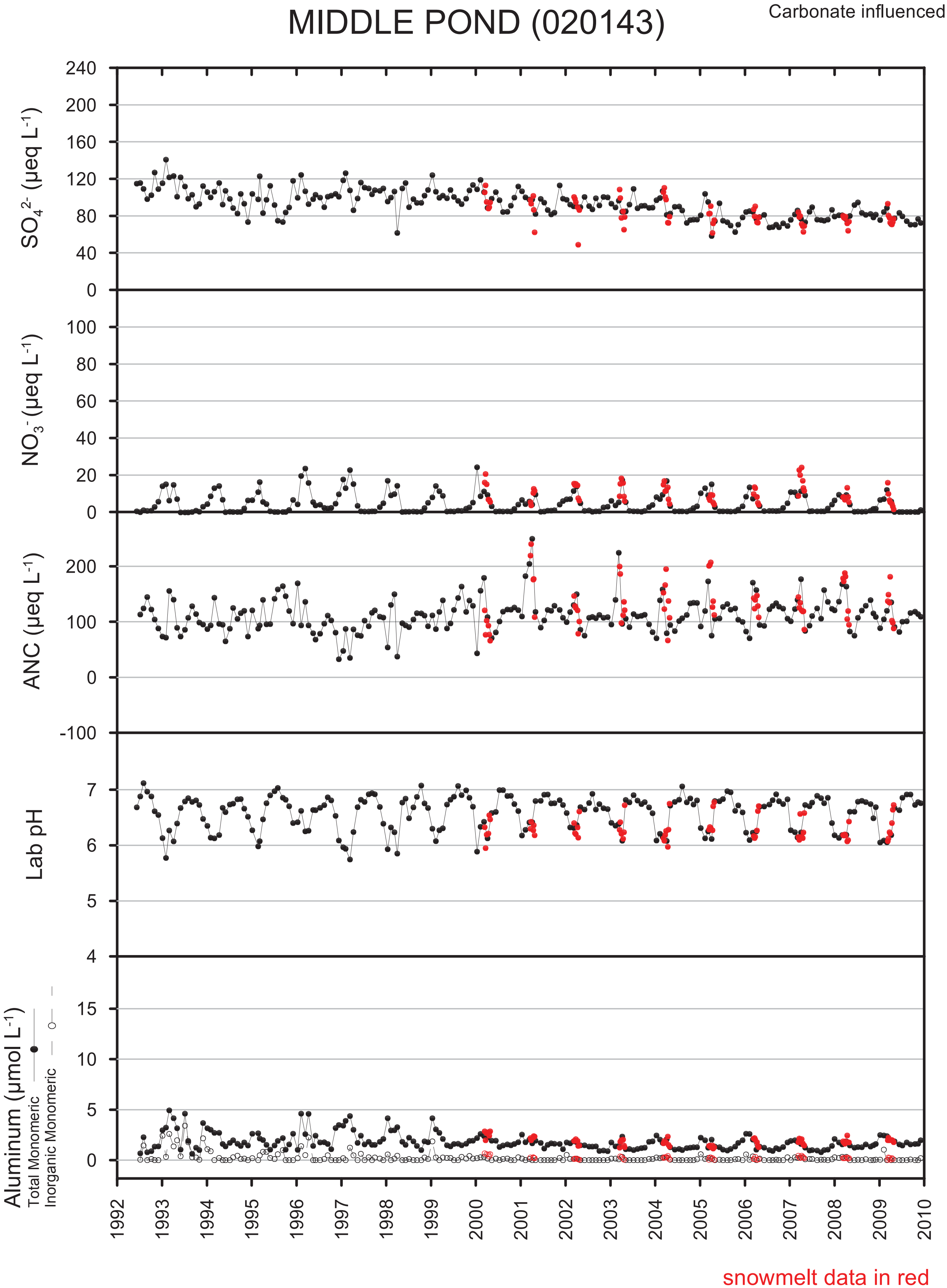


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-98	Northern pike	15	388	621	12071	15
May-98	Golden shiner	24	87	191	384	54
May-98	Fallfish	1	211	211	104	1
May-98	Brown bullhead	27	135	390	8188	82
May-98	Pumpkinseed	15	135	211	1993	15
May-98	Largemouth bass	3	327	479	3210	3
May-98	Yellow perch	24	76	281	2041	83
May-84	Northern pike	9	403	552	6220	9
May-84	Golden shiner	10	78	174	261	32
May-84	Brown bullhead	10	279	342	5205	49
May-84	Pumpkinseed	7	145	202	890	7
May-84	Largemouth bass	1	480	480	1800	1
May-84	Yellow perch	10	149	209	629	44

Watershed disturbance: The 1916 fire protection source data reveal 100% of the watershed as virgin and second growth green timber with no slash. The watershed was unaffected by the November 1950 blowdown and July 1995 microburst storms (APA 2001). The watershed experienced light damage from the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Bukaveckas,P.A. and Robbins-Forbes,M. 2000. Role of dissolved organic carbon in the attenuation of photosynthetically active and ultraviolet radiation in Adirondack lakes. Freshwater Biology 43: 339-354.

Dittman,J.A. and Driscoll,C.T. 2009. Factors influencing changes in mercury concentrations in lake water and yellow perch (*Perca flavescens*) in Adirondack lakes. Biogeochemistry 93: 179-196.

Dixit,S.S., Cumming,B.F., Birks,H.J.B., Smol,J.P., Kingston,J.C., Uutala,A.J., Charles,D.F., and Camburn,K.E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology 41: 5191-5197.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Schoch, N., Evers, D., Duron, M., Robbins, K., Yates, D., Simonin, H., Glennon, Michale, and Ozard, J. 2007. Long-Term Monitoring and Assessment of Mercury Based on Integrated Sampling Efforts Using the Common Loon, Prey Fish, Water, and Sediment and Understanding Methylmercury Cycling in Aquatic and Terrestrial Foodwebs in New York. Interim Report to the New York State Energy Research and Development Authority, Albany, NY.

Sullivan,T.J., McMartin,B., and Charles,D.F. 1996. Re-examination of the role of landscape change in the acidification of lakes in the Adirondack Mountains, New York. The Science of the Total Environment 183: 231-248.

This page intentionally left blank.

Sunday Pond 020188

Lat. 44° 20’ 41’’ N Long. 074° 18’ 02’’ W

Lake: Sunday Pond lies in the Lake Champlain watershed at 495 m. The pond is located within 700 m of the shoreline of Upper Saranac Lake and has no inlets or outlets (Figure 1). It reaches a maximum depth of 11.0 m (Figure 2).

Sunday Pond is classified as a mounded seepage lake with low dissolved organic carbon. The pond is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. Weekly sampling during spring melt has been ongoing since 1998.

Lake chemistry: The ALS sampled the lake on 19 Jul 1984 finding: Lab pH 5.69, ANC 11.1 µeq L^{-1}, SO_4^{2-} 70.37 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 43.91 µeq L^{-1}, Mg^{2+} 36.21 µeq L^{-1}, DOC 4.0 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes appear in Figure 3.

Aquatic biota: On 10 Oct 1984, emergent aquatic plants occupied 1% of the surface and submergents occupied 1% of the lake bottom. Species identified were: Nuphar spp. and Eriocaulon spp. On 12 Oct 1984, a dip net survey found the following Insecta; Odonata Libellulidae, Corduliidae and Aeshnidae; Trichoptera Phryganeidae; Hemiptera Notonectidae; and Megaloptera Sialidae. On 19 Jul 1984 a thermocline was detected between 4 and 6 m (ALSC 1985).

Fisheries: NYSDEC initially stocked the lake with brook trout in 1929. The lake was limed each year from 1959-1962, and again in 1970 and 1976. The lake was treated with rotenone in 1964 (ALSC 1985). Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: Sunday Pond is one of 36 ALTM lakes evaluated by Momen and Zehr (1998) during 1994 examining lake-water chemistry and terrestrial characteristics with the existing watershed classifications (Momen, B. and Zehr, J. P. 1998). Ito et al 2006 evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998-2000

Figure 1. Catchment

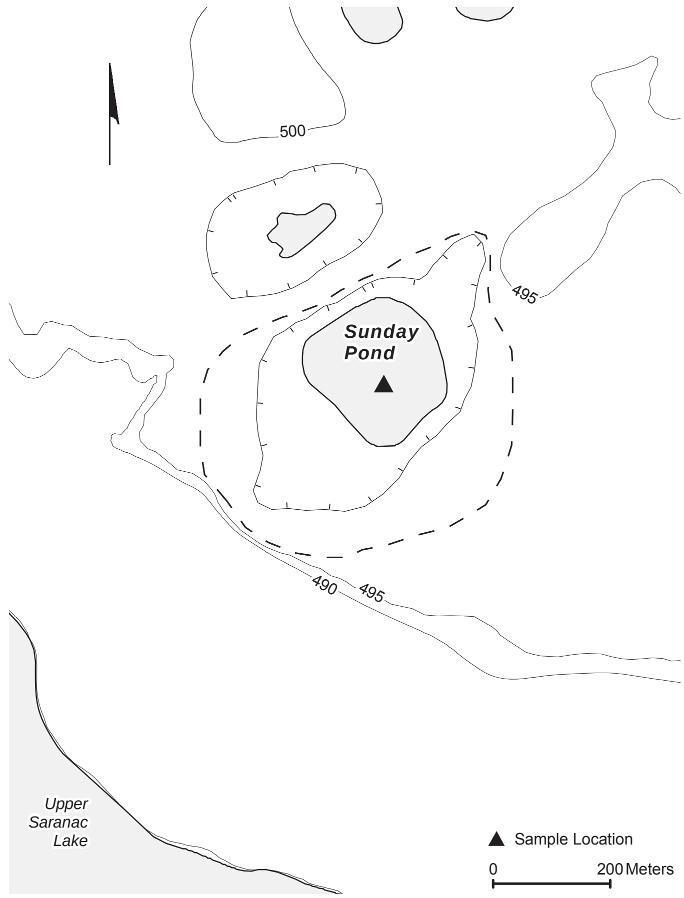
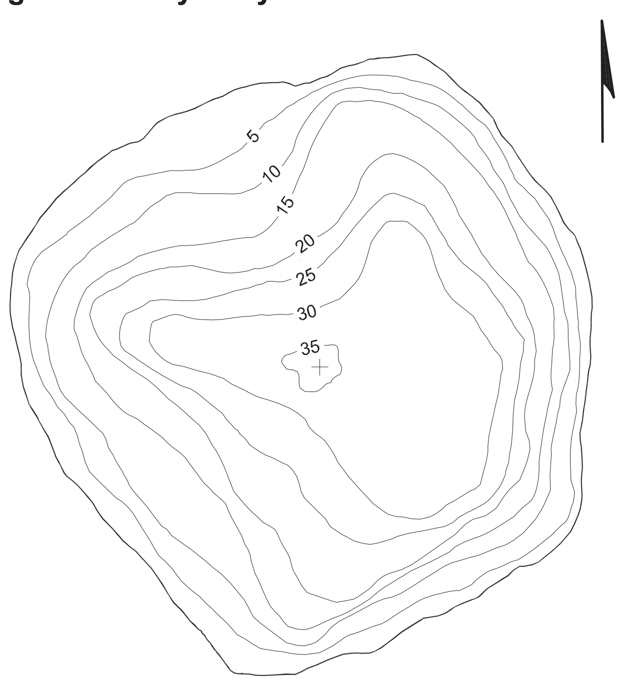


Figure 2. Bathymetry



Maximum Depth (+): 36 ft
Source: ALSC 1984

(Ito, M. et al. 2006). Bukaveckas and Robbins-Forbes (2000) characterized the attenuation of photosynthetic radiation in relation to lake chemistry in this lake as part of a regional survey (Bukaveckas, P. A. and Robbins-Forbes, M. 2000).

Deposition: The nearest NADP deposition monitoring site is 32 km east at Whiteface Mountain. The nearest NYSDEC wet deposition monitoring site is 11 km northeast at Paul Smiths.

Watershed: Sunday Pond and its watershed lie on metanorthosite and anorthositic gneiss. The watershed is primarily overlain by outwash sand and gravel with areas of swamp deposits comprised of muck/silt/sand (APA 2001). The watershed is relatively flat and rises to a maximum elevation of 495 m. In 1984, the ALS found the shoal water substrate comprised of 90% sand/gravel and 10% muck/silt (ALSC 1985).

Table 1. Lake Chemistry

020188			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	52.47	84.11	62.06	36.95	47.65	42.35	μeq L^{-1}
NO_3^-	-0.24	30.32	5.33	0.00	2.76	0.39	μeq L^{-1}
Cl^-	3.95	10.44	5.74	4.52	5.99	4.92	μeq L^{-1}
F^-	0.58	1.00	0.71	0.00	1.24	0.73	μeq L^{-1}
ANC	-22.94	6.74	-3.15	-9.33	1.44	-2.18	μeq L^{-1}
DIC	-0.83	124.88	60.78	15.82	132.38	49.90	μmol L^{-1} -C
DOC	163.68	338.19	242.83	91.75	179.87	127.13	μmol L^{-1} -C
SiO_2	-2.16	5.99	1.58	-3.16	1.37	-0.03	μmol L^{-1}
Ca^{2+}	23.95	53.90	39.67	21.96	34.43	25.22	μeq L^{-1}
Mg^{2+}	19.75	29.62	24.21	12.43	13.99	13.37	μeq L^{-1}
Na^+	1.74	7.83	3.26	2.17	3.48	2.80	μeq L^{-1}
K^+	1.28	9.98	7.05	5.37	6.28	5.84	μeq L^{-1}
NH_4^+	-0.33	7.82	2.86	-1.28	2.55	0.04	μeq L^{-1}
AL_TD	-0.30	2.30	0.41	0.11	0.52	0.29	μmol L^{-1}
AL_TM	0.37	2.34	1.29	1.26	1.84	1.61	μmol L^{-1}
AL_OM	-0.01	0.74	0.39	1.33	1.93	1.59	μmol L^{-1}
AL_IM	0.26	1.89	0.90	0.00	0.30	0.08	μmol L^{-1}
LABPH	4.52	5.42	5.07	5.02	5.26	5.14	
AIREQPH	4.53	5.82	5.14	5.09	5.28	5.21	
TRUECOLOR	0	15	9	10	15	13	Pt Co
SCONDUCT	10.61	25.44	13.25	8.48	10.65	9.58	μS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	495 m
Maximum depth	11 m
Mean depth	5.4 m
Volume	21.9×10^4 m^3
Surface area	4 ha
Watershed area	21.5 ha
Watershed ratio	0.18
Hydraulic retention time (year)	NA
Watershed	Lake Champlain
County, Town	Franklin, Santa Clara
USGS Quadrangle	Upper Saranac Lake
Land use classification	Saranac Lakes Wild Forest

Figure 3. Chemistry Time Series

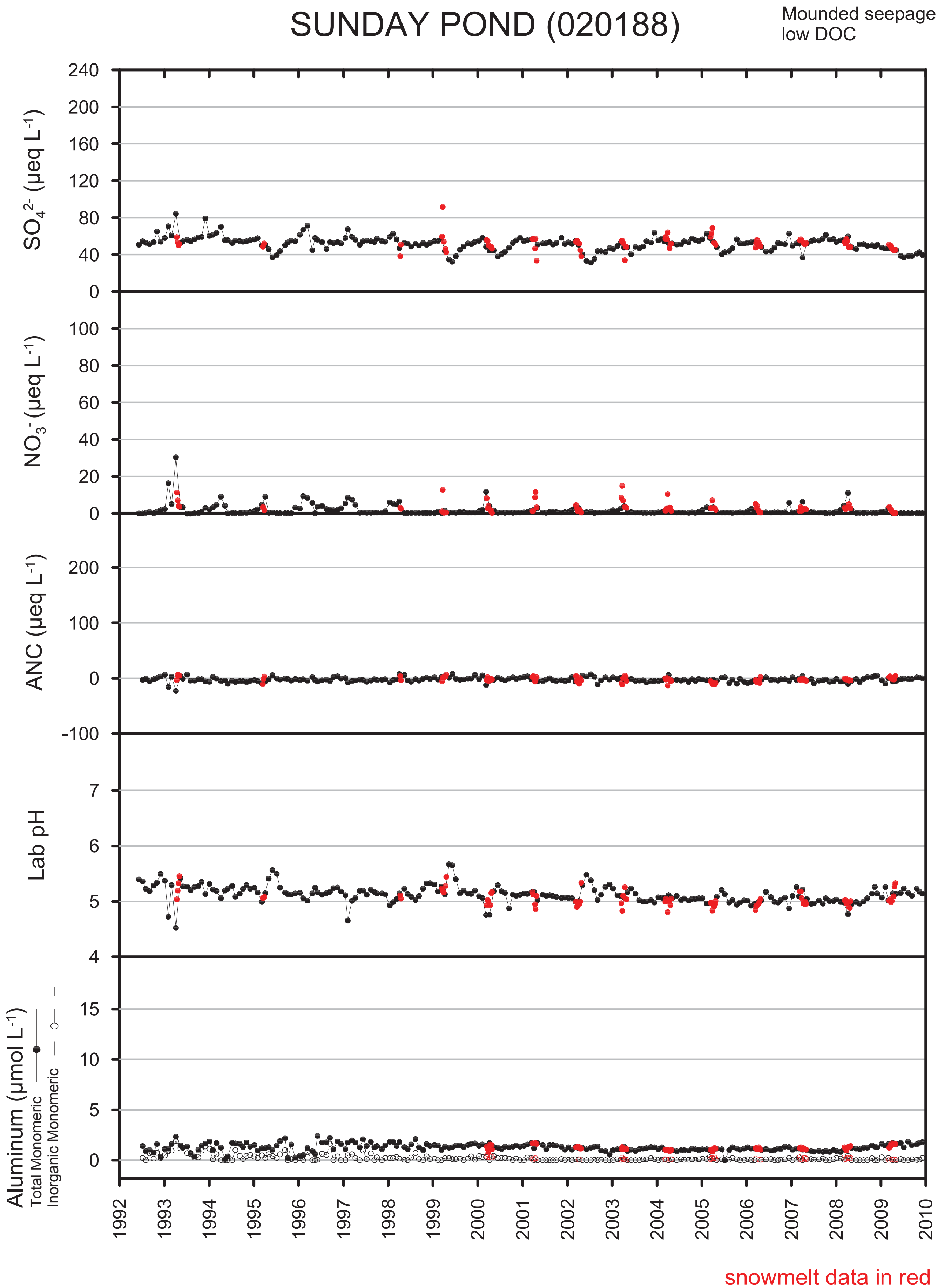


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	735	10
1981	Brook trout	630	6
1982	Brook trout	500	20
1984	Brook trout	668	31
1985	Brook trout	770	12
1986	Brook trout	700	22
1987	Brook trout	700	4
1988	Brook trout	700	6
1989	Brook trout	770	11
1990	Brook trout	760	8
1991	Brook trout	700	7
1992	Brook trout	700	9
1993	Brook trout	700	7
1994	Brook trout	550	10
1995	Brook trout	350	3
1996	Brook trout	700	19
1997	Brook trout	700	15
1998	Brook trout	720	15
1999	Brook trout	700	5
2000	Brook trout	700	8
2001	Brook trout	700	12
2002	Brook trout	700	12
2003	Brook trout	700	5
2004	Brook trout	500	7
2005	Brook trout	500	7
2006	Brook trout	550	9

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
July-98	Brook trout	22	251	354	-	22
May-99	Brook trout	20	185	294	-	20
June-00	Brook trout	17	238	340	-	17
October-84	Brook trout	17	210	393	5040	17
October-84	Lake trout	1	558	558	1300	1

Land cover/use: In 1984, deciduous forest covered 90% of the watershed and deciduous-coniferous mixed forest the remainder. The immediate shoreline was 95% deciduous-conifer mix and 5% coniferous forest (ALSC 1985). The pond and its watershed are located within the Saranac Lakes Wild Forest. There are two seasonal dirt roads on either side of the pond. The road on the western side leads to a sand pit, while the road on the east leads to a sandy hand launch access on the northern shore.

Watershed Disturbance: The 1916 fire protection data reveal 100% of the watershed as virgin and second growth green timber with no slash. The watershed was unaffected by the November 1950 blowdown and July 1995 microburst storms (APA 2001). The watershed experienced light damage from the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Bukaveckas,P.A. and Robbins-Forbes,M. 2000. Role of dissolved organic carbon in the attenuation of photosynthetically active and ultraviolet radiation in Adirondack lakes. Freshwater Biology 43: 339-354.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

Momen,B. and Zehr,J.P. 1998. Watershed classification by discriminant analyses of lakewater-chemistry and terrestrial characteristics. Ecological Applications 8: 497-507.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

This page intentionally left blank.

Sochia Pond 020197

Lat. 44° 21' 08" N Long. 074° 17' 41" W

Lake: Sochia Pond lies in the Lake Champlain watershed at 495 m. This small 1.6 ha kettle hole lake has no inlets or outlets (Figure 1) with a bog fringe (ALSC 1985). The lake has a maximum depth of 5.5 m (Figure 2).

Sochia Pond is classified as a mounded seepage lake with low dissolved organic carbon. It is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992.

Lake chemistry: Sochia Pond was sampled by the ALS on 26 Jul 1984 finding: Lab pH 4.63, ANC -21.1 µeq L^{-1}, SO_4^{2-} 53.92 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 22.96 µeq L^{-1}, Mg^{2+} 7.41 µeq L^{-1}, DOC 2.1 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes appear in Figure 3.

Aquatic biota: On 10 May 1984, a dip net survey by the ALS identified the following Insecta: Odonata Libellulidae, Lestidae, and Coenagriidae; Trichoptera Phryganeidae and Polycentropodidae; Hemiptera Notonectidae and Nepidae; Megaloptera Sialidae; Coleoptera Dytiscidae and Gyrinidae; and Diptera Culicidae. No macrophyte data were available (ALSC 1985).

Fisheries: NYSDEC stocked the pond with brook trout from 1942 to 1974 (ALSC 1985). The ALSC surveyed the lake on 11 May 1984 and on 23 May 1995. No fish were caught in either survey**.**

Intensive studies: Sochia Pond is one of 36 ALTM lakes evaluated by Momen and Zehr (1998) during 1994 examining lake-water chemistry and terrestrial characteristics with the existing watershed classifications (Momen, B. and Zehr, J. P. 1998; Ito, M. et al. 2006). Ito et al 2006 evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store, or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998-2000 (Ito, M. et al. 2006).

Deposition: The nearest NADP deposition monitoring site is 31 km east at Whiteface Mountain. The nearest NYSDEC wet deposition monitoring site is 10 km northeast at Paul Smiths.

Figure 1. Catchment

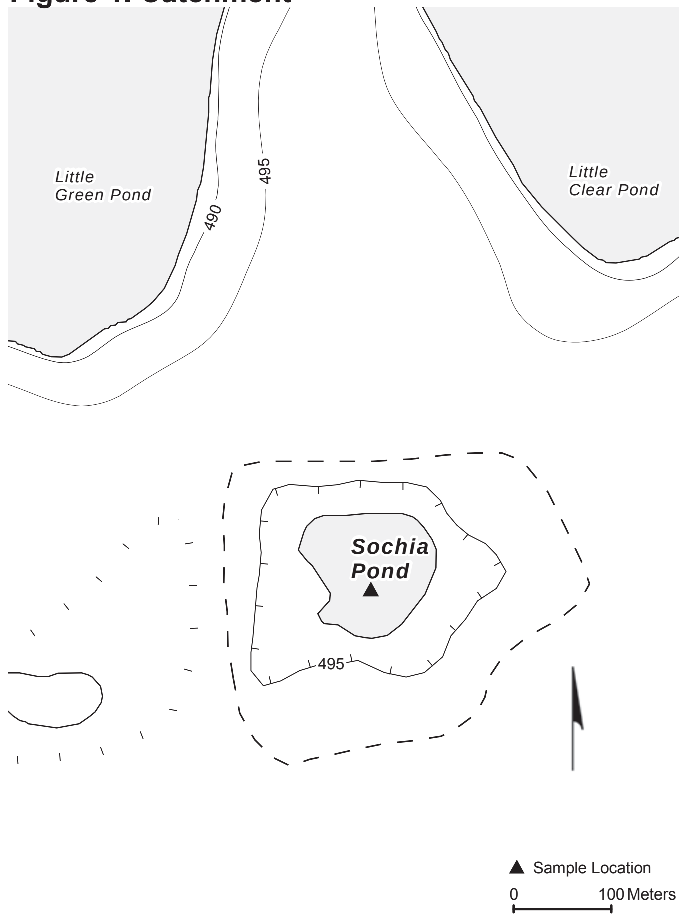
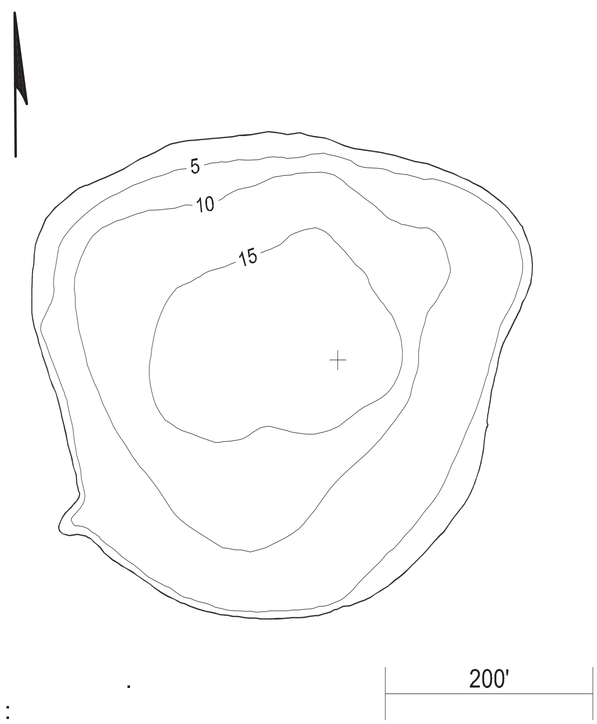


Figure 2. Bathymetry



Watershed: The pond and its watershed are underlain by anorthositic gneiss and is overlain by deposited outwash sand and gravel (APA 2001). The watershed has a maximum elevation of 495 m that is the same elevation as the pond, so there is no detectible relief to the watershed. In 1984, the ALS found the shoal water substrate comprised of 90% muck/silt and 10% organic (ALSC 1985).

Land cover/use: In 1984, coniferous forest covered 50% of the watershed, while 45% was deciduous-coniferous mixed forest and 5% wetland. The immediate shoreline was predominately wetland vegetation (ALSC 1985). The pond and its watershed are located within the Saranac Lakes Wild Forest. There is a foot trail on the southeastern side of the pond.

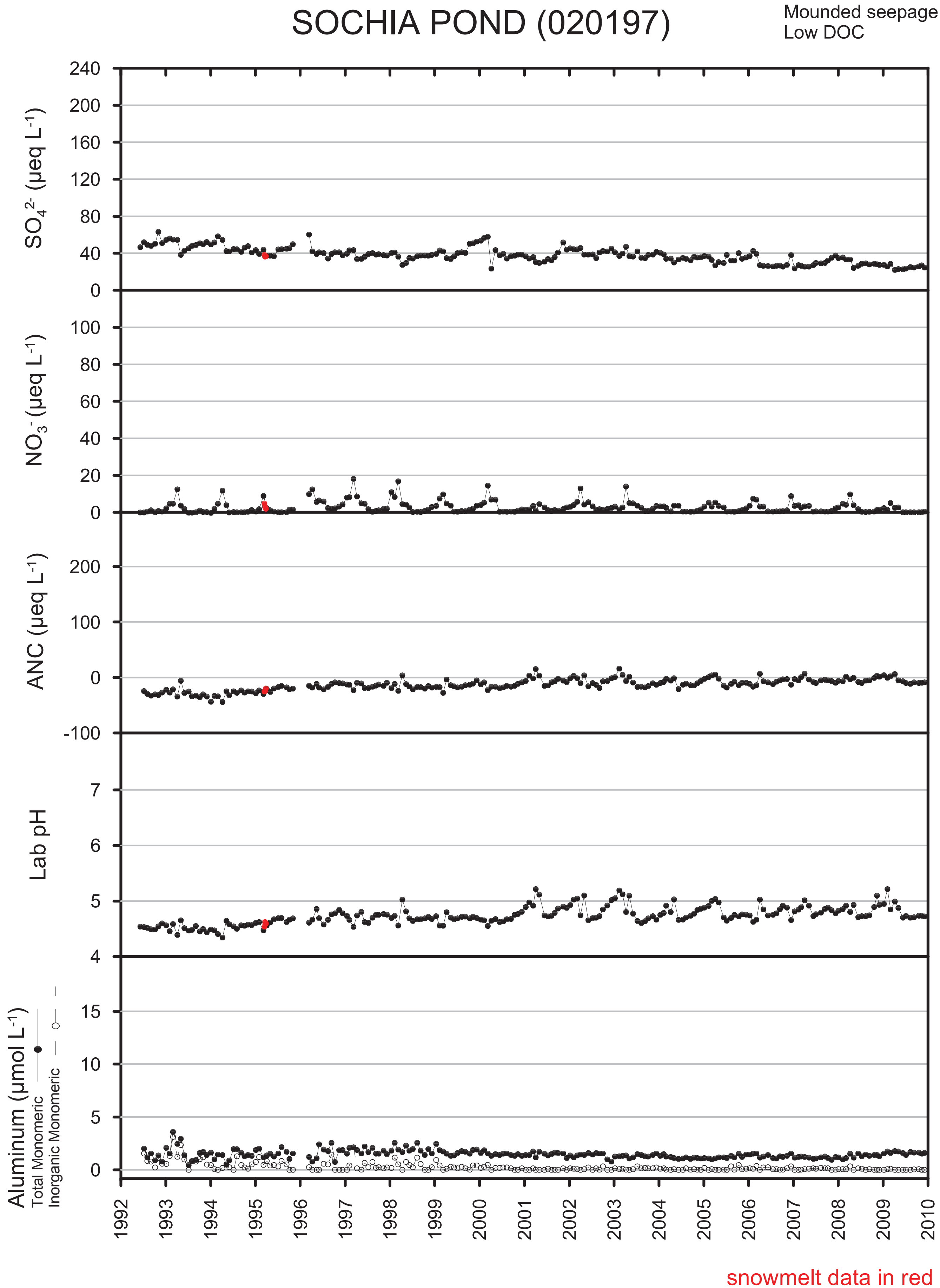
Table 1. Lake Chemistry

020197			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	38.31	56.01	49.59	21.96	28.46	24.93	µeq L^{-1}
NO_3^-	-0.24	12.42	2.49	0.00	5.14	1.19	µeq L^{-1}
Cl^-	1.41	8.18	4.44	2.86	7.91	5.58	µeq L^{-1}
F^-	0.16	0.68	0.51	0.31	0.79	0.56	µeq L^{-1}
ANC	-35.43	-5.83	-27.53	-11.42	6.51	-4.75	µeq L^{-1}
DIC	22.48	228.12	90.06	34.13	302.22	101.94	µmol L^{-1}-C
DOC	214.13	359.00	293.09	332.27	428.02	368.72	µmol L^{-1}-C
SiO_2	-5.99	5.99	0.94	-0.33	3.16	1.54	µmol L^{-1}
Ca^{2+}	11.98	33.93	18.71	10.98	20.46	14.07	µeq L^{-1}
Mg^{2+}	6.58	12.34	9.12	6.50	7.51	7.09	µeq L^{-1}
Na^+	1.74	5.65	3.44	3.04	4.78	3.84	µeq L^{-1}
K^+	1.02	7.16	3.47	0.65	3.84	2.72	µeq L^{-1}
NH_4^+	-0.44	11.03	3.43	-1.00	20.62	5.51	µeq L^{-1}
AL_TD	-0.07	2.45	0.59	0.18	0.67	0.49	µmol L^{-1}
AL_TM	0.44	3.60	1.74	1.41	1.78	1.63	µmol L^{-1}
AL_OM	-0.18	1.52	0.58	1.48	1.96	1.72	µmol L^{-1}
AL_IM	0.00	3.11	1.16	0.00	0.11	0.02	µmol L^{-1}
LABPH	4.39	4.65	4.50	4.70	5.21	4.80	
AIREQPH	4.42	4.80	4.51	4.71	5.39	4.87	
TRUECOLOR	5	20	13	20	45	32	Pt Co
SCONDUCT	14.12	22.63	17.14	8.87	11.31	10.53	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	495 m
Maximum depth	5.5 m
Mean depth	3.1 m
Volume	5.0 x 10^4 m^3
Surface area	1.6 ha
Watershed area	9.6 ha
Watershed ratio	0.17
Hydraulic retention time (year)	NA
Watershed	Lake Champlain
County, Town	Franklin, Santa Clara
USGS Quadrangle	Upper Saranac Lake
Land use classification	Saranac Lakes Wild Forest

Figure 3. Chemistry Time Series



Watershed disturbance: The 1916 fire protection source data reveal 100% of the watershed as virgin and second growth green timber with no slash. The watershed was unaffected by the November 1950 blow down and July 1995 microburst storms (APA 2001). The watershed experienced light damage from the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

Momen,B. and Zehr,J.P. 1998. Watershed classification by discriminant analyses of lakewater-chemistry and terrestrial characteristics. Ecological Applications 8: 497-507.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Owen Pond 020233

Lat. 44° 19' 23" N   Long. 073° 54' 12" W

Lake: Owen Pond lies in the Lake Champlain watershed at 514 m. This 7.6 ha lake lies on a shelf on the northwestern slopes of Stewart Mt. and Kilburn Mt. in the Sentinel Range. One inlet drains the combined outlets of Winch Pond, Marsh Pond, and Copperas Pond. A secondary inlet drains from Kilburn Mountain (Figure 1). Remnants of an old log dam or weir appear approximately 50 m downstream from the free flowing outlet. The lake outlet drains to the West Branch of the Ausable River. Owen Pond reaches a maximum depth of 9.4 m (Figure 2).

Owen Pond is classified as a thick till lake with low dissolved organic carbon. The lake is not considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. Spring melt weekly sampling has been ongoing since 1998.

Lake chemistry: Owen Pond was sampled during the ALS on 24 Jul 1984 finding: Lab pH 6.91, ANC 108.5 µeq L^{-1}, SO_4^{2-} 163.85 µeq L^{-1}, NO_3^- 2.43 µeq L^{-1}, Ca^{2+} 222.57 µeq L^{-1}, Mg^{2+} 55.96 µeq L^{-1}, DOC 4.8 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent water chemistry. Monthly plots of the major analytes appear in Figure 3.

Aquatic biota: On 13 Sep 1984, the ALS aquatic plant survey found submergent plants covered 60% of the lake bottom. Floating and emergent aquatic plants occupied 8% and 2% of the lake surface, respectively. Species identified were: Sparganium spp., Potamogeton spp., Eriocaulon spp., Pontederia spp., Juncus spp., Nuphar spp., and Utricularia spp. A dip-net survey on the same date found: Demospong Haplosclerina Spongillidae; Crustacea Decapoda Astacidae; and the following Insecta: Ephemeroptera Heptageniidae; Odonata Coenagriidae and Gomphidae (ALSC 1985). On 24 Jul 1984 a thermocline was detected between 2 and 4 m (ALSC 1985).

Fisheries: NYSDEC stocked rainbow trout from 1931-1949. In September 1952, DEC reclaimed the lake with rotenone. In October 1952, they began annual stocking of brook trout until 1989. Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Figure 1. Catchment

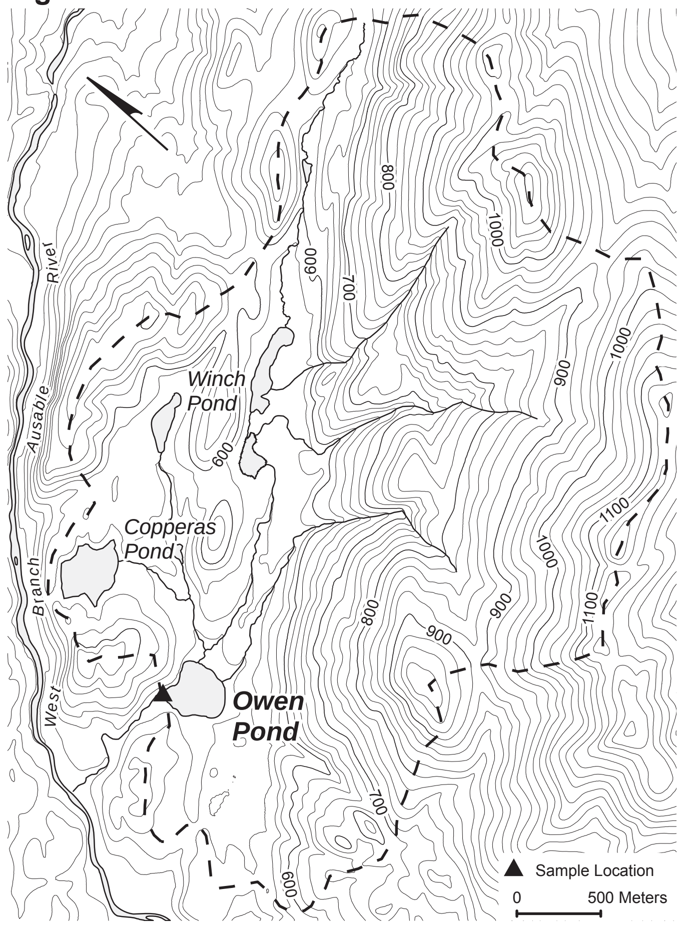
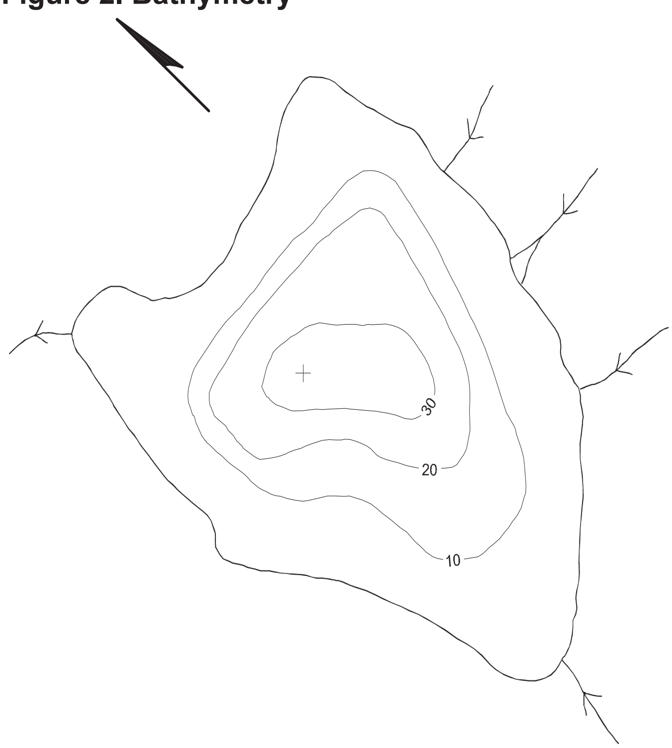


Figure 2. Bathymetry



Maximum Depth (+): 31 ft
Source: NYSDEC, ALSC Rev. 1984

Intensive studies: Owen Pond was a study watershed for the Adirondack/Catskill comparison during 1992-2001 (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in the watershed.

Deposition: The nearest NADP deposition and NYSDEC wet deposition monitoring sites are co-located 9 km north at Whiteface Mountain.

Watershed: Owen Pond lies on predominantly metanorthosite and anorthositic gneiss (66%) and interlayered gabbroic or noritic metanorthosite (17%) bedrock. Till overlays 65% of the watershed while 35% of the watershed has exposed bedrock (APA 2001). Two-thirds of the watershed is above 600 m. About 20% of the watershed is above 900 m and 10% above 1000 m. The maximum elevation is 1183 m on the peak of Kilburn Mountain within the Sentinel Range. The maximum relief is 669 m. In 1984, the ALS found the shoal water substrate comprised of 40% rubble, 40% muck/silt, and 20% organic (ALSC 1985).

Land cover/use: In 1984, a deciduous-coniferous mixed forest covered 97% of the watershed while shrub-sampling made up the remaining 3%. The immediate shoreline was 85% deciduous-coniferous forest and 15% shrub saplings (ALSC 1985). Owen Pond and its watershed occur entirely within the Sentinel Range Wilderness. A popular hiking trail skirts the north shoreline of the pond. There is a primitive campsite on the northeastern shoreline of the pond.

Watershed disturbance: The 1916 fire protection source data reveal a mix of virgin and second growth green timber with wide areas of logging for softwoods only. There is a small area to the north of the watershed where logging occurred for both soft and hardwoods. The November 1950 blowdown storm impacted two very small areas north of Winch Pond, but otherwise did not affect the watershed. The July 1995 microburst storm did not affect the watershed (APA 2001). The watershed experienced heavy damage from the January 1998 ice storm (NYSDEC 1998).

Table 1. Lake Chemistry

020233			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	121.38	178.01	152.09	71.91	117.81	91.93	µeq L^{-1}
NO_3^-	6.82	38.93	19.22	5.84	43.41	23.64	µeq L^{-1}
Cl^-	7.62	12.97	10.62	6.56	13.44	9.74	µeq L^{-1}
F^-	0.95	1.37	1.14	1.13	2.03	1.34	µeq L^{-1}
ANC	56.44	175.35	109.15	57.67	154.63	119.54	µeq L^{-1}
DIC	81.59	309.71	161.66	93.25	242.27	163.05	µmol L^{-1} -C
DOC	263.01	509.61	390.60	277.24	550.74	431.30	µmol L^{-1} -C
SiO_2	68.40	184.07	132.51	108.85	176.26	135.67	µmol L^{-1}
Ca^{2+}	115.28	265.48	202.69	143.72	209.09	172.54	µeq L^{-1}
Mg^{2+}	38.68	83.11	59.86	37.85	65.83	50.18	µeq L^{-1}
Na^+	23.49	43.50	34.00	26.97	43.50	35.10	µeq L^{-1}
K^+	3.33	6.91	5.16	3.33	4.95	4.10	µeq L^{-1}
NH_4^+	-0.44	4.32	2.39	-0.26	3.52	1.17	µeq L^{-1}
AL_TD	2.59	6.71	4.26	1.82	7.15	4.86	µmol L^{-1}
AL_TM	0.76	3.12	1.98	1.86	3.11	2.35	µmol L^{-1}
AL_OM	0.67	2.91	1.49	1.56	2.89	2.19	µmol L^{-1}
AL_IM	0.00	1.28	0.54	0.00	0.41	0.18	µmol L^{-1}
LABPH	6.36	6.89	6.57	6.41	6.99	6.64	
AIREQPH	6.71	7.30	7.04	6.79	7.40	7.11	
TRUECOLOR	20	45	28	20	60	37	Pt Co
SCONDUCT	26.55	41.91	33.69	24.54	36.82	29.19	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	514 m
Maximum depth	9.4 m
Mean depth	3.7 m
Volume	28.4 x 10^4 m^3
Surface area	7.6 ha
Watershed area	1159 ha
Watershed ratio	0.006
Hydraulic retention time (year)	0.03
Watershed	Lake Champlain
County, Town	Essex, North Elba
USGS Quadrangle	Lake Placid
Land use classification	Sentinel Range Wilderness

Figure 3. Chemistry Time Series

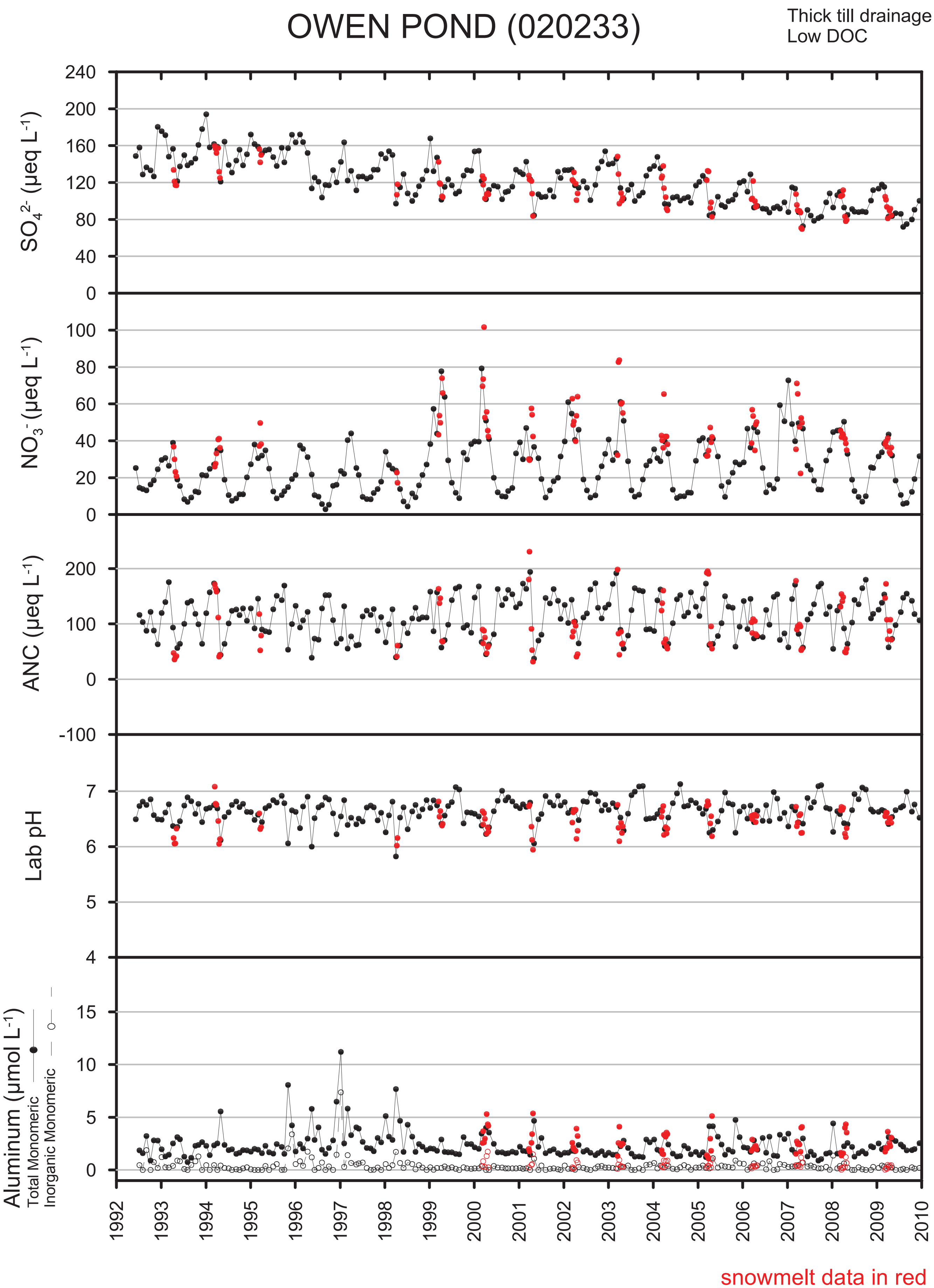


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	945	11
1981	Brook trout	810	19
1982	Brook trout	900	7
1983	Brook trout	900	6
1984	Brook trout	666	6
1985	Brook trout	990	8
1986	Brook trout	900	4
1987	Rainbow trout	800	98
1987	Brook trout	900	5
1988	Brook trout	900	4
1989	Brook trout	1980	34
1990	Brown trout	900	34
1991	Brown trout	900	28
1992	Brown trout	900	24
1993	Brown trout	900	25
1994	Brown trout	900	19
1995	Brown trout	900	32
1996	Brown trout	900	79
1997	Brown trout	900	55
1998	Brown trout	430	85
1999	Brown trout	330	30
2000	Brown trout	430	35
2001	Brown trout	400	43
2002	Brown trout	400	35
2003	Brown trout	370	32
2004	Brown trout	360	35
2005	Brown trout	370	26
2006	Brown trout	380	37

Table 4. Netting History

Date Month-Year	Species	Number	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-94	Brown trout	4	310	357	1424	4
May-94	Brook trout	8	144	293	1086	8
May-94	N. redbelly dace	4	50	65	6	5
May-94	Fathead minnow	1	65	65	3	1
May-94	Blacknose dace	25	55	70	27	28
May-94	Creek chub	34	60	128	187	34
May-94	White sucker	28	165	418	4901	74
May-94	Pumpkinseed	12	61	128	190	12
May-94	Common shiner	3	91	97	21	3
September-84	Brown trout	5	249	550	3580	5
September-84	Brook trout	3	194	202	185	3
September-84	Creek chub	20	89	117	-	31
September-84	Pearl dace	2	62	76	-	2
September-84	White sucker	16	100	349	2249	16
September-84	Pumpkinseed	2	62	111	33	2

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns,D.A., McHale,M.R., Driscoll,C.T., and Roy,K.M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology 41: 5191-5197.

NYSDEC. Icing Zones 1998. New York State Department of Environmental Conservation, Albany, NY.

This page intentionaly left blank.

Heart Lake 020264

Lat. 44° 10' 47'' N Long. 073° 58' 03'' W

Lake: Heart Lake lies in the Lake Champlain watershed at 661 m. It has no permanent inlets, but intermittent inlet streams occur (Figure 1). The 10.7 ha lake has a maximum depth of 16.8 m (Figure 2). In 1985, the ALS observed an active beaver dam at the outlet. The beaver dam is no longer present. The outlet flows into a tributary of the West Branch of the Ausable River.

Heart Lake is a medium till drainage lake, with low dissolved organic carbon. The lake is considered moderately sensitive to acidification. This is one of the original ALS waters and has been monitored on a monthly basis since June 1982. Weekly spring melt sampling has been ongoing since 2002.

Lake chemistry: The ALS sampled Heart Lake on 8 Jul 1985 finding: Lab pH 6.59, ANC 29.5 µeq L^{-1}, SO_4^{2-} 94.52 µeq L^{-1}, NO_3^- 0.49 µeq L^{-1}, Ca^{2+} 102.30 µeq L^{-1}, Mg^{2+} 21.39 µeq L^{-1}, DOC 2.7 mg L^{-1}-C (ALSC 1986). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes appear in Figure 3.

Aquatic biota: On 8 Jul 1985, submergent aquatic plants occupied 1% of the lake bottom. Emergent aquatic plants occupied 1% of the lakes surface and consisted of Eriocaulon spp. in flowering stage. On 6 May 1985, a dip-net survey by the ALS found the following Insecta: Ephemeroptera Leptophlebiidae, Heptageniidae, and Ephemerellidae; Odonata Macromiidae and Coenagriidae; Trichoptera Unspecified; Diptera Chironomidae; and Hemiptera Gerridae. Also found were Gastropod Mesogastropoda Viviparidae and Demosponge Haplosclerina Spongillidae. The thermocline on 8 Jul 1985 was between 5 and 6 m (ALSC 1986).

Fisheries: Heart Lake is a privately owned water and is reported to have been an excellent trout water prior to 1945 (Bath, D. W. 2003). It has no history of stocking. Refer to Table 3 for a recent fish netting history.

Intensive studies: Heart Lake was studied during RILWAS in 1985 (Driscoll, C. T. and Newton, R. M. 1985). Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Heart Lake was part of a three lake study along with

Figure 1. Catchment

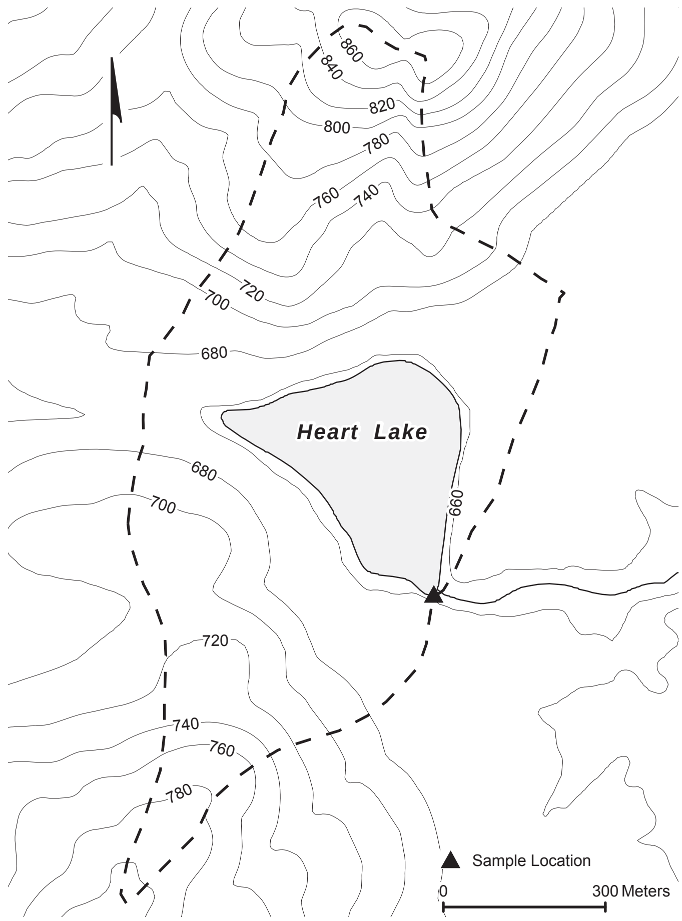
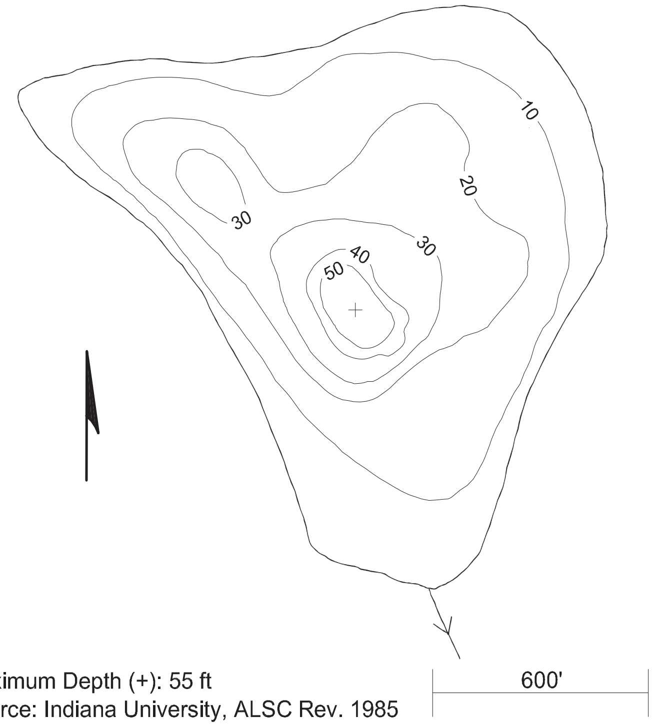


Figure 2. Bathymetry



Lake Arnold and Upper Wallface Pond demonstrating paleoecological techniques to reconstruct long term changes in lake chemistry, trophic state, watershed vegetation and soils in the High Peaks region (Whitehead, D. R. et al. 1989). During 1986 and 1987 snowmelt, Schaefer and Driscoll (1993) evaluated episodic acidification at the outlet. Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995).

Deposition: The nearest NADP and co-located NYS DEC wet deposition monitoring sites are 25 km north at Whiteface Mountain.

Watershed: The bedrock underlying this moderately high elevation watershed is primarily metanorthosite and anorthositic gneiss. This type of bedrock is known to be hard and dense metamorphic rock that resists weathering and erosion. Deposited glacial till, a mixture of clay, silt, sand and stone occur near and around the base of mountains where hardwoods and mixed conifer sites dominate (NYSDEC 1999). Eighty-seven percent of the watershed is overlain by till, 12.7% lascustrine delta sand and gravel, and less than one percent exposed bedrock. The highest point in the watershed is Mt. Jo at 877 m. The maximum relief in this watershed is 216 m. In 1985, the ALS characterized the shoal water substrate as 70% sand, 15% boulder/rubble, and 15% organic (ALSC 1986).

Land cover/use: In 1985, the ALS described the watershed as: 75% deciduous forest; 15% coniferous forest; and 10% developed. The immediate shoreline was 80% deciduous-coniferous mixed forest, 15% coniferous forest and 5% developed (ALSC 1986). Heart Lake and its watershed are in private ownership in Resource Management under the APA Land Use and Development Plan (APA 2001) and are bordered by the High Peaks Wilderness Area (HPWA). Hiking trails circle the lake. The Adirondack Mountain Club has a lodge, campground, developed beach area and numerous lean-tos along the shoreline.

Table 1. Lake Chemistry

020264			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	81.61	117.42	93.05	56.64	75.16	62.58	μeq L^{-1}
NO_3^-	-0.40	22.56	5.54	0.00	18.92	4.12	μeq L^{-1}
Cl^-	6.21	9.87	7.80	6.10	7.77	6.80	μeq L^{-1}
F^-	0.84	1.26	0.99	0.72	1.23	1.02	μeq L^{-1}
ANC	17.65	56.44	37.70	35.29	54.20	46.00	μeq L^{-1}
DIC	44.96	148.20	80.13	59.11	132.38	88.21	μmol L^{-1} -C
DOC	158.60	325.03	220.30	158.27	218.91	189.35	μmol L^{-1} -C
SiO_2	21.64	59.91	36.57	15.20	67.24	40.45	μmol L^{-1}
Ca^{2+}	75.35	145.72	108.21	81.34	99.31	86.56	μeq L^{-1}
Mg^{2+}	18.93	30.45	23.31	16.46	22.22	19.34	μeq L^{-1}
Na^+	17.83	28.27	21.17	18.70	23.92	20.97	μeq L^{-1}
K^+	1.53	4.09	2.34	1.28	2.05	1.71	μeq L^{-1}
NH_4^+	0.28	3.55	1.07	-0.78	2.33	0.61	μeq L^{-1}
AL_TD	0.07	3.37	1.28	0.33	2.67	1.21	μmol L^{-1}
AL_TM	0.16	2.02	0.79	1.30	1.96	1.63	μmol L^{-1}
AL_OM	-1.78	1.80	0.45	1.48	1.96	1.66	μmol L^{-1}
AL_IM	0.00	0.89	0.36	0.00	0.33	0.06	μmol L^{-1}
LABPH	5.85	6.69	6.31	6.01	6.59	6.33	
AIREQPH	6.51	6.91	6.69	6.62	6.90	6.76	
TRUECOLOR	5	15	10	15	20	16	Pt Co
SCONDUCT	16.91	23.06	18.76	14.23	17.91	15.26	μS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	661 m
Maximum depth	16.8 m
Mean depth	5.1 m
Volume	54.5×10^4 m^3
Surface area	10.7 ha
Watershed area	69.3 ha
Watershed ratio	0.15
Hydraulic retention time (year)	1.03
Watershed	Lake Champlain
County, Town	Essex, North Elba
USGS Quadrangle	Keene Valley
Land use classification	Private - Resource Management

Figure 3. Chemistry Time Series

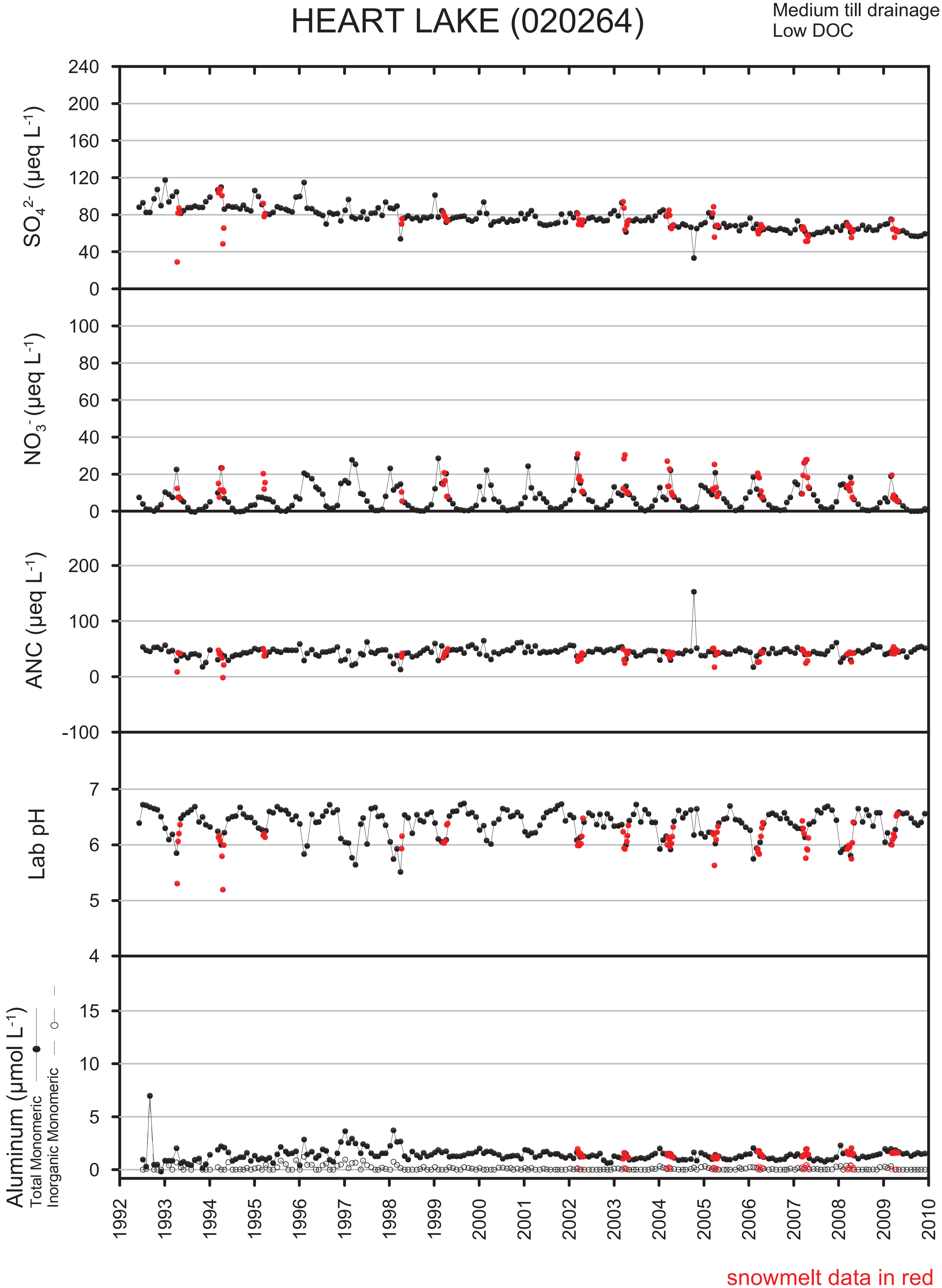


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-04	Brook trout	12	95	360	2934	12
May-04	Lake chub	2	109	116	12	2
May-04	Golden shiner	26	83	116	260	63
May-04	White sucker	16	200	518	14238	16
May-04	Brown bullhead	26	100	287	1736	40
May-04	Smallmouth bass	1	540	540	2900	1
May-85	Brook trout	17	205	340	2930	17
May-85	Lake chub	13	113	155	308	13
May-85	White sucker	29	185	350	5954	66
May-85	Brown bullhead	25	115	192	1043	48

Watershed disturbance: During the 19th century, the Adirondack region supported a logging industry that denuded vast areas that were subject to wildfire. During the summer and fall of 1903, nearly 243,000 hectares of land burned in the Adirondacks, including areas of the HPWA. Piles of dry logging slash, an extended drought and unseasonably high winds contributed to frequent major fires. In 1908 and 1909, an additional 121,406 hectares burned throughout the park. Lumbering practices were reformed to reduce fire risk and the state implemented extra measures of fire prevention and detection (NYSDEC 1999). The 1916 fire protection source data show nearly 95% of the Heart Lake watershed as waste and denuded with no slash. There is a very small area of burned with some slash to the eastern side of the pond. The watershed was not impacted by the November 1950 or July 1995 microburst storms (APA 2001). The watershed experienced light damage from the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Bath, D. W. Long term monitoring pond descriptions. 2003. Whitepaper. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Dixit,S.S., Cumming,B.F., Birks,H.J.B., Smol,J.P., Kingston,J.C., Uutala,A.J., Charles,D.F., and Camburn,K.E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack Lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

New York State Department of Environmental Conservation (NYSDEC) 1999. High Peaks Wilderness Complex Unit Management Plan. Ray Brook, NY.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Schaefer,D.A. and Driscoll,C.T. 1993. Identifying sources of snowmelt acidification with a watershed mixing model. Water, Air, and Soil Pollution 67: 345-365.

Whitehead,D.R., Charles,D.F., Jackson,S.T., Smol,J.P., and Engstrom,D.R. 1989. The developmental history of Adirondack (N.Y.) lakes. Journal of Paleolimnology 2: 185-206.

This page intentionally left blank.

Marcy Dam Pond 020265

Lat. 44° 09' 32" N Long. 073° 57' 11" W

Lake: Marcy Dam Pond lies in the Lake Champlain watershed at 720 m. This 1.2 ha impoundment has a major inlet forming Marcy Brook and several unnamed streams (Figure 1). The outlet flows over a 7 m wooden dam of recent origin that replaced a dam installed at the turn-of-the century to control water for the logging industry (NYSDEC 1999). The lake reaches a maximum depth of 2.4 m (Figure 2).

Marcy Dam Pond is classified as a thin till drainage lake with low dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the pond in June 1992.

Lake chemistry: Marcy Dam Pond was sampled during the ALS on 9 Jul 1985 finding: Lab pH 5.46, ANC -3.1 µeq L^{-1}, SO_4^{2-} 107.01 µeq L^{-1}, NO_3^- 2.59 µeq L^{-1}, Ca^{2+} 86.83 µeq L^{-1}, Mg^{2+} 21.39 µeq L^{-1}, DOC 3.3 mg L^{-1}-C (ALSC 1986). Table 1 summarizes recent water chemistry taken at the outlet. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 9 Jul 1985 the ALS aquatic plant survey found Sparganium spp. covering 1% of the lake bottom. A dip-net survey on 13 May 1985 identified the following Insecta: Odonata Aeshnidae, Hemiptera Corixidae, Notonectidae, and Gerridae; Megaloptera Sialidae; and Coleoptera Gyrinidae. Also found was Mollusca Pelecypod Unspecified (ALSC 1986).

Fisheries: NYSDEC began stocking brook trout in Marcy Dam Pond in 1955 (ALSC 1986). Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: NYSDOH conducted a limnological survey of Marcy Dam Pond in August 1975 (Wood, L. W. 1978). Ito evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 - 2000 (Ito, M. et al. 2006).

Deposition: The nearest NADP deposition and NYSDEC wet deposition monitoring sites are co-located 27 km north at Whiteface Mountain.

Figure 1. Catchment

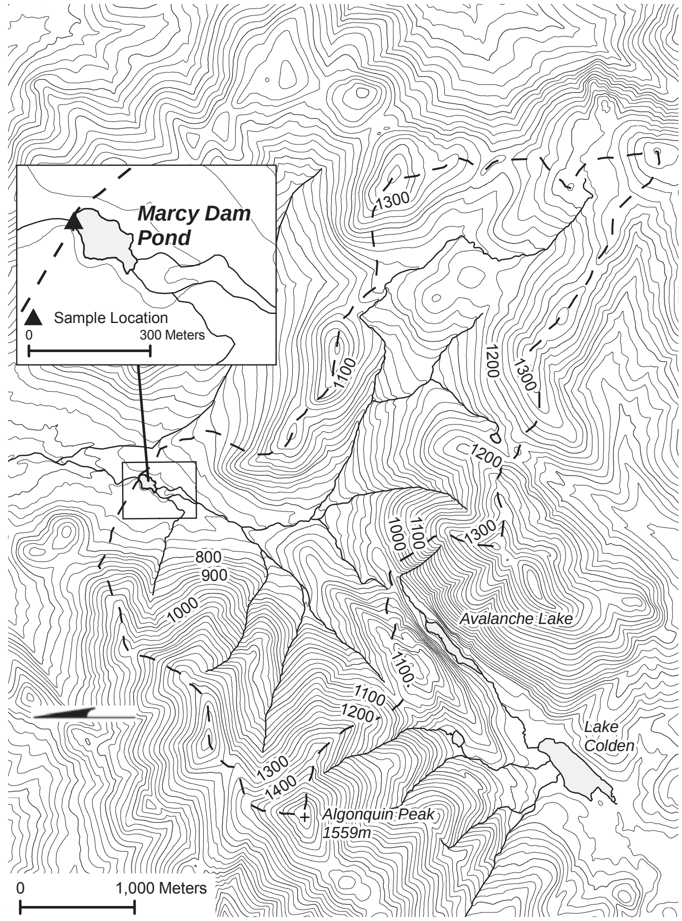
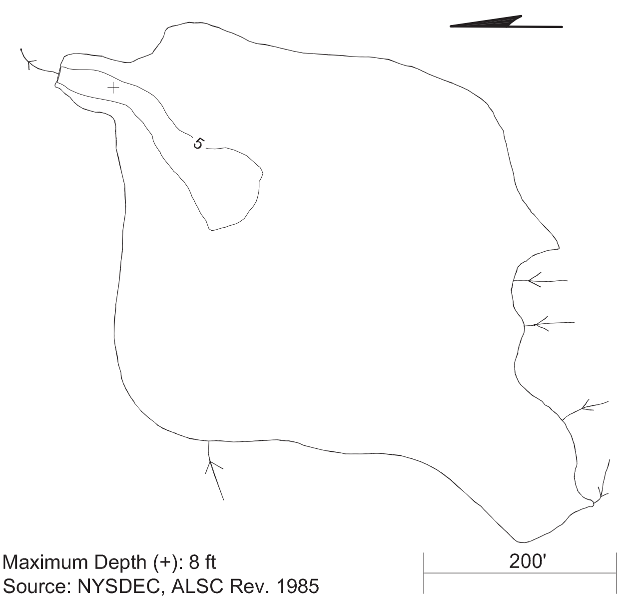


Figure 2. Bathymetry



Maximum Depth (+): 8 ft
Source: NYSDEC, ALSC Rev. 1985

Watershed: The bedrock underlying this high elevation watershed is primarily metanorthosite and anorthositic gneiss. Glacial till, a mixture of clay, silt, sand, and stone are common near and around the base of mountains where hardwoods and mixed conifer sites dominate (NYSDEC 1999). Till covers 80% of the watershed while exposed bedrock accounts for the remaining surface area. The highest elevation in the watershed is the summit of Algonquin Mountain at 1560 m. The maximum relief is 840 m. In 1984, the ALS found the shoal water substrate comprised of 80% sand/gravel, 15% organic and 5% muck/silt (ALSC 1986).

Land cover/use: In 1985, deciduous/coniferous mixed forest covered approximately 85% of the watershed while the remaining 15% was shrub/sapling vegetation. Vegetation bordering the immediate shoreline was primarily deciduous-conifer forest with 12% shrub sapling vegetation and 3% open grassy areas (ALSC 1986). Marcy Dam Pond and its watershed occur entirely within the High Peaks Wilderness Area (HWPA). Nearly 140,000 recreational visitors used the area in 1998**.** Thirty campsites, four lean-tos and a ranger outpost are located within the watershed. The dam at Marcy Pond is one of four functioning and maintained dams in the HPWA (NYSDEC 1999).

Watershed disturbance: In the 19th century, the area supported a logging industry that denuded vast areas of the watershed and left it prone to wildfires. During the summer and fall of 1903, nearly 243,000 hectares of land burned in the Adirondacks, including areas of the HPWA. Contributing to the fire storms were dry logging slash, an extended drought and unseasonably high winds. Fire storms raged again in 1908 and 1909, burning an additional 121,406 hectares throughout the park. Lumbering practices were reformed to reduce fire risk and the state took extra measures of fire prevention and detection (NYSDEC 1999).

The 1916 fire protection source data reveal 70% of the Marcy Dam Pond watershed as logged for both soft and hardwoods, 25% as virgin and second growth with no slash, while the remaining 5% was burned over. The November 1950 blowdown had less than 1% impact on the watershed. The watershed was not affected by the July 1995 microburst storm (APA 2001). The watershed experienced light damage from the January 1998 ice storm (NYSDEC 1998).

Table 1. Lake Chemistry

020265			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	59.96	119.72	95.32	52.96	78.11	63.85	µeq L^{-1}
NO_3^-	2.89	41.94	16.97	3.91	33.18	14.73	µeq L^{-1}
Cl^-	3.67	9.87	7.10	2.73	8.65	5.58	µeq L^{-1}
F^-	0.47	1.05	0.73	0.71	1.01	0.85	µeq L^{-1}
ANC	-8.99	58.40	17.80	10.16	64.87	29.36	µeq L^{-1}
DIC	7.49	158.19	56.48	25.81	115.73	57.29	µmol L^{-1} -C
DOC	147.86	446.75	270.13	182.75	369.99	265.90	µmol L^{-1} -C
SiO_2	53.42	165.26	120.50	72.56	150.45	121.12	µmol L^{-1}
Ca^{2+}	36.43	132.74	90.74	51.40	109.29	73.18	µeq L^{-1}
Mg^{2+}	9.05	33.74	21.94	10.70	32.09	19.17	µeq L^{-1}
Na^+	10.44	42.63	24.14	15.66	38.28	24.58	µeq L^{-1}
K^+	0.51	3.07	1.81	0.26	1.53	1.01	µeq L^{-1}
NH_4^+	-0.67	2.61	0.44	-1.41	2.29	0.04	µeq L^{-1}
AL_TD	5.56	18.75	11.50	5.41	11.82	8.29	µmol L^{-1}
AL_TM	2.46	22.30	7.71	2.30	6.93	3.99	µmol L^{-1}
AL_OM	1.90	6.08	3.53	2.00	4.82	3.05	µmol L^{-1}
AL_IM	0.52	17.81	4.18	0.02	3.04	0.94	µmol L^{-1}
LABPH	4.95	6.27	5.39	5.36	6.49	5.89	
AIREQPH	4.98	6.88	5.38	5.34	7.04	5.98	
TRUECOLOR	15	25	19	15	30	25	Pt Co
SCONDUCT	14.86	23.36	19.14	12.05	21.13	15.35	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	720 m
Maximum depth	2.4 m
Mean depth	0.7 m
Volume	0.8×10^4 m^3
Surface area	1.2 ha
Watershed area	1177.2 ha
Watershed ratio	0.001
Hydraulic retention time (year)	.0009
Watershed	Lake Champlain
County, Town	Essex, North Elba
USGS Quadrangle	Keene Valley
Land use classification	High Peaks Wilderness

Figure 3. Chemistry Time Series

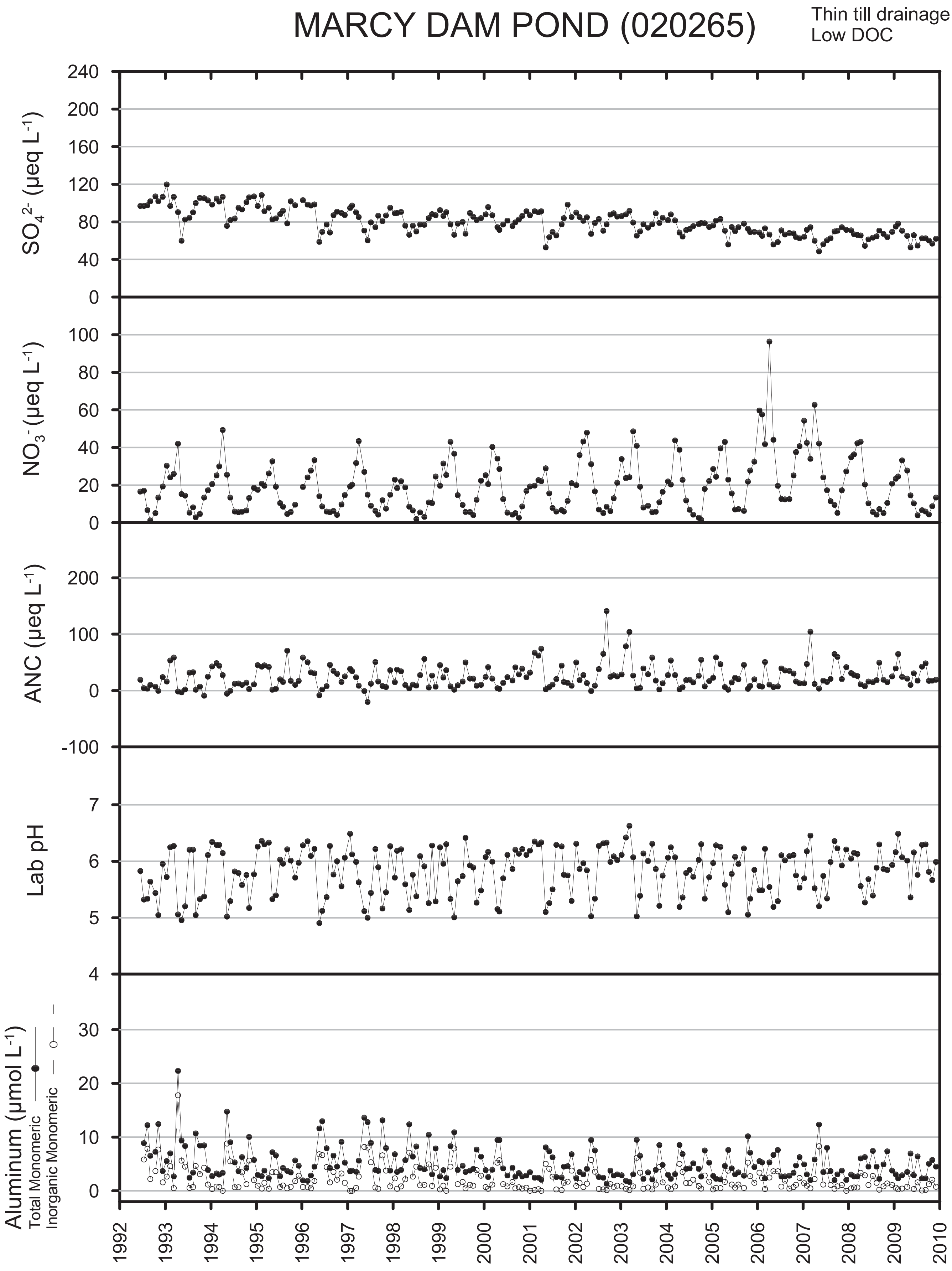


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	315	4
1981	Brook trout	270	6
1982	Brook trout	300	2
1983	Brook trout	300	11
1984	Brook trout	222	2
1985	Brook trout	330	8
1986	Brook trout	300	1
1987	Brook trout	300	3
1988	Brook trout	300	1
1989	Brook trout	330	3
1990	Brook trout	330	1
1991	Brook trout	300	3
1992	Brook trout	300	4
1993	Brook trout	300	3
1994	Brook trout	240	4
1995	Brook trout	280	7
1996	Brook trout	300	7
1997	Brook trout	320	16
1998	Brook trout	320	12
1999	Brook trout	250	3
2000	Brook trout	250	3
2002	Brook trout	250	5
2003	Brook trout	250	2
2004	Brook trout	250	4

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-01	Brook trout	39	87	320	2993	39
May-85	Brook trout	54	100	265	4123	54

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

NYSDEC 1999. High Peaks Wilderness Complex Unit Management Plan. New York State Department of Environmental Conservation, Ray Brook, NY.

Wood, L. W. 1978. Limnology of remote lakes in the Adirondack region of New York State with emphasis on acidification problems. New York State Department of Health, Albany, NY.

Grass Pond 030171

Lat. 44° 39' 26'' N Long. 074° 29' 45'' W

Lake: Grass Pond lies in the St. Lawrence River watershed at 381 m. This 1.6 ha water has no inlets or outlets (Figure 1). It is one of seven seepage lakes monitored in the ALTM program. The pond is due south of Little Clear Pond (030172) another ALTM seepage lake. Both lakes are in proximity to Long Pond, separated by an esker. Grass Pond reaches a maximum depth of 7 m (Figure 2).

Grass Pond is classified as a mounded seepage lake, with high dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the pond in June 1992.

Lake Chemistry: The ALS sampled Grass Pond on 18 Jul 1984 finding: Lab pH 4.48, ANC 7.1 µeq L^{-1}, SO_4^{2-} 49.55 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 21.46 µeq L^{-1}, Mg^{2+} 10.70 µeq L^{-1}, DOC: 6.6 mg L^{-1} -C (ALSC 1985). Table 1 summarizes recent water chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 10 Oct 1984, a dip-net survey by the ALS identified the following Insecta: Odonata Corduliidae; Hemiptera Notonectidae; Coleoptera Dytiscidae; and Diptera Unspecified. No macrophytes were observed during a survey on 09 Oct 1984 (ALSC 1985).

Fisheries: DEC stocked Grass Pond with brook trout from 1957-1963 and rainbow trout in 1962-1963, after which stocking was discontinued (ALSC 1985). The ALSC surveyed the lake on 09 Oct 1984 and on 16 Jun 1998. No fish were captured in either survey.

Intensive studies: Grass Pond is one of 36 ALTM lakes evaluated by Momen and Zehr (1998) during 1994 examining lake-water chemistry and terrestrial characteristics with the existing watershed classifications. Ito evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998-2000 (Ito, M. et al. 2006). In 2003, this lake watershed was part of a 36 lake-watershed regional survey of foliar nitrogen gradients in the Adirondack Park (McNeil, B. E. et al. 2007).

Figure 1. Catchment

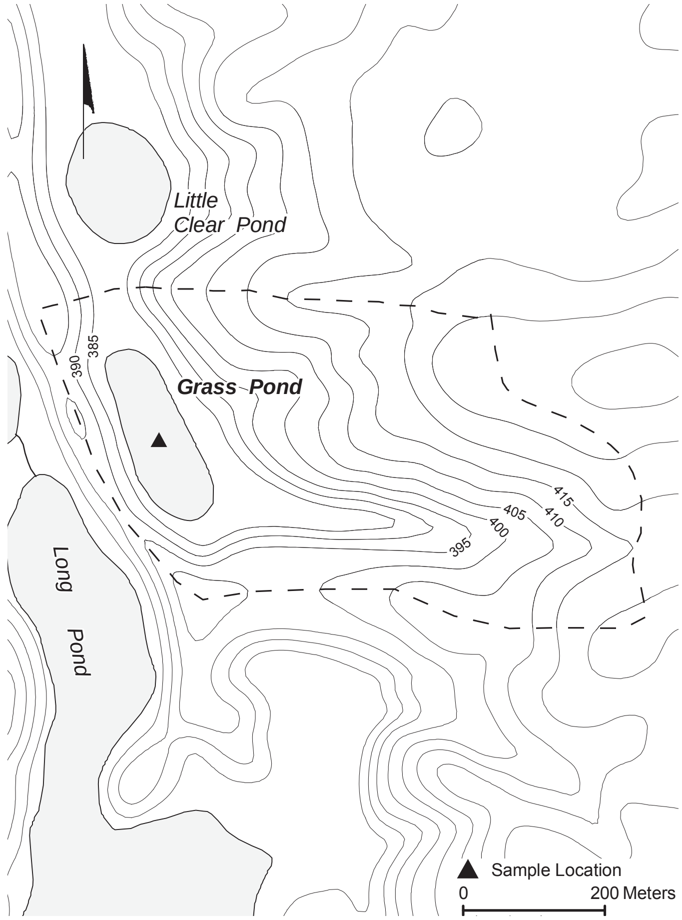
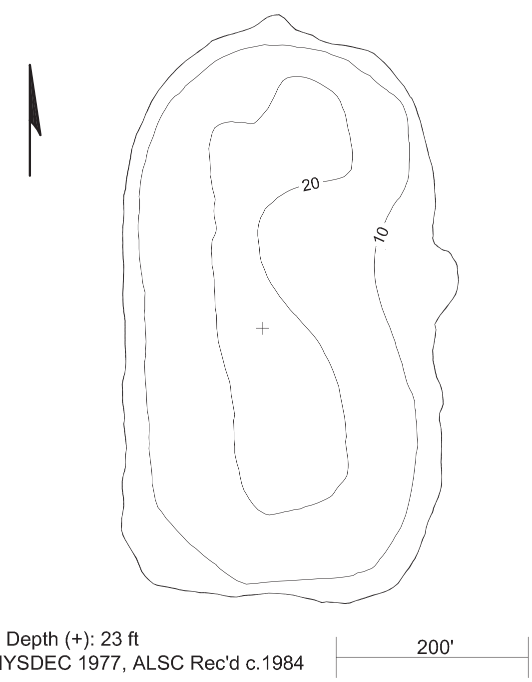


Figure 2. Bathymetry



Maximum Depth (+): 23 ft
Source: NYSDEC 1977, ALSC Rec'd c.1984

Deposition: The nearest NADP deposition monitoring site is 30 km north at Akwesasne Mohawk-Fort Covington. The nearest NYSDEC wet deposition monitoring site is 32 km southeast at Paul Smiths.

Watershed: Grass Pond and 32% of its watershed is underlain by interlayered amphibolite and granitic, charnockitic, syenitic gneiss. The remaining 68% is underlain by biotite and/or hornblende granite gneiss overlain by gravel and sand deposits (APA 2001). The highest elevation in the watershed is 425 m. The watershed has a maximum relief of 44 m. In 1984, the ALS found the shoal water substrate comprised of 90% muck/silt and 10% organic (ALSC 1985).

Land cover/use: In 1984, deciduous forest covered 95% of the watershed, and the remaining 5% was deciduous-conifer mixed forest. The immediate shoreline characteristics consisted of 99% coniferous forest and the entire pond was surrounded by a floating bog mat consisting primarily of sphagnum, leather leaf, and wild cranberry (ALSC 1985). Total wetland area is 2.29 ha and comprises 8% of the watershed. The predominant wetland type is classified as scrub/shrub needle-leaf deciduous and scrub/shrub needle-leaf evergreen (APA 2001). The pond is located in the Debar Mountain Wild Forest and has no designated trails or development.

Watershed disturbance: The 1916 fire protection source data show the watershed containing a mix of agricultural, open grasslands, portions of virgin and second growth, and burned over areas. The watershed was not affected by the November 1950 blowdown or July 1995 microburst storms (APA 2001). The watershed experienced heavy damage from the January 1998 ice storm (NYSDEC 1998).

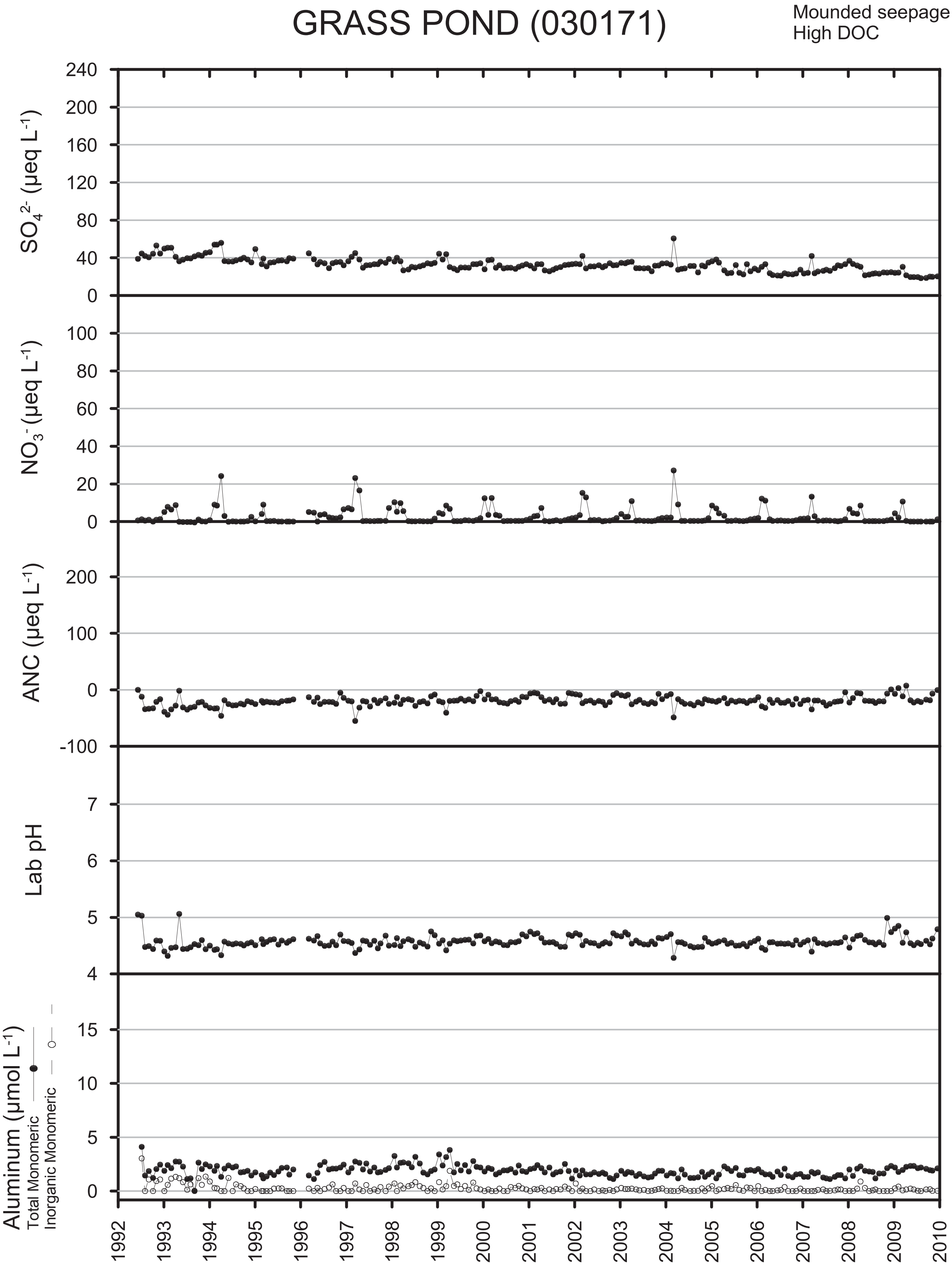
Table 1. Lake Chemistry

030171			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	36.44	50.59	43.13	18.43	30.39	21.30	µeq L^{-1}
NO_3^-	-0.40	8.71	2.35	0.00	10.67	1.56	µeq L^{-1}
Cl^-	5.08	15.80	7.36	4.81	8.53	5.85	µeq L^{-1}
F^-	0.79	1.26	1.04	0.71	1.27	1.02	µeq L^{-1}
ANC	-43.91	-1.82	-28.80	-22.36	7.29	-11.09	µeq L^{-1}
DIC	30.80	223.13	74.65	27.47	220.63	118.87	µmol L^{-1} -C
DOC	515.35	706.51	594.15	660.92	815.99	755.21	µmol L^{-1} -C
SiO_2	-4.99	13.48	4.88	1.06	11.65	7.10	µmol L^{-1}
Ca^{2+}	18.96	35.93	25.91	18.86	37.43	25.03	µeq L^{-1}
Mg^{2+}	10.70	14.81	12.89	10.66	12.56	11.41	µeq L^{-1}
Na^+	2.61	10.87	4.75	3.48	6.52	4.37	µeq L^{-1}
K^+	5.88	11.25	8.48	5.86	7.67	6.65	µeq L^{-1}
NH_4^+	0.00	7.76	1.90	-1.16	19.40	6.70	µeq L^{-1}
AL_TD	0.44	1.30	0.77	0.63	1.74	1.06	µmol L^{-1}
AL_TM	0.04	2.75	1.97	1.78	2.33	2.10	µmol L^{-1}
AL_OM	0.55	2.63	1.46	1.37	2.26	1.97	µmol L^{-1}
AL_IM	0.00	1.34	0.75	0.00	0.41	0.14	µmol L^{-1}
LABPH	4.32	5.06	4.48	4.50	4.85	4.62	
AIREQPH	4.37	5.07	4.50	4.56	4.95	4.68	
TRUECOLOR	40	70	53	45	140	95	Pt Co
SCONDUCT	10.90	23.50	18.53	13.38	18.60	15.12	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	381 m
Maximum depth	7.0 m
Mean depth	4.2 m
Volume	6.8×10^4 m^3
Surface area	1.6 ha
Watershed area	29.5 ha
Watershed ratio	0.05
Hydraulic retention time (year)	NA
Watershed	St. Lawrence
County, Town	Franklin, Waverly
USGS Quadrangle	Santa Clara
Land use classification	Debar Mountain Wild Forest

Figure 3. Chemistry Time Series



References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology 41: 5191-5197.

Momen,B. and Zehr,J.P. 1998. Watershed classification by discriminant analyses of lakewater-chemistry and terrestrial characteristics. Ecological Applications 8: 497-507.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Little Clear Pond 030172

Lat. 44° 39' 38'' N Long. 074° 29' 53'' W

Lake: Little Clear Pond lies in the St. Lawrence River watershed at 381 m. This 1.9 ha lake has no inlets or outlets (Figure 1). It is one of seven seepage lakes monitored in the ALTM program. It is located due north of Grass Pond (030171) another ALTM seepage lake. Little Clear Pond is bounded by an esker on about 75% of its shoreline. A break in the esker on the north shore evidences underground seepage to a forested wetland area north of the pond. The lake has a maximum depth of 14 m (Figure 2).

Little Clear Pond is classified as a mounded seepage lake, with low dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the pond in June 1992.

Lake chemistry: The ALS sampled Little Clear Pond on 18 Jul 1984 finding: Lab pH 4.97, ANC -5.0 μeq L^{-1}, SO_4^{2-} 42.06 μeq L^{-1}, NO_3^- LTD, Ca^{2+} 36.43 μeq L^{-1}, Mg^{2+} 13.17 μeq L^{-1}, DOC 5.9 mg L^{-1}-C (1) (ALSC 1985). Little Clear Pond is not included in the ALTM overall water chemistry trend analyses due to liming. Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: A dip-net survey by the ALS on 10 Oct 1984, identified the following Insecta: Odonata Corduliidae and Hemiptera Notonectidae. On that date an aquatic plant survey found 1% of the lake surface was comprised of Nuphar spp (ALSC 1985).

Fisheries: Little Clear Pond has a history of stocking beginning in 1885 with brook trout and salmon. From 1892-1899 several species were stocked, including: lake trout, brown trout, rainbow trout, brook trout, Atlantic salmon, and lake whitefish. Annual stocking of brook trout started in1940. The lake was limed in 1962 and in 1996 (ALSC 2003). Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive Studies: Little Clear Pond was one of 36 ALTM lakes evaluated by Momen and Zehr (1998) during 1994 examining lake-water chemistry and terrestrial characteristics with the existing watershed classifications (3). Bukaveckas and Robbins-Forbes (2000) characterized the attenuation of photosynthetic radiation in relation to lake chemistry in this lake as part of a regional survey (4). Ito and

Figure 1. Catchment

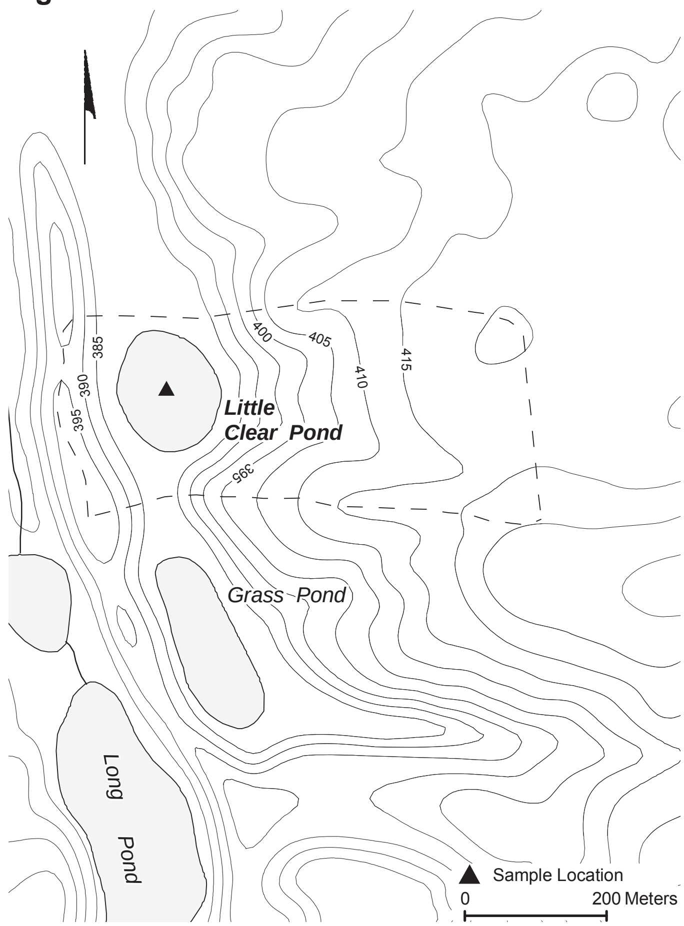
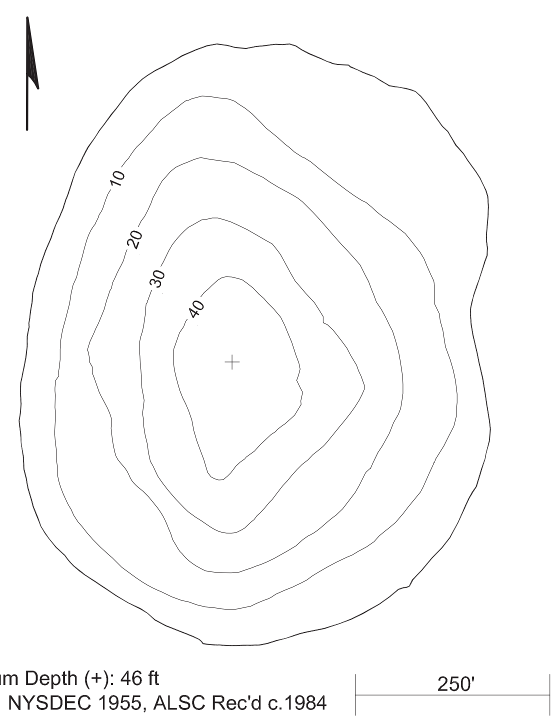


Figure 2. Bathymetry



Maximum Depth (+): 46 ft
Source: NYSDEC 1955, ALSC Rec'd c.1984

others (2006) evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 – 2000 (5). In 2003, this lake watershed was part of a 36 lake-watershed regional survey of foliar nitrogen gradients in the Adirondack Park.

Deposition: The nearest NADP deposition monitoring site is 29 km north at Akwesasne Mohawk. The nearest NYSDEC wet deposition monitoring site is 32 km southeast at Paul Smiths.

Watershed: The bedrock underlying this watershed is 52% biotite and/or hornblende granitic gneiss and 48% interlayed amphibolite and granitic, charnockitic, syenitic gneiss. The rock is overlain by gravel and sand deposits (7). The highest elevation in the watershed is 420 m. The watershed is relatively flat with a maximum relief of 39 m. The pond is within a small grouping of other kettle-hole type ponds near the St. Regis River. In 1984, the ALS found the shoal water substrate of Little Clear Pond comprised of 80% muck/silt and 20% organic (ALSC 1985).

Land Cover/Use: In 1984, the ALS found watershed cover as 95% deciduous forest and 5% deciduous-coniferous mixed forest. The immediate shoreline consisted of 70% deciduous/coniferous mixed forest, 20% deciduous and 10% coniferous forest (ALSC 1985). A small portion of needle-leaved evergreen forested wetland

Table 1. Lake Chemistry

030172			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	36.64	49.76	44.75	17.34	25.48	21.38	μeq L^{-1}
NO_3^-	-0.40	15.48	2.24	0.00	1.62	0.25	μeq L^{-1}
Cl^-	4.51	7.33	6.18	3.50	7.70	4.94	μeq L^{-1}
F^-	0.84	1.16	1.01	0.67	1.46	1.00	μeq L^{-1}
ANC	-30.18	44.17	3.11	58.58	127.11	80.89	μeq L^{-1}
DIC	15.82	372.15	158.67	54.95	407.95	191.63	μmol L^{-1} -C
DOC	458.74	648.40	549.43	499.45	646.90	571.57	μmol L^{-1} -C
SiO_2	-1.17	13.48	6.12	1.83	14.98	6.26	μmol L^{-1}
Ca^{2+}	20.96	53.40	39.55	61.65	143.22	86.81	μeq L^{-1}
Mg^{2+}	13.17	18.10	14.54	32.09	41.97	36.75	μeq L^{-1}
Na^+	2.17	5.22	3.77	3.04	4.78	3.83	μeq L^{-1}
K^+	7.67	16.37	10.32	7.93	11.25	9.41	μeq L^{-1}
NH_4^+	-0.11	32.76	11.03	-1.39	28.77	7.12	μeq L^{-1}
AL_TD	0.33	3.04	0.94	0.31	1.11	0.62	μmol L^{-1}
AL_TM	0.42	3.37	1.84	1.45	1.82	1.63	μmol L^{-1}
AL_OM	0.36	3.69	1.50	1.37	1.86	1.60	μmol L^{-1}
AL_IM	0.00	1.40	0.53	0.00	0.19	0.07	μmol L^{-1}
LABPH	4.51	5.57	4.97	6.01	6.82	6.22	
AIREQPH	4.50	6.62	5.04	6.69	7.28	6.96	
TRUECOLOR	30	60	40	40	70	50	Pt Co
SCONDUCT	11.22	17.53	13.76	11.67	19.80	14.72	μS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	381 m
Maximum depth	14.0 m
Mean depth	5.5 m
Volume	10.2×10^4 m^3
Surface area	1.9 ha
Watershed area	17.99 ha
Watershed ratio	0.11
Hydraulic retention time (year)	NA
Watershed	St. Lawrence
County, Town	Franklin, Waverly
USGS Quadrangle	Santa Clara
Land use classification	Debar Mountain Wild Forest

Figure 3. Chemistry Time Series

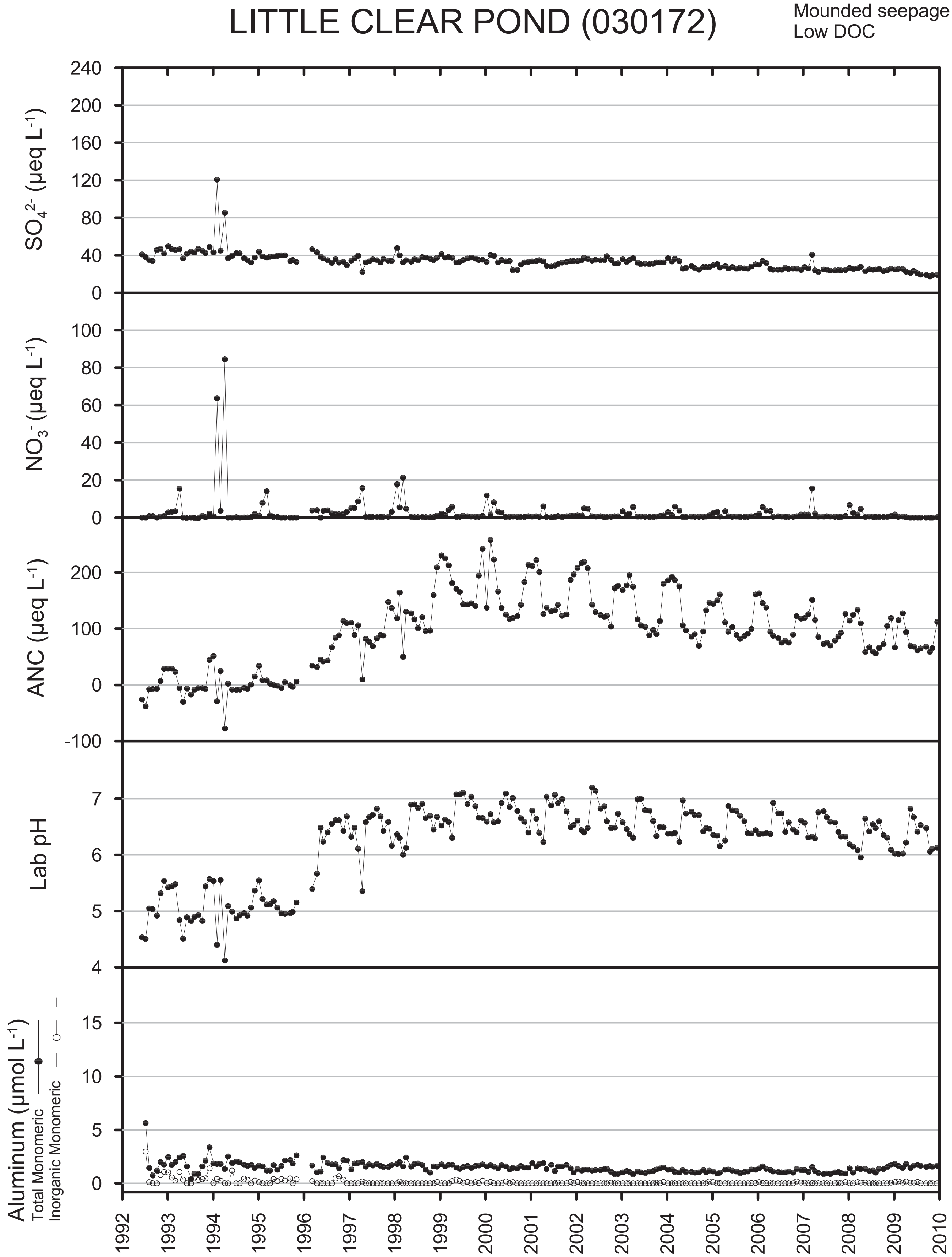


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	400	41
1981	Brook trout	330	38
1982	Brook trout	375	48
1983	Brook trout	345	57
1984	Brook trout	325	51
1985	Brook trout	300	50
1986	Brook trout	740	95
1988	Brook trout	310	44
1989	Brook trout	330	79
1990	Brook trout	220	3
1991	Brook trout	200	2
1992	Brook trout	200	2
1993	Brook trout	200	4
1994	Brook trout	160	2
1995	Brook trout	190	4
1996	Brook trout	200	4
1997	Brook trout	250	5
1998	Brook trout	210	11
1999	Brook trout	200	4
2000	Brook trout	200	3
2001	Brook trout	200	10
2002	Brook trout	200	4
2003	Brook trout	200	2
2004	Brook trout	200	6
2005	Brook trout	200	6
2006	Brook trout	220	8

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-94	Brook trout	3	105	130	21	3
May-94	Northern pike	1	490	490	858	1
May-94	Brown bullhead	30	61	240	164	80
October-84	Brook trout	9	228	292	1820	9
October-84	Brown bullhead	37	78	235	-	37

is located on the northern end of the watershed, indicating the potential direction of seepage flow, but no wetlands border the shoreline. The pond is divided between public Debar Mountain Wild Forest, and private land with a Rural Use designation. A jeep trail leads to a campsite on the pond from the northwest.

Watershed disturbance: The 1916 fire map shows the watershed containing a mix of agricultural, open grasslands, portions of virgin and second growth, and burned-over areas. The watershed was not affected by the November 1950 blowdown or July 1995 microburst storms (APA 2001). The watershed experienced heavy damage from the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Momen B. and Zehr J.P. Watershed classification by discriminant analyses of lakewater-chemistry and terrestrial characteristics. *Ecological Applications* 8 (2):497-507, 1998.

Bukaveckas P. A. and Robbins-Forbes M. Role of dissolved organic carbon in the attenuation of photosynthetically active and ultraviolet radiation in Adirondack lakes. *Freshwater Biology* 43:339-354, 2000.

Ito M., M. J. Mitchell M. J., Driscoll C. T., and Roy K. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. *Biogeochemistry* 72:283-314, 2006.

McNeil B. E., Read J. M., and Driscoll C.T. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. *Environmental Science & Technology* 41:5191-5197, 2007.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

This page intentionally left blank.

Black Pond 030256 & Black Pond Stream 030255

Lat. 44° 26’ 00’’ N   Long. 074° 18’ 03’’ W

Lake: Black Pond lies in the St. Lawrence River watershed at 495 m. The 29 ha lake has one inlet from Long Pond to the north. An esker runs along the western shore of both Long and Black Ponds. A kettle hole embayment with a depth of over 9 m forms the eastern section of Black Pond. The main lake reaches a maximum depth of 13.7 m (Figure 2). The lake outlet becomes a broad sandy flow identified as Black Pond Stream (030255) to a fish barrier/weir continuing to flow into an impounded portion of the St. Regis River (Figure 1).

Black Pond is a thick till chain drainage lake with low dissolved organic carbon. It is considered insensitive to acidification. Black Pond Stream (030255, Station 1) is one of the 17 original ALTM sites, monitored monthly since June 1982. This roadside site is 0.3 km downstream from the lake. The ALTM collected monthly samples at the main lake (030256, Station 1) from June 1993 until December 2006. Sampling was discontinued at this location when it was determined that the chemistry was statistically similar to the chemistry at Black Pond Stream (Cirmo et al. 2007).

Lake chemistry: The ALS surveyed the lake on 17 Jul 1985 finding: Lab pH 7.44, ANC 206.4 μeq L^{-1}, SO_4^{-2} 129.29 μeq L^{-1}, NO_3^- LTD, Ca^{2+} 210.59 μeq L^{-1}, Mg^{2+} 97.92 μeq L^{-1}, DOC 3.5 mg L^{-1}-C (ALSC 1986). Table 1 summarizes recent ALTM water chemistry collected at Black Pond Stream. Monthly plots of the major analytes appear in Figure 3.

Aquatic biota: In 1985, the ALS conducted two aquatic plant surveys in the lake. On 17 Jul 1985, submergent plants occupied 10% of the lake bottom while floating vegetation covered 5% of the surface. Species identified were: Eriocaulon spp., Sphagnum spp., Nuphar spp. and Nymphaea spp. On 10 Oct 1985, submergent vegetation occupied 2% of the bottom. Emergent and floating plants each occupied 1% of the surface area. Plants included: Sparganium spp., Potamogeton spp., Eriocaulon spp., Pontederia spp. and Nymphaea spp.

On 10 Oct 1985, a dip-net survey found the following Insecta: Ephemeroptera Heptageniidae, Odonata Aeshnidae and Coenagriidae, Trichoptera Phryganeidae and Polycentropodidae, Diptera Chironomidae and Culicidae, Hemiptera

Figure 1. Catchment

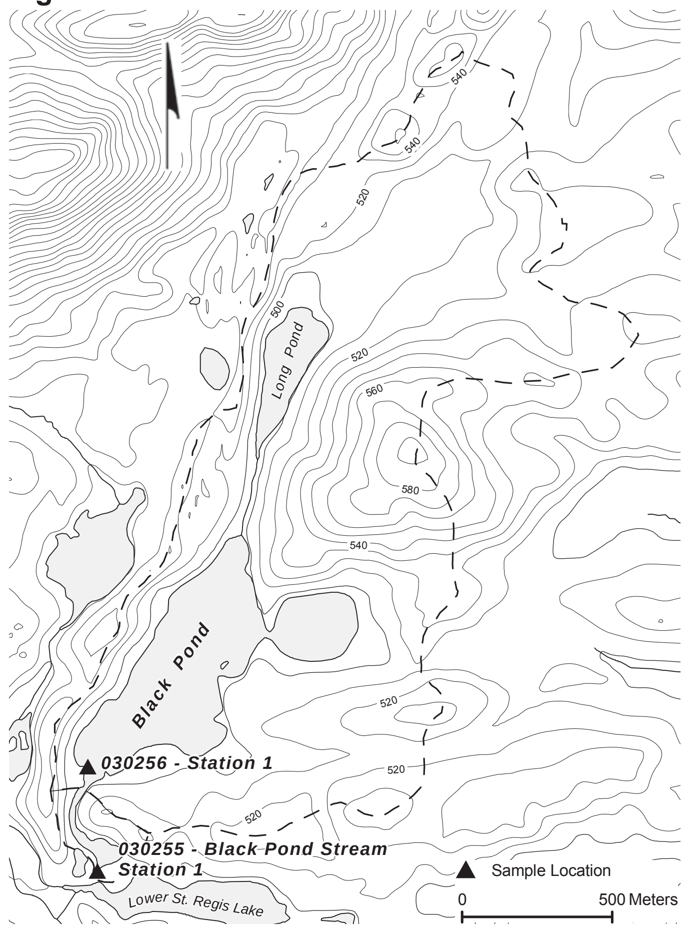
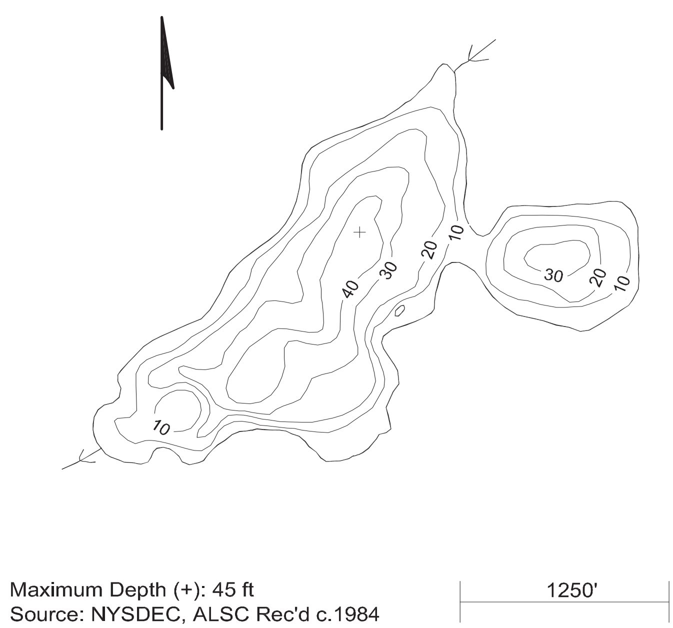


Figure 2. Bathymetry



Gerridae, and Megaloptera Sialidae. Also found were: Arachnoid Hydracarina Unspecified, Pelecypod Veneroida Sphaeriidae, Demospong Haplosclerina Spongillidae, and the following Crustacea: Isopoda Unspecified, Amphipoda Unspecified, and Decapoda Unspecified. On 17 Jul 1985, ALS field crews detected a thermocline between 3.0 and 4.0 m. (ALSC 1986)

Fisheries: DEC stocked the lake with brook trout from 1958 - 1960, and from 1964 - 1971. Splake were stocked in 1961 and 1962. Rainbow trout were stocked in 1975. Rotenone treatments occurred in 1957, 1963, 1967, 1970 (ALSC 1986) and 1997. Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: Black Pond was studied as part of RILWAS in 1985 (Driscoll, C. T. and Newton, R. M. 1985). Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). During 1986 and 1987 snowmelt, Schaefer and Driscoll (1993) evaluated episodic acidification at Black Pond Stream. Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Deposition: The nearest NADP deposition monitoring site is 32 km east at Whiteface Mountain. The nearest NYSDEC wet deposition monitoring site is 4 km east at Paul Smiths.

Watershed: The Black Pond Stream watershed is underlain by metanorthosite and anorthositic gneiss. Approximately 80% of the watershed is overlain with kame deposits of gravel and/or sand and till comprises the remaining 20%. The highest point in the watershed is an unnamed hill that rises to an elevation of 593 m east of Long Pond. The maximum relief is 98 m. In 1985, the ALS described the shoal water substrate around the lake as 35% boulder/rubble, 55% sand and gravel, 5% muck/silt, and 5% organic (ALSC 1986).

Table 1. Lake/Stream Chemistry (Station 1)

030255			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	99.73	132.00	118.12	69.35	91.38	77.90	µeq L^{-1}
NO_3^-	-0.40	24.68	8.40	0.00	21.73	5.90	µeq L^{-1}
Cl^-	7.90	12.41	9.61	7.28	9.87	8.52	µeq L^{-1}
F^-	2.11	3.00	2.38	2.34	3.23	2.66	µeq L^{-1}
ANC	182.98	230.14	202.64	172.33	255.84	215.12	µeq L^{-1}
DIC	211.47	407.95	294.59	224.79	385.48	296.76	µmol L^{-1} -C
DOC	255.85	382.39	311.94	251.64	342.68	294.89	µmol L^{-1} -C
SiO_2	100.69	183.74	145.11	100.19	170.26	143.65	µmol L^{-1}
Ca^{2+}	173.16	255.50	210.05	170.74	263.49	188.92	µeq L^{-1}
Mg^{2+}	83.11	108.62	96.96	80.64	97.40	89.26	µeq L^{-1}
Na^+	40.02	53.50	44.66	38.44	50.02	44.29	µeq L^{-1}
K^+	7.93	14.58	9.48	7.42	9.46	8.30	µeq L^{-1}
NH_4^+	-0.67	9.87	2.25	-1.16	5.10	1.01	µeq L^{-1}
AL_TD	0.22	1.48	0.75	0.07	1.45	0.73	µmol L^{-1}
AL_TM	0.49	14.01	2.16	1.33	1.78	1.59	µmol L^{-1}
AL_OM	0.07	4.25	0.92	1.22	1.74	1.55	µmol L^{-1}
AL_IM	0.00	13.94	1.63	0.00	0.44	0.08	µmol L^{-1}
LABPH	6.53	7.32	6.86	6.51	7.24	6.82	
AIREQPH	7.35	7.58	7.45	7.31	7.58	7.50	
TRUECOLOR	20	70	29	30	45	37	Pt Co
SCONDUCT	33.54	39.76	36.47	32.11	37.60	34.40	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	495 m
Maximum depth	13.7 m
Mean depth	6.2 m
Volume	180.5 x 10^4 m^3
Surface area	29.0 ha
Watershed area	237.9 ha
Watershed ratio	0.12
Hydraulic retention time (year)	0.66
Watershed	St. Lawrence
County, Town	Franklin, Brighton
USGS Quadrangle	St. Regis Mtn.
Land use classification	Private - Resource Management

Figure 3. Chemistry Time Series

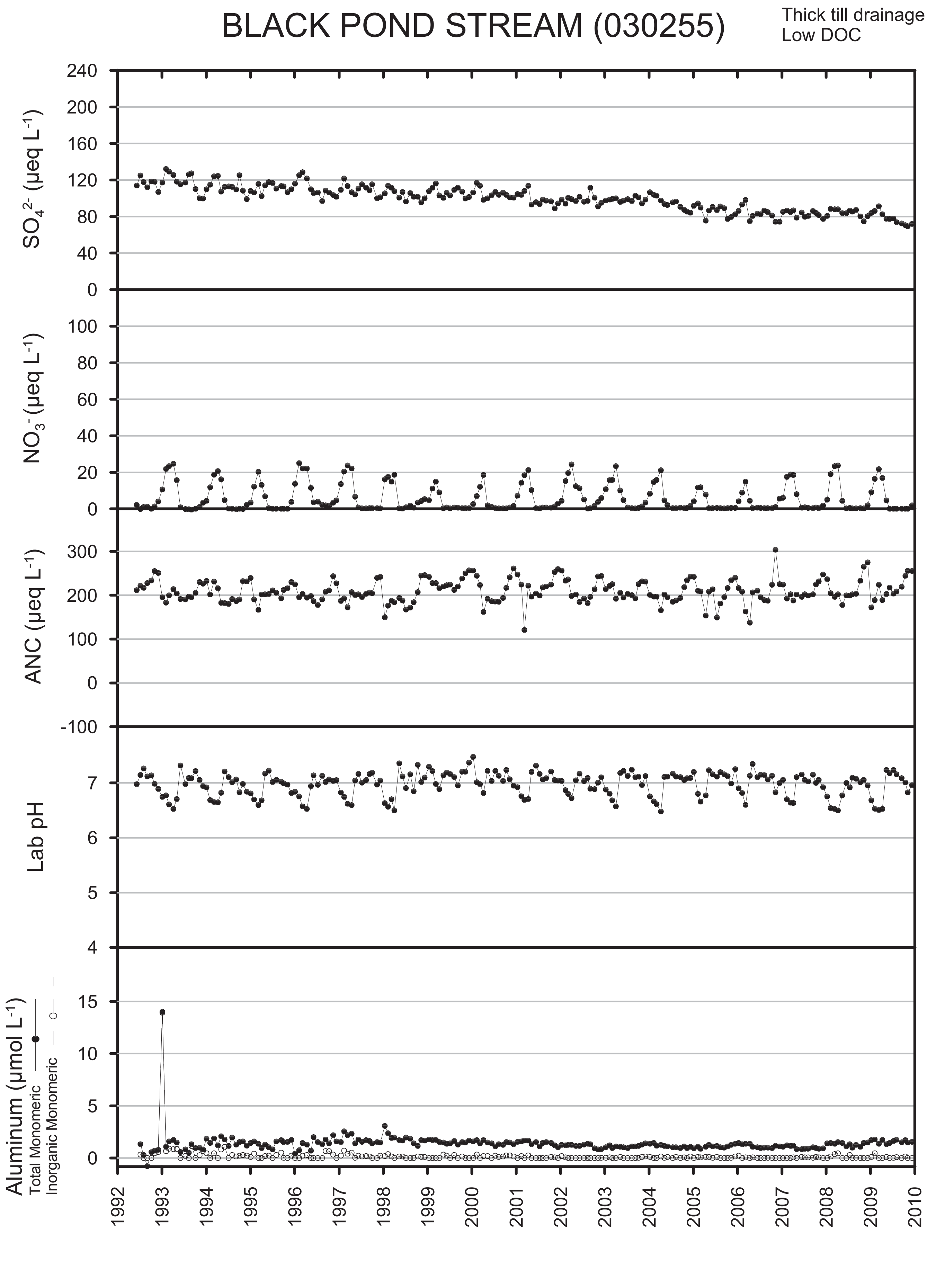


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1998	Brook trout	4500	144
1999	Brook trout	2600	13
2001	Brook trout	2485	14
2002	Brook trout	2924	27
2006	Brook trout	2300	35

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
July-98	Brook trout	79	158	279	-	79
October-85	Brook trout	50	83	356	6013	63
October-85	Golden shiner	6	78	101	41	6
October-85	Yellow perch	25	100	144	456	44

Land cover/use: In 1985, the ALS characterized the Black Pond watershed as 75% deciduous-coniferous mixed forest, 10% deciduous forest and 15% shrub-sapling vegetation. The immediate shoreline was characterized as 50% deciduous-coniferous forest, 25% deciduous forest, 10% coniferous forest, and 15% scrub-sapling vegetation (ALSC 1986). Wetlands occupy 5.1% of the watershed or 12.2 ha. Forested needle-leaf evergreen covers 9.1 ha while scrub-shrub broad leaf evergreen covers 3.1 ha. The outlet flow from the main lake of Black Pond (030256, Station 1) to the weir at Black Pond Stream (030255, Station 1) is edged with a scrub-shrub wetland fringe (APA 2001).

The Black Pond Stream watershed lies within private land leased to the Adirondack Park Visitor Interpretive Center. The area receives moderate recreational use. A trail follows most of the lake shore. A foot bridge exists at the constriction of the eastern bay. Two lean-to structures are located on the shoreline and are restricted to day use only. Motorized watercraft are prohibited on the lake. The lake and watershed are classified as Resource Management under the Adirondack Park Agency State Land Master Plan.

Watershed disturbance: The 1916 fire protection source data show the majority of the Black Pond watershed was severely burned over, while a smaller section on the east indicates virgin and second growth with no slash. The watershed was not affected by the November 1950 blowdown or the July 1995 microburst storms (APA 2001). The watershed experienced light damage from the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1986. Adirondack Lakes Survey 1985 Field Studies Report Volumes 6-10. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Cirmo C.P., K. M. Roy, N. L. Houck and K. Civerolo 2007. A comparison of Water Quality Parameters at Eight Paired Lake Outlet Sampling Sites of the Adirondack Long – Term Monitoring Project: Scoping Paper. White Paper. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Dixit,S.S., Cumming,B.F., Birks,H.J.B., Smol,J.P., Kingston,J.C., Uutala,A.J., Charles,D.F., and Camburn,K.E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack Lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Schaefer,D.A. and Driscoll,C.T. 1993. Identifying sources of snowmelt acidification with a watershed mixing model. Water, Air, and Soil Pollution 67: 345-365.

This page intentionally left blank.

Loon Hollow Pond 040186

Lat. 43° 57' 41'' N Long. 075° 02' 43'' W

Lake: Loon Hollow Pond lies in the Oswegatchie-Black watershed at 605 m. A single inlet drains a deciduous forest wetland in the northeast (Figure 1). This 5.7 ha headwater lake drains to a series of wetlands and small ponds to the southwest, which flows north to the Middle Branch of the Oswegatchie River. In 1985, an active beaver dam was present at the outlet (ALSC 1986).This lake reaches a maximum depth of 11.6 m (Figure 2).

Loon Hollow Pond is classified as a thin till drainage lake, with low dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. This lake is accessed by helicopter.

Lake chemistry: Loon Hollow Pond was sampled during the ALS on 25 Jul 1985 finding: Lab pH 4.61, ANC -22.0 µeq L^{-1}, SO_4^{2-} 101.39 µeq L^{-1}, NO_3^- 3.56 µeq L^{-1}, Ca^{2+} 38.92 µeq L^{-1}, Mg^{2+} 11.52 µeq L^{-1}, DOC 3.7 mg L^{-1}-C (ALSC 1986). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 17 Jun 1985, the ALS found emergent aquatic plants occupied 1% of the lake surface, including: Sphagnum spp.; Eriocaulon spp.; Dulichium spp.; Carex spp; and Nymphaea spp. On 17 Jun 1985, a dip-net survey identified: Insecta: Odonata Libellulidae and Coenagriidae; Trichoptera Unspecified and Polycentropodidae; Diptera Chironomidae and Culicidae; Hemiptera Corixidae and Notonectidae; and Coleoptera Dytiscidae and Gyrinidae. Also found were Oligochaeta Unspecified. On 25 Jul 1984, the ALS found the lake thermally stratified between 2 and 4 m (ALSC 1986). In 2003, the average value of chlorophyll a was 1.02 µg L^{-1} (Momen, B. et al. 2006).

Fisheries: Brook trout were stocked by NYSDEC annually during 1932 to 1937. The lake was surveyed by the ALSC on 17 Jun 1985 and on 28 May 2002. No fish were captured in either survey (ALSC 86).

Intensive studies: The aquatic biota of this lake has been studied by the AEAP since 1994 (Momen, B. et al. 2006). Loon Hollow Pond was one of 36 ALTM lakes evaluated by Momen and Zehr's (1998) 1994 examination of lake-water chemistry and terrestrial characteristics with existing watershed

Figure 1. Catchment

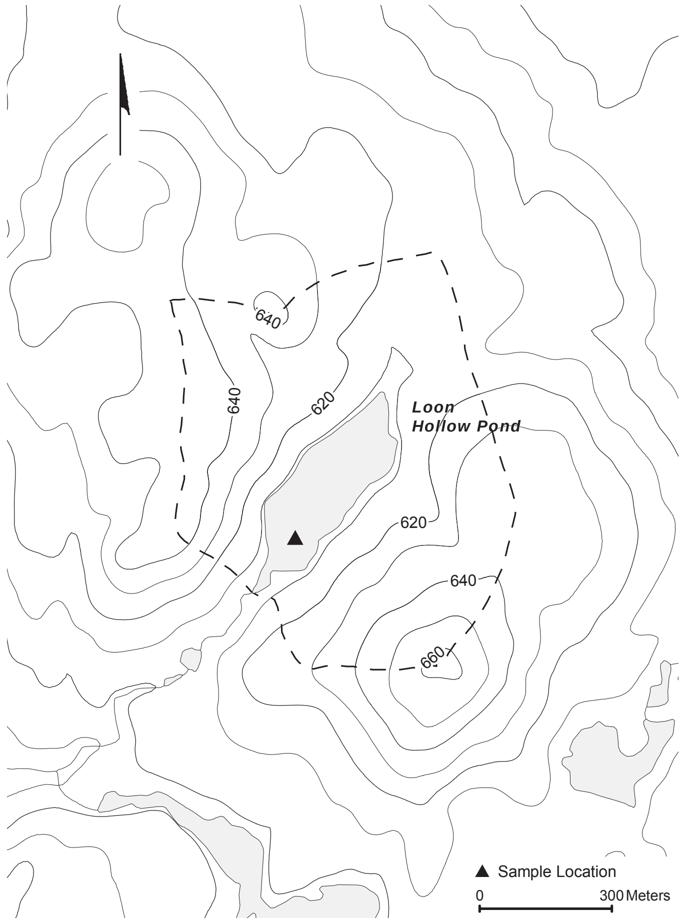
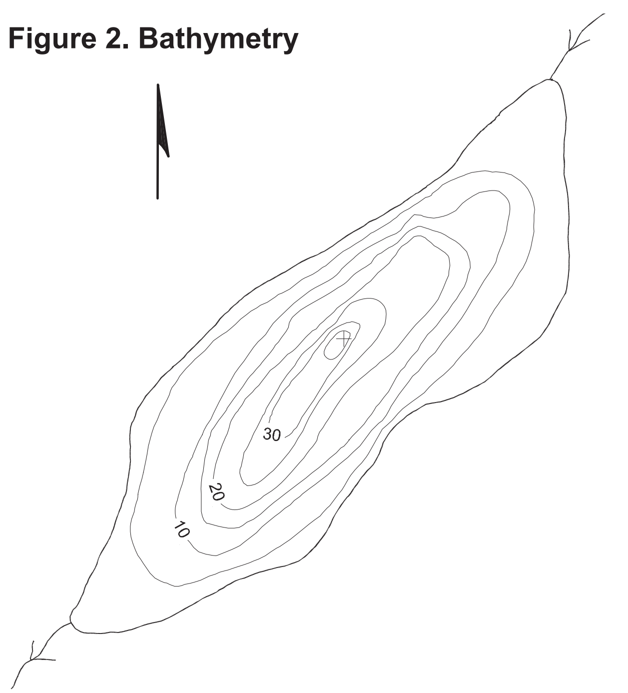


Figure 2. Bathymetry



Maximum Depth (+): 38 ft
Source: NYSDEC, ALSC Rev. 1985

classifications (Momen, B. and Zehr, J. P. 1998). Ito and others (2006) evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 – 2000 (Ito, M. et al. 2006). In 2003, this lake watershed was part of a 36 lake-watershed regional survey of foliar nitrogen gradients in the Adirondack Park (McNeil, B. E. et al. 2007).

Deposition: The nearest NADP deposition monitoring site is 25 km southeast at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 24 km northeast at Wanakena.

Watershed: Loon Hollow Pond and its watershed are underlain by biotite and/or hornblende granite gneiss with low to no ANC (Roy, K. M. et al. 1997). The watershed is entirely composed of basal till. The highest elevation in the watershed is 665 m. The maximum relief is 60 m. In 1985, the ALS found shoal water substrate comprised of 94% muck/silt/organic and 6% bedrock/boulder (ALSC 1986).

Land cover/use: In 1985, 98% of the watershed was covered in deciduous-coniferous mixed forest (ALSC 1986). Wetland area is 8.6 ha and comprises 15.5% of the watershed (Roy, K. M. et al. 1996). The lake is bounded by a broad-leaf deciduous scrub/shrub dominant emergent marsh with evidence of a beaver wetland fringe. Leather leaf and sphagnum are found on 10% of this shoreline fringe (ALSC 1986).

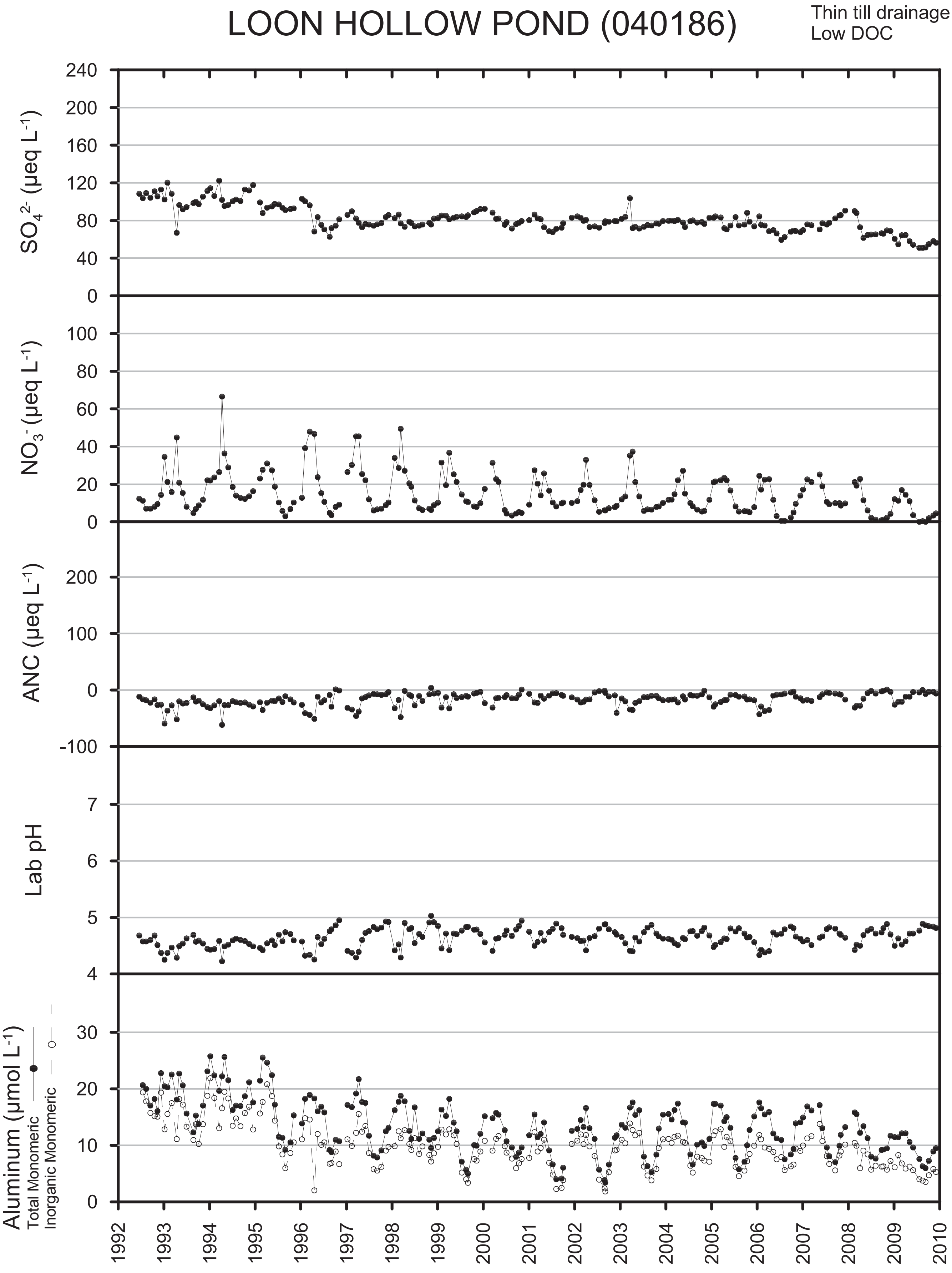
Table 1. Lake Chemistry

040186			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	67.04	120.13	99.47	50.93	64.58	56.62	µeq L^{-1}
NO_3^-	4.60	44.84	17.89	0.00	16.88	6.60	µeq L^{-1}
Cl^-	6.21	13.54	8.34	4.90	6.99	5.83	µeq L^{-1}
F^-	1.26	2.16	1.81	1.25	1.84	1.55	µeq L^{-1}
ANC	-59.16	-13.17	-29.08	-25.72	-0.08	-9.90	µeq L^{-1}
DIC	19.98	122.39	52.87	27.93	137.37	58.37	µmol L^{-1} -C
DOC	236.28	617.26	401.19	333.95	550.90	448.15	µmol L^{-1} -C
SiO_2	11.82	65.91	39.86	4.61	46.77	27.49	µmol L^{-1}
Ca^{2+}	26.95	41.42	33.44	18.46	24.88	22.43	µeq L^{-1}
Mg^{2+}	9.87	18.10	12.41	6.58	9.05	8.00	µeq L^{-1}
Na^+	10.00	17.40	13.74	10.44	15.66	13.01	µeq L^{-1}
K^+	4.60	11.51	5.88	2.33	4.86	3.41	µeq L^{-1}
NH_4^+	0.39	3.71	2.32	-0.59	3.05	1.19	µeq L^{-1}
AL_TD	13.27	26.65	21.37	11.93	22.50	17.22	µmol L^{-1}
AL_TM	12.26	23.07	18.48	5.93	12.16	9.39	µmol L^{-1}
AL_OM	1.31	7.60	4.06	2.40	6.26	3.90	µmol L^{-1}
AL_IM	10.24	18.77	14.42	3.53	8.26	5.49	µmol L^{-1}
LABPH	4.25	4.69	4.47	4.50	4.89	4.70	
AIREQPH	4.23	4.64	4.46	4.50	4.85	4.67	
TRUECOLOR	10	50	29	20	60	40	Pt Co
SCONDUCT	19.24	37.38	26.45	13.34	22.95	17.04	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	605 m
Maximum depth	11.6 m
Mean depth	3.4 m
Volume	19.1×10^4 m^3
Surface area	5.7 ha
Watershed area	55.2 ha
Watershed ratio	0.10
Hydraulic retention time (year)	0.46
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Stillwater
Land use classification	Five Ponds Wilderness Area

Figure 3. Chemistry Time Series



The pond and watershed are primarily located on private land in Resource Management as designated by the Adirondack Park Agency State Land Master Plan. The southwestern tip and part of the watershed lie in the Five Ponds Wilderness Area.

Watershed disturbance: The 1916 fire protection data show 90.3% of the watershed logged for softwood with considerable slash. The November 1950 storm caused 50 to 100% blowdown over the entire watershed. The watershed was not disturbed by the July 1995 microburst storm (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

ALSC 1986. Adirondack Lakes Survey 1985 Field Studies Report Volumes 6-10. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology 41: 5191-5197.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in Summer Chemistry Linked to Productivity in Lakes Recovering from Acid Deposition in the Adirondack Region of New York. Ecosystems 9: 1306-1317.

Momen,B. and Zehr,J.P. 1998. Watershed classification by discriminant analyses of lakewater-chemistry and terrestrial characteristics. Ecological Applications 8: 497-507.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Willys Lake 040210

Lat. 43° 58' 20'' N Long. 074° 57' 20'' W

Lake: Willys Lake lies in the Oswegatchie-Black watershed at 632 m. The 24.3 ha headwater lake drains north to the Middle Branch Oswegatchie River (Figure1). The lake has two inlets. The lake has a maximum depth of 13.7 m (Figure 2). In 1984, an active beaver dam was present at the outlet.

Willys Lake is classified as a thin till drainage lake with low dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. This lake is accessed by helicopter.

Lake chemistry: Willys Lake was sampled during the ALS on 30 Jul 1984 finding: Lab pH 4.74, ANC -11.0 µeq L^{-1}, SO_4^{2-} 128.04 µeq L^{-1}, NO_3^- 4.53 µeq L^{-1}, Ca^{2+} 66.37 µeq L^{-1}, Mg^{2+} 17.28 µeq L^{-1}, DOC 1.7 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 06 Jun 1984, an ALSC dip-net survey found the following Insecta: Odonata Coenagriidae; Trichoptera Phryganeidae; Diptera Unspecified; Coleoptera Dytiscidae and Gyrinidae. No macrophyte data were available. The lake was thermally stratified between 6 and 7 m on 30 Jul 1984 (ALSC 1985). The AEAP reported an average value of chlorophyll a of 1.27 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: The NYSDEC stocked the lake with brook trout from 1929 to 1934. The ALS surveyed the lake on 6 Jun 1984 and on 28 May 2002. No fish were captured in either survey.

Intensive studies: Chen and others studied Willys Lake as an example of a mature forested watershed using the biogeochemical model PnET-BGC (Chen, L. and Driscoll, C. T. 2004; Chen, L. et al. 2004). The AEAP has studied this lake since 1994 (Momen, B. et al. 2006). The lake was part of the EPA's EMAP in 1994 and 1997. Since 1999, the lake is sampled annually by the ALSC as part of the TIME project (Stoddard, J. L. et al. 2003).

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006b; Sullivan, T. J. et al. 2006a).

Figure 1. Catchment

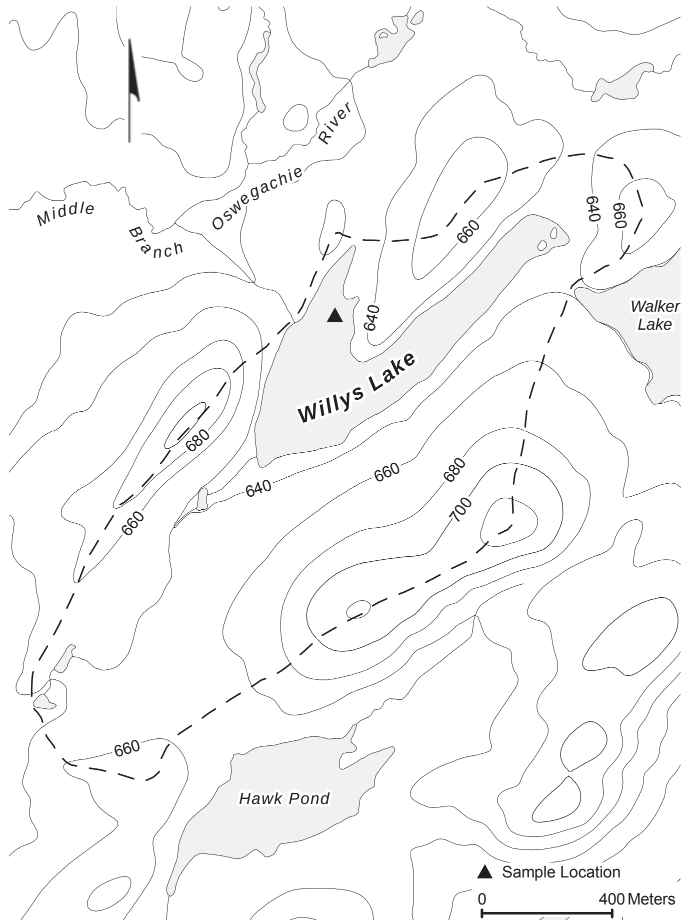
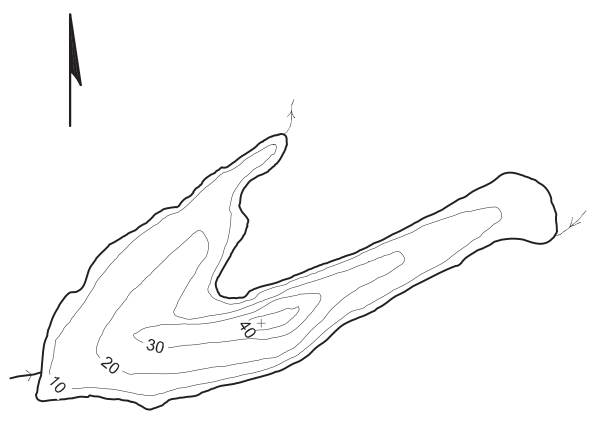


Figure 2. Bathymetry



Maximum Depth (+): 45 ft
Source: NYSDEC, ALSC Rev. 1984

Deposition: The nearest NADP deposition monitoring site is 22 km south at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 20 km north at Wanakena.

Watershed: Willys Lake and its watershed are underlain by biotite and/or hornblende granite gneiss with low to no ANC. The entire watershed is comprised of basal till (Roy, K. M. et al. 1997). To the southeast, the watershed rises to a maximum of 738 m. The maximum relief is 106 m. In 1984, the ALS found the shoal water substrate comprised of 70% boulder and sand, 20% muck/silt and 10% organic (ALSC 1985).

Land cover/use: In 1984, a deciduous-coniferous mixed-forest covered 90% of the watershed and coniferous forest 10% (ALSC 1985). Total wetland area was 11.9 ha and comprised 7.5% of the watershed (Roy, K. M. et al. 1996). About 25% of the lake shoreline is fringed with an emergent marsh wetland. Scrub/shrub deciduous and evergreen wetland areas are found in the upstream sections. A forested wetland area lies in the lower section of the southeastern tributary. Willy's Lake and watershed are entirely within the Five Ponds Wilderness area. There is no developed trail access.

Watershed disturbance: The 1916 fire protection source data show 81.4% of the watershed as green timber with no slash and 6.1% of the watershed as logged for softwood. The November 1950 storm caused 50 to 100% blowdown throughout this watershed. A July 1995 microburst storm damaged 0-30% of the tree crowns throughout the watershed (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

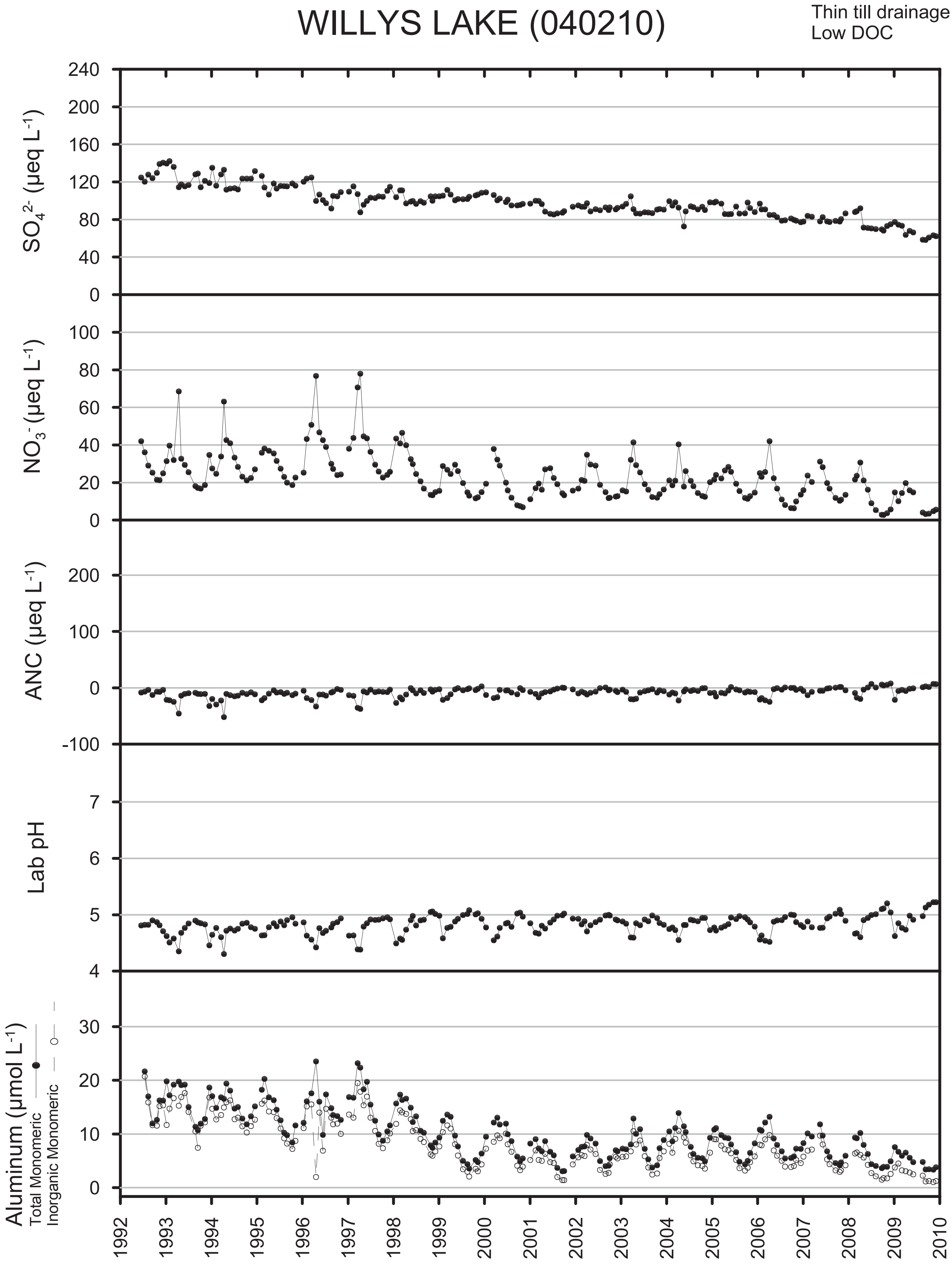
Table 1. Lake Chemistry

040210			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	114.30	142.20	124.42	58.33	77.20	65.97	µeq L^{-1}
NO_3^-	16.71	68.54	30.37	3.24	19.75	10.07	µeq L^{-1}
Cl^-	6.77	10.15	8.16	5.01	7.39	6.27	µeq L^{-1}
F^-	3.05	4.16	3.57	2.26	2.58	2.44	µeq L^{-1}
ANC	-45.61	-8.69	-18.45	-21.12	7.06	-1.75	µeq L^{-1}
DIC	19.98	104.07	45.10	27.47	155.69	66.00	µmol L^{-1} -C
DOC	91.91	376.65	190.16	285.40	449.00	327.87	µmol L^{-1} -C
SiO_2	33.95	57.58	49.29	9.10	40.94	25.49	µmol L^{-1}
Ca^{2+}	46.41	92.82	64.79	35.93	43.42	39.79	µeq L^{-1}
Mg^{2+}	14.81	19.75	16.25	9.05	11.52	10.69	µeq L^{-1}
Na^+	10.44	17.40	15.33	14.35	17.40	15.42	µeq L^{-1}
K^+	5.12	9.21	6.78	5.12	7.02	6.26	µeq L^{-1}
NH_4^+	0.50	5.65	2.35	-0.01	5.04	2.81	µeq L^{-1}
AL_TD	11.53	23.79	18.49	6.18	14.75	10.07	µmol L^{-1}
AL_TM	10.67	19.79	16.22	3.33	7.56	5.07	µmol L^{-1}
AL_OM	0.39	8.12	2.44	2.15	3.78	2.63	µmol L^{-1}
AL_IM	7.41	17.62	13.78	1.03	4.52	2.44	µmol L^{-1}
LABPH	4.35	4.89	4.65	4.62	5.22	4.92	
AIREQPH	4.33	4.84	4.62	4.63	5.24	4.92	
TRUECOLOR	5	25	12	20	35	30	Pt Co
SCONDUCT	21.84	36.45	26.71	13.24	21.28	16.16	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	632 m
Maximum depth	13.7 m
Mean depth	4.9 m
Volume	118.8 x 10^4 m^3
Surface area	24.3 ha
Watershed area	158.2 ha
Watershed ratio	0.15
Hydraulic retention time (year)	1.0
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Beaver River
Land use classification	Five Ponds Wilderness Area

Figure 3. Chemistry Time Series



References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Chen,L. and Driscoll,C.T. 2004. Modeling the response of soil and surface waters in the Adirondack and Catskill regions of New York to changes in atmospheric deposition and historical land disturbance. Atmospheric Environment 38: 4099-4109.

Chen,L., Driscoll,C.T., Gbondo-Tugbawa,S.S., Mitchell,M.J., and Murdoch,P.S. 2004. The application of an integrated biogeochemical model (PnET-BGC) to five forested watersheds in the Adirondack and Catskill regions of New York. Hydrological Processes 18: 2631-2650.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in Summer Chemistry Linked to Productivity in Lakes Recovering from Acid Deposition in the Adirondack Region of New York. Ecosystems 9: 1306-1317.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Stoddard, J. L., Kahl, J. S., Deviney, F. A., DeWalle, D. R., Driscoll, C. T., Herlihy, A. T., Kellogg, J. H., Murdoch, P. S., Webb, J. R., and Webster, K. E. 2003. Response of Surface Water Chemistry to the Clean Air Act Amendments of 1990. United States Environmental Protection Agency No. EPA620/R-03/001.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Woods Lake 040576

Lat. 43° 52' 10'' N Long. 074° 58' 05'' W

Lake: Woods Lake lies in the Oswegatchie-Black watershed at 605 m. This headwater lake receives drainage from two major tributary streams (Figure 1). One inlet drains a large beaver pond and wetlands, while the second inlet is free flowing (Cirmo, C. P. and Driscoll, C. T. 1996). An earthen barrier dam with a spillway defines the outlet that, in the late 1980s, contained a diversion fish trap to monitor the movement of brook trout out of the lake. A deactivated USGS gage house and weir are present at the outlet (Driscoll, C. T. et al. 1996). Woods Lake drains 3 km to the south where it meets Twitchell Creek and eventually the Stillwater Reservoir. The lake reaches a maximum depth of 10.1 m (Figure 2).

Woods Lake is classified as a thin till drainage lake with low dissolved organic carbon and is considered sensitive to acidification. The ALTM began monitoring the lake in June of 1992. This lake is accessed by helicopter.

Lake chemistry: The lake was not sampled during the ALS 1984-1987 nor by the EPA during the ELS. Woods Lake is not included in the ALTM water chemistry trend analyses due to past liming activities. Table 1 summarizes recent ALTMS chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: In May, July, and October 1984 two crustaceans were found: the copepods, calanoid Diaptomus minutus and cyclopoid Mesocyclops edax. Also present was the cladoceran Bosmina longirostris. Dominant rotifers found were: Karatella taurocephala, Karatella hiemalis, Polyarthra spp. and Synchaeta spp. The macroinvertebrate community was dominated by Dipterans, Oligochaetes, and Ephemeropterans that together comprised 68% of the community, while Amphipods, Hydracarinae, and Odonates accounted for 15% of the community (Heinemann, J. et al. 1985).

Bukavecas and Shaw (1998) found phosphorus as the limiting nutrient and chlorophyll a averaging 1.27 µg L^{-1} in July 1990 and 1991.

Fisheries: The NYSDEC stocked brook trout in the lake intermittently during 1958 to 1977. Due to poor success, the lake was classified as "chemically unsuitable" for brook trout and stocking was abandoned in 1977 (Heinemann, J. et al. 1985). The

Figure 1. Catchment

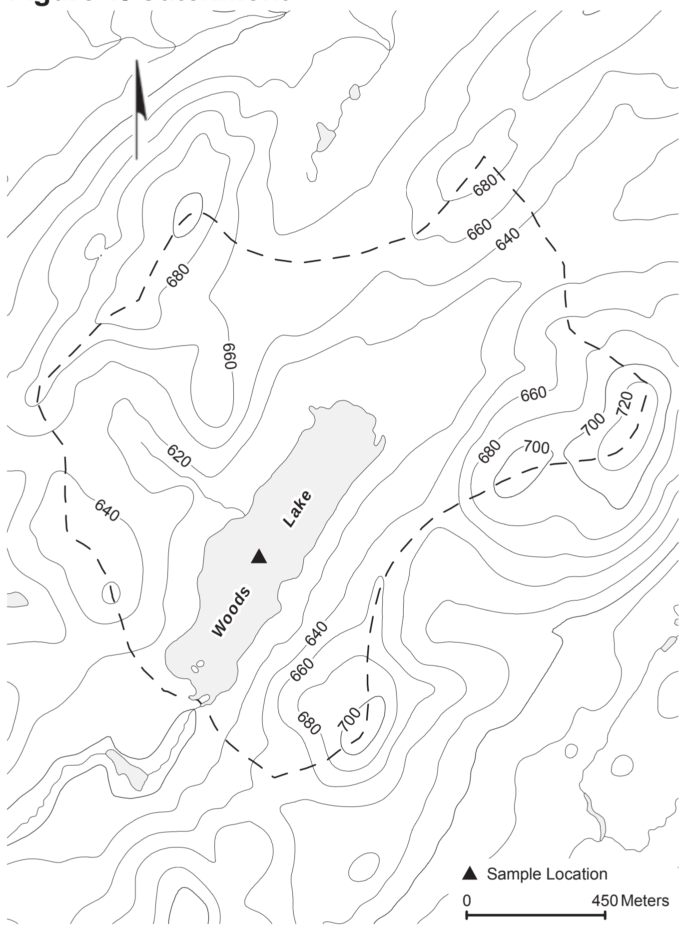
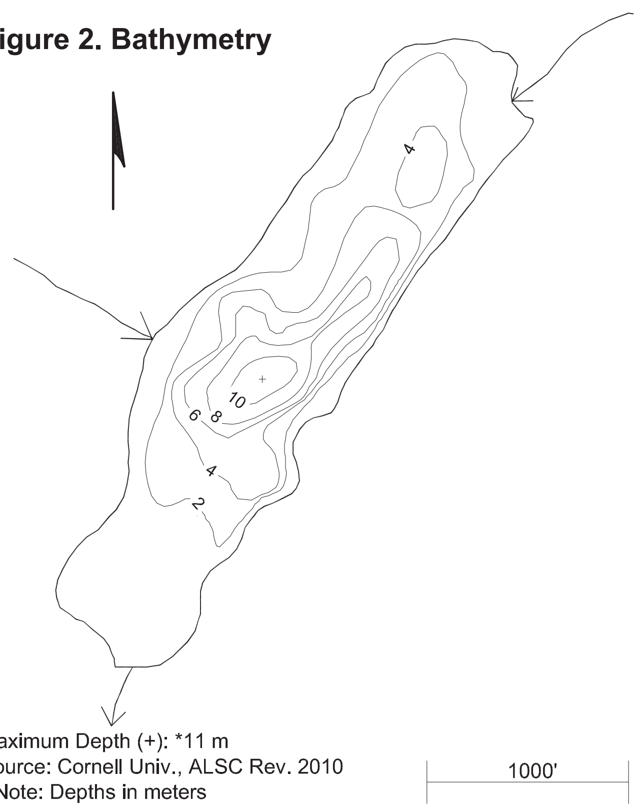


Figure 2. Bathymetry



Maximum Depth (+): *11 m
Source: Cornell Univ., ALSC Rev. 2010
* Note: Depths in meters

lake was limed in 1984, 1985 and 1989 as part of a larger project to evaluate the effects of experimental watershed liming. The ALTM surveyed the lake on 27 May 1997 and found brook trout. Refer to Table 3 for recent netting history.

Intensive studies: Woods Lake was considered the most sensitive of three lakes studied by Schofield and others (1985) from 1977 - 1981 under the Integrated Lake-Watershed Acidification Study (ILWAS). Researchers evaluated acidification and aluminum mobilization processes and developed detailed soil and bedrock maps for each lake (Schofield, C. L. et al. 1985). Phase II of ILWAS was a hydrologic analysis of Woods and Panther Lake conducted from January 1980 through December 1981 (Peters, N. E. and Murdoch, P. S. 1985). Woods Lake was part of the Lake Acidification Mitigation Project (LAMP), which also included Little Simon Pond (060182) and Cranberry Pond to assess the chemical and biological effects of liming on lake ecosystems. LAMP model calibrations were made from detailed geologic, hydrologic, bathymetric, baseline biota and chemistry data collected in the survey (Heinemann, J. et al. 1985). Watershed and lake liming studies occurred from 1985 to 1990 as part of the Experimental Watershed Liming Study (Driscoll, C. T. et al. 1996). A phytoplankton and zooplankton experiment was conducted in 1990 (Bukaveckas, P. and Shaw, W. 1998). Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Landscape characteristics and disturbance history have been evaluated within this watershed (Sullivan, T. J. et al. 1999). Woods Lake was one of 20 Adirondack lakes studied to evaluate regional trends in chrysophyte-inferred lake water pH (Cumming, B. F. et al. 1994; Smol, J. P. et al. 1998). Several planktonic community investigations have been performed at Woods lake (Bukaveckas, P. A. 1989; Bukaveckas, P. A. and W. H. Shaw 1997; Heinemann, J. et al. 1985). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: Schofield and others (1985) evaluated acidification and aluminum mobilization processes and developed detailed soil and bedrock maps for the study areas (Schofield, C. L. et al. 1985).

Deposition: The nearest NADP deposition monitoring site is 12 km southeast at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 21 km south at Nicks Lake.

Table 1. Lake Chemistry

040576			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	103.89	178.01	120.17	57.43	81.34	64.61	μeq L^{-1}
NO_3^-	1.10	58.38	17.01	0.05	48.69	14.62	μeq L^{-1}
Cl^-	5.92	8.74	7.03	5.04	7.57	6.17	μeq L^{-1}
F^-	1.53	1.84	1.72	1.38	1.78	1.56	μeq L^{-1}
ANC	8.65	37.77	27.12	5.56	40.13	26.33	μeq L^{-1}
DIC	44.96	189.82	87.56	31.64	165.68	77.61	μmol L^{-1} -C
DOC	279.24	429.77	321.74	299.22	391.55	338.85	μmol L^{-1} -C
SiO_2	38.45	111.84	59.24	20.12	66.41	37.37	μmol L^{-1}
Ca^{2+}	108.29	201.61	137.61	71.36	117.27	89.98	μeq L^{-1}
Mg^{2+}	18.10	21.39	20.23	12.34	18.93	15.92	μeq L^{-1}
Na^+	13.92	20.44	16.67	11.31	18.27	15.23	μeq L^{-1}
K^+	5.12	8.70	5.95	2.05	4.86	3.79	μeq L^{-1}
NH_4^+	-0.39	2.33	1.09	-0.07	2.22	1.08	μeq L^{-1}
AL_TD	1.89	11.60	5.44	1.31	10.34	4.88	μmol L^{-1}
AL_TM	1.00	8.38	3.43	1.66	9.41	3.06	μmol L^{-1}
AL_OM	0.71	4.86	2.17	1.74	3.34	2.27	μmol L^{-1}
AL_IM	0.00	5.11	1.48	0.00	6.30	0.84	μmol L^{-1}
LABPH	5.22	6.38	5.89	5.15	6.35	5.69	
AIREQPH	5.49	6.69	6.15	5.30	6.63	5.91	
TRUECOLOR	15	30	20	25	40	29	Pt Co
SCONDUCT	19.98	29.07	22.10	14.55	22.59	16.14	μS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	605 m
Maximum depth	10.1 m
Mean depth	3.5 m
Volume	80.9 x 10^4 m^3
Surface area	24.7 ha
Watershed area	208.7 ha
Watershed ratio	0.12
Hydraulic retention times (year)	0.51
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Big Moose
Land use classification	Private - Resource Management and Independence River Wild Forest

Figure 3. Chemistry Time Series

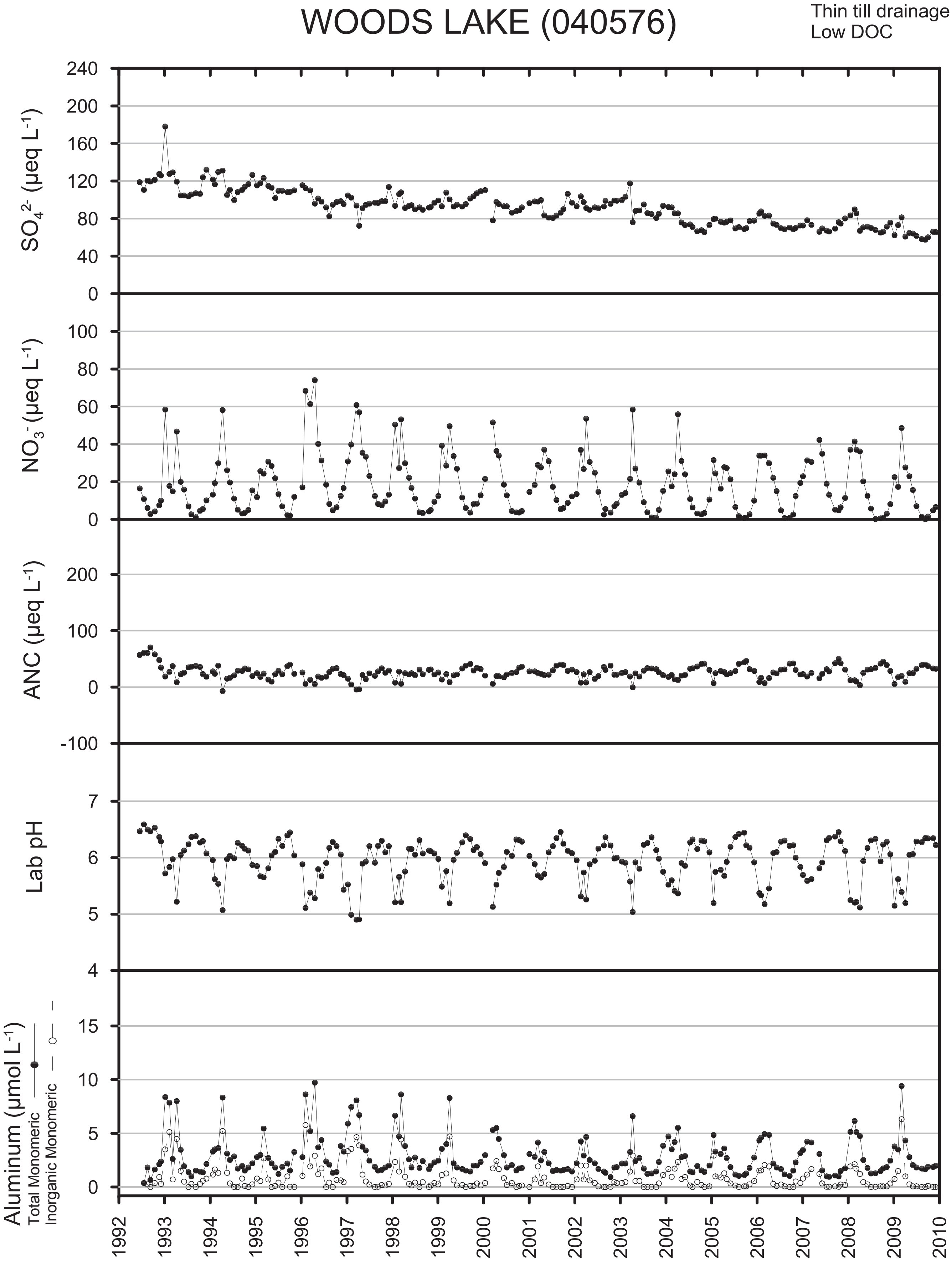


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams
May-97	Brook trout	24	75	465	11250

Watershed: Woods Lake and its watershed are underlain by charnockite, mangerite, pyroxene-quartz syenite gneiss with low to no ANC (Roy, K. M. et al. 1997). Till overlies 80% of the watershed and bedrock makes up the remainder. A mantle of eolian silt overlies the till in part of the watershed (Peters, N. E. and Murdoch, P. S. 1985). Rock outcrops and shallow (< 0.5 m) soils appear above 640 m elevation. Basal till defines the remaining area around the lake (Roy, K. M. et al. 1997). The maximum elevation in the watershed is 735 m and the maximum relief is 130 m.

Land cover/use: The watershed is primarily forested with hardwoods: maples 48.0%; beech-birch 41.3% and conifers 10.7% (Heinemann, J. et al. 1985). Total wetland area is 11.8 ha and comprises 5.6% of the watershed. The predominant wetland vegetation types are scrub/shrub, broad-leaf deciduous and needle leaf evergreen. Pockets of emergent marsh appear near the shoreline and forested needle-leaf evergreen near the outlet (Roy, K. M. et al. 1996). The southern half of the lake is in Resource Management. There is one seasonal camp on the shoreline. Recently, some logging has occurred in the southwestern part of the watershed. The northern half of the lake is NYS public land in the Independence River Wild Forest.

Watershed disturbance: The 1916 fire protection source data show 41.9% as burned over, 25% as green timber, 15.4% as logged for softwoods only and the remaining 9.9% as being logged for both soft and hardwoods. The November 1950 storm severely damaged 100% of the watershed with 50-100% blow down. A July 1995 microburst storm caused moderate damage to 21.5% of the watershed with a 30-60% change in tree crowns. The remainder of the watershed incurred little-to-no damage with 0-30% change in tree crowns (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Bukaveckas,P. and Shaw,W. 1998. Phytoplankton responses to nutrient and grazer manipulations among northeastern lakes of varying pH. Canadian Journal of Fisheries and Aquatic Sciences 55: 958-966.

Bukaveckas,P.A. 1989. Effects of calcite treatment on primary producers in acidified Adirondack lakes. II. Short-term response by phytoplankton communities. Canadian Journal of Fisheries and Aquatic Sciences 46: 352-359.

Bukaveckas,P.A. and Shaw,W.H. 1997. Effects of base addition and brook trout (*Salvelinus fontinalis*) introduction on the plankton community of an acidic Adirondack lake. Canadian Journal of Fisheries and Aquatic Sciences 54: 1367-1376.

Cirmo,C.P. and Driscoll,C.T. 1996. The impacts of a watershed $CaCO_3$ treatment on stream and wetland biogeochemistry in the Adirondack Mountains. Biogeochemistry 32: 265-297.

Cumming,B.F., Davey,K.A., Smol,J.P., and Birks,H.J.B. 1994. When did acid-sensitive Adirondack lakes (New York, USA) begin to acidify and are they still acidifying? Canadian Journal of Fisheries and Aquatic Sciences 51: 1550-1568.

Dixit,S.S., Cumming,B.F., Birks,H.J.B., Smol,J.P., Kingston,J.C., Uutala,A.J., Charles,D.F., and Camburn,K.E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Driscoll,C.T., Cirmo,C.P., Fahey,T.J., Blette,V.L., Bukaveckas,P.A., Burns,D.A., Gubala,C.P., Leopold,D.J., Newton,R.M., Raynal,D.J., Schofield,C.L., Yavitt,J.B., and Porcella,D.B. 1996. The Experimental Watershed Liming Study: Comparison of lake and watershed neutralization strategies. Biogeochemistry 32: 143-174.

Heinemann, J., Gloss, S., Schofield, C., Whitehead, D., Bukaveckas, P., DePinto, J., Young, T., Driscoll, C., and Staubitz, W. 1985. Lake Acidification Mitigation Project (LAMP). Electric Power Research Institute No. 1397-03-85-CR Volume I.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology 41: 5191-5197.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Peters,N.E. and Murdoch,P.S. 1985. Hydrogeologic comparison of an acidic-lake basin with a neutral-lake basin in the west-central Adirondack Mountains, New York. Water, Air, and Soil Pollution 26: 387-402.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schofield,C.L., Galloway,J.N., and Hendrey,G.R. 1985. Surface Water Chemistry in the ILWAS Basins. Water, Air, & Soil Pollution 26: 403-423.

Smol,J.P., Cumming,B.F., Dixit,A.S., and Dixit,S.S. 1998. Tracking recovery patterns in acidified lakes: A paleolimnological perspective. Restoration Ecology 6: 318-326.

Sullivan,T.J., Charles,D.F., Bernert,J.A., McMartin,B., Vaché,K.B., and Zehr,J. 1999. Relationship between landscape characteristics, history, and lakewater acidification in the Adirondack Mountains, New York. Water, Air, and Soil Pollution 112: 407-427.

This page intentionally left blank.

Middle Settlement Lake 040704

Lat. 43° 41' 02'' N Long. 075° 06' 00'' W

Lake: Middle Settlement Lake lies in the Oswegatchie-Black watershed at 526 m. The 15.8 ha headwater lake has one inlet (Figure 1). The lake outlet flows to Middle Branch Creek, a tributary to Pine Creek. In 1984, an active beaver dam was present at the outlet (ALSC 1985). The lake reaches a maximum depth is 11.0 m (Figure 2).

Middle Settlement Lake is classified as a thin till drainage lake, with low dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. The lake is accessed by helicopter.

Lake chemistry: Middle Settlement Lake was sampled during the ALS on 14 Aug 1984 finding: Lab pH 4.96, ANC -7.6 µeq L^{-1}, SO_4^{2-} 104.1 µeq L^{-1}, NO_3^- 0.49 µeq L^{-1}, Ca^{2+} 47.91 µeq L^{-1}, Mg^{2+} 15.63 µeq L^{-1}, DOC 2.1 mg L^{-1} -C (ALSC 1985). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 18 Sep 1984, submergent vegetation occupied 10% of the lake bottom. Emergent and floating vegetation occupied 5% and 1% of the lake surface, respectively. Species identified included: Carex spp., Nymphaea spp. and Utricularia spp. A dip net survey on that date found the following Insecta: Odonata, Hemiptera, Trichoptera, and Coleoptera (ALSC 1985).

In August 1975, DOH found total phosphorus at 54.0 mg m^{-3} and total chlorophyll a at 4.17 µg L^{-1} (Wood, L. W. 1978). In 2003, the average value of chlorophyll a was 1.49 µg L^{-1} (Momen, B. et al. 2006). On 14 Aug 1984, the lake was thermally stratified between 6 and 8 m (ALSC 1985).

Fisheries: The earliest records show stocking of brook trout in 1929. During the 1950's, DEC stocked the lake three times with brown trout. Annual stocking of brook trout continued from 1960-1984. Refer to Tables 3 & 4 for recent fish stocking and netting histories.

Intensive studies: NYSDOH conducted a limnological survey of Middle Settlement Lake in August 1975 (Wood, L. W. 1978). This lake has been studied as part of the AEAP since 1994 (Momen, B. et al. 2006). Ito evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or

Figure 1. Catchment

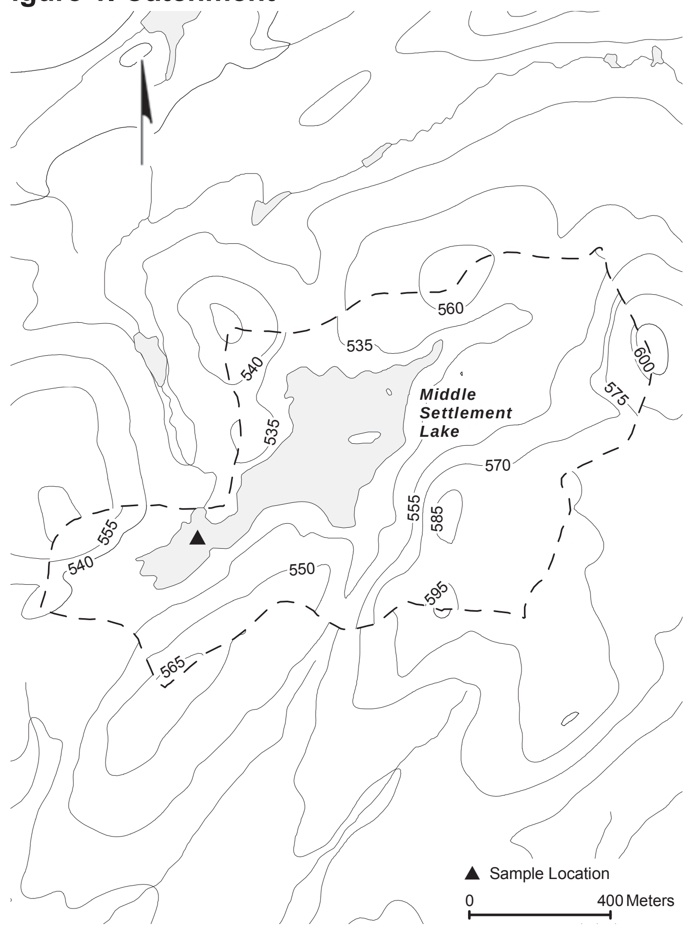
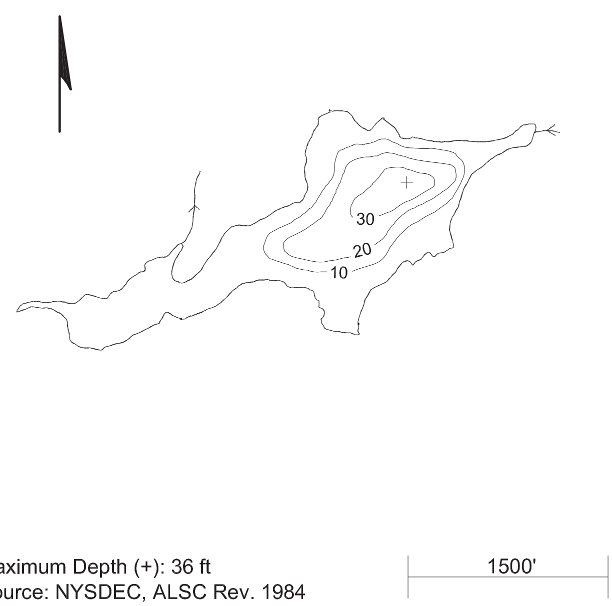


Figure 2. Bathymetry



Maximum Depth (+): 36 ft
Source: NYSDEC, ALSC Rev. 1984

release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 – 2000 (Ito, M. et al. 2006). In 2003, this lake watershed was part of a 36 lake-watershed regional survey of foliar nitrogen gradients in the Adirondack Park (McNeil, B. E. et al. 2007).

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 23 km northeast at Moss Lake. The nearest NYSDEC deposition monitoring site is 9 km east at Nicks Lake.

Watershed: Middle Settlement Lake and its entire watershed lie on biotite and hornblende granite gneiss with little to no ANC capacity (Roy, K. M. et al. 1997). Till overlays 100% of the watershed and is comprised primarily of shallow soils. A small percentage of hydric soils are found in the area around the lake (APA 2001). The highest elevation in the watershed is 605 m. The watershed has a maximum relief of 79 m. In 1984, the ALS found the shoal water substrate comprised of 45% muck/silt, 30% rock/boulder/rubble, and 25% sand/gravel (ALSC 1985).

Land cover/use: A deciduous-coniferous mixed forest covers 95% of the watershed with the remaining cover shrub-sapling and wetland. In 1984, a deciduous-coniferous mixed forest bordered 70% of the lake shoreline, while the remaining edge cover was 30% wetland/shrub-sapling (ALSC 1985). Total wetland area was 2.5 ha and comprised 2.2% of the watershed. The predominant wetland type is forested needle-leaf evergreen and is primarily found in the low lying areas northeast of the lake (Roy, K. M. et al. 1996).

The lake and watershed are in the Ha-De-Ron-Dah Wilderness (NYSDEC 1995). A trail follows the entire northwestern shore . A lean-to and several primitive campsites are on the shoreline.

Table 1. Lake Chemistry

040704			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	62.67	101.19	92.94	53.47	68.24	59.57	µeq L^{-1}
NO_3^-	-0.31	19.03	7.11	0.00	9.33	3.72	µeq L^{-1}
Cl^-	4.23	9.59	6.98	3.35	7.93	6.03	µeq L^{-1}
F^-	1.89	3.32	2.75	2.23	3.08	2.58	µeq L^{-1}
ANC	-15.72	23.86	3.76	12.92	28.14	19.90	µeq L^{-1}
DIC	19.15	220.63	82.91	33.30	250.60	101.10	µmol L^{-1} -C
DOC	151.53	473.89	225.20	206.64	371.69	273.44	µmol L^{-1} -C
SiO_2	12.48	62.41	39.86	12.65	93.87	44.40	µmol L^{-1}
Ca^{2+}	28.94	56.39	50.15	39.92	55.89	45.28	µeq L^{-1}
Mg^{2+}	9.87	23.04	17.76	13.17	17.28	15.40	µeq L^{-1}
Na^+	11.74	26.97	23.13	21.31	26.78	24.85	µeq L^{-1}
K^+	3.58	6.39	5.12	3.13	5.88	4.78	µeq L^{-1}
NH_4^+	0.83	12.86	6.26	-0.12	11.31	4.43	µeq L^{-1}
AL_TD	2.93	11.45	7.08	1.20	9.71	5.20	µmol L^{-1}
AL_TM	2.33	10.49	5.69	1.52	4.19	2.55	µmol L^{-1}
AL_OM	0.37	2.85	1.59	1.39	2.63	2.06	µmol L^{-1}
AL_IM	0.85	7.71	4.09	0.00	2.15	0.49	µmol L^{-1}
LABPH	4.67	5.71	5.12	5.34	6.08	5.69	
AIREQPH	4.67	5.92	5.18	5.91	6.40	6.11	
TRUECOLOR	5	25	15	20	35	25	Pt Co
SCONDUCT	15.56	20.78	17.35	12.02	15.19	12.99	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	526 m
Maximum depth	11.0 m
Mean depth	3.4 m
Volume	54.5 x 10^4 m^3
Surface area	15.8 ha
Watershed area	114.3 ha
Watershed ratio	0.14
Hydraulic retention time (year)	0.63
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Thendara
Land use classification	Ha-De-Ron-Dah Wilderness

Figure 3. Chemistry Time Series

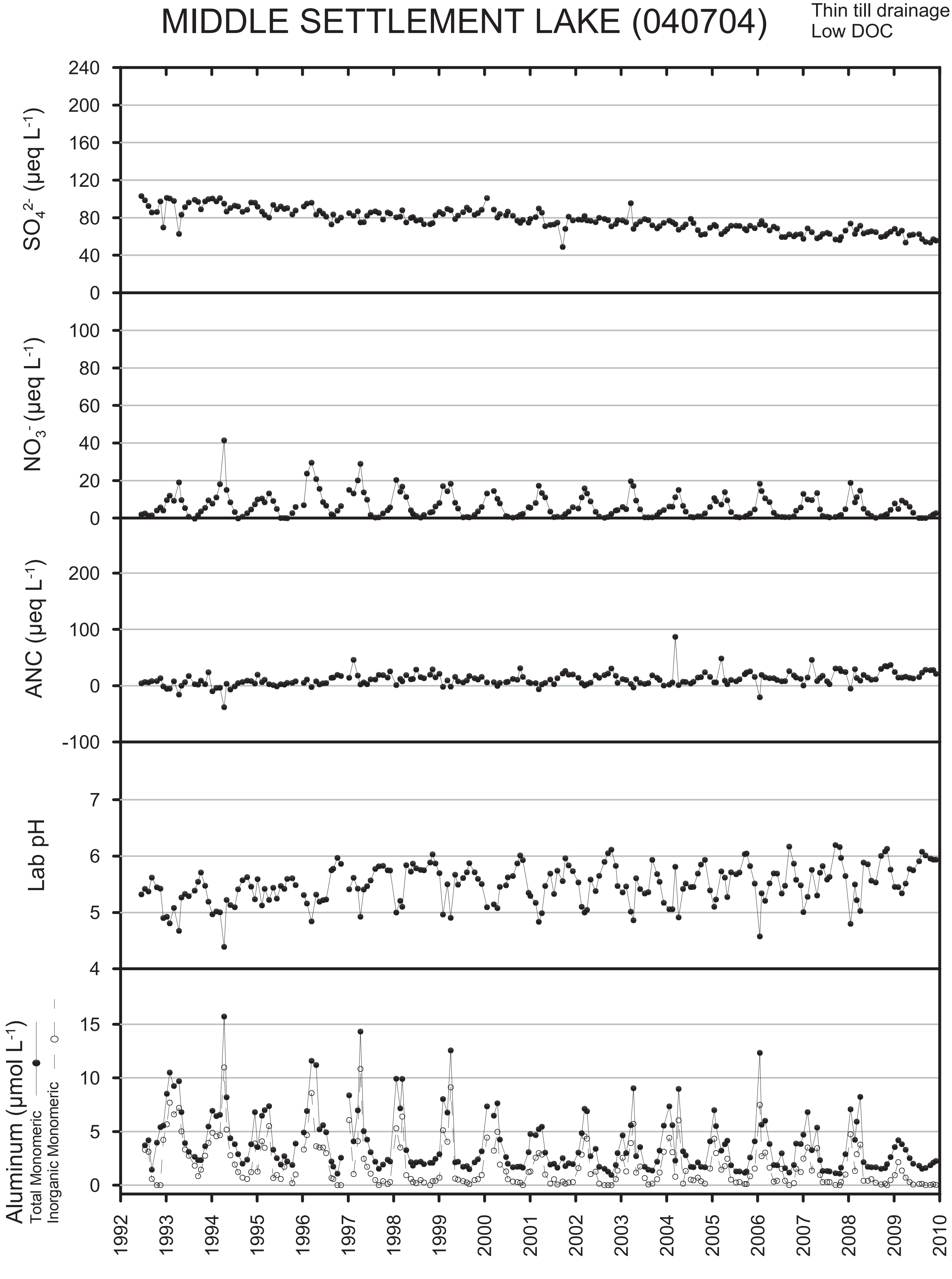


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	285	7
1981	Brook trout	540	17
1982	Brook trout	600	5
1983	Brook trout	600	22
1984	Brook trout	444	10
1985	Brook trout	660	15
1986	Brook trout	600	7
1987	Brook trout	600	5
1988	Brook trout	600	7
1989	Brook trout	660	7
1990	Brook trout	600	26
1991	Brook trout	600	9
1992	Brook trout	600	14
1993	Brook trout	600	21
1994	Brook trout	470	16
1995	Brook trout	560	31
1996	Brook trout	600	25
1997	Brook trout	630	26
1998	Brook trout	630	18
1999	Brook trout	600	19
2000	Brook trout	600	17
2001	Brook trout	530	20
2202	Brook trout	600	32
2003	Brook trout	600	32
2004	Brook trout	600	32
2005	Brook trout	600	32
2006	Brook trout	660	25

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-03	Brook trout	19	190	494	4181	19
June-03	Central mudminnow	1	94	94	7	1
September-84	Brook trout	6	295	445	5450	6
September-84	Central mudminnow	13	72	98	98	18

Watershed disturbance: The 1916 fire protection data show 92.2% of the watershed as burned over. A November 1950 storm moderately impacted the watershed causing 50 to 100% blowdown in 17.1% of the watershed and 25 to 50% blowdown in 15.3 % of the watershed. A microburst storm in July 1995 also caused forest damage with 100% of the watershed incurring 0 to 30% change in tree crowns (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology 41: 5191-5197.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in Summer Chemistry Linked to Productivity in Lakes Recovering from Acid Deposition in the Adirondack Region of New York. Ecosystems 9: 1306-1317.

New York State Department of Environmental Conservation 1995. HA-DE-RON-DAH Wilderness Unit Management Plan First Five Year Revision.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Wood, L. W. 1978. Limnology of remote lakes in the Adirondack region of New York State with emphasis on acidification problems. New York State Department of Health, Albany, NY.

This page intentionally left blank.

Grass Pond 040706

Lat. 43° 41' 25'' N Long. 075° 03' 54'' W

Lake: Grass Pond lies in the Oswegatchie-Black watershed at 549 m. This 5.3 ha headwater lake receives drainage from several tributaries (Ito, M. et al. 2006) (Figure 1). The outlet flows into Cedar Pond. In 1984, an active beaver dam was present at the outlet (ALSC 1985). The lake reaches a maximum depth of 5.2 m (Figure 2).

Grass Pond is classified as a medium till drainage lake, with low dissolved organic carbon. The lake is considered moderately sensitive to acidification. The ALTM program began monitoring the lake in June 1992. This lake is accessed by helicopter. Snow core samples have been collected monthly in the watershed (Figure 1) since January 1999.

Lake chemistry: Grass Pond was sampled during the ALS on 13 Aug 1984 finding: Lab pH 6.03, ANC 50.3 µeq L^{-1}, SO_4^{2-} 122.01 µeq L^{-1}, NO_3^- 3.07 µeq L^{-1}, Ca^{2+} 112.28 µeq L^{-1}, Mg^{2+} 37.85 µeq L^{-1}, DOC 4.9 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 17 Sep 1984, submergent plants occupied 70% of the lake bottom. Emergent and floating vegetation occupied 10% and 30% of the surface, respectively. Plants identified were: Sphagnum spp., Potamogeton spp., Dulichium spp., Carex spp., Juncus spp., Nuphar spp., Nymphaea spp., and Utricularia spp. On the same date a dip net survey found the following Insecta: Odonata Unspecified, Hemiptera Unspecified, and Coleoptera Unspecified (ALSC 1985).

The ALS found the lake thermally stratified between 4 and 6 m on 13 Aug 1984 (ALSC 1985). In 2003, the average value of chlorophyll a was 1.17 µg L^{-1} (Momen, B. et al. 2006).

Fisheries: Grass Pond does not have a history of fish stocking. It is reported to have had Natural Spawning Adequate (NSA) status up to 1980 (Bath, D. W. 2003). Refer to Table 3 for recent netting history.

Intensive studies: Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Landscape characteristics and disturbance history have been evaluated within this watershed (Sullivan, T. J. et al. 1999). This lake has been studied by the AEAP

Figure 1. Catchment

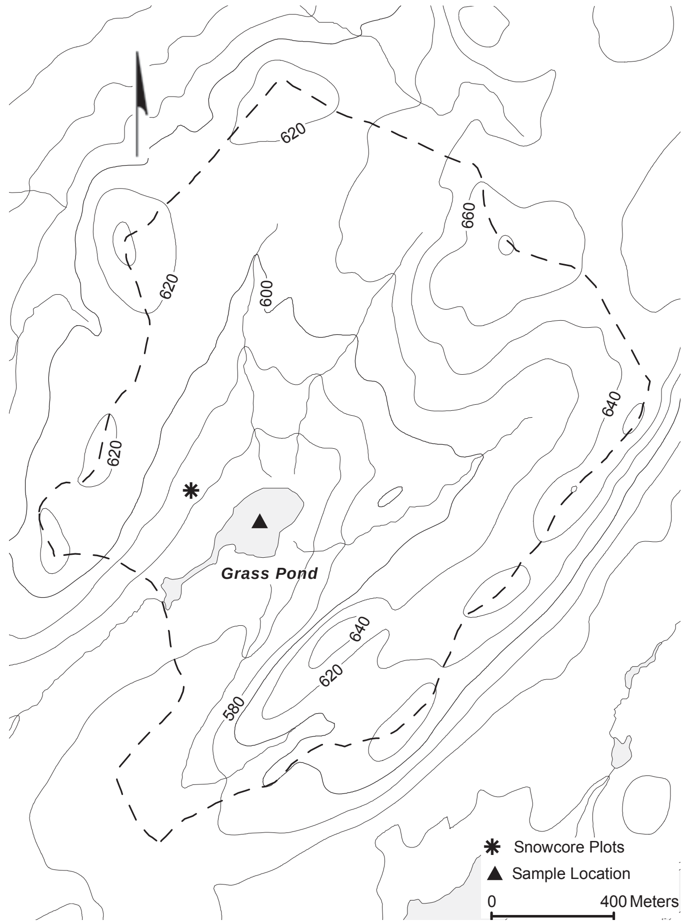
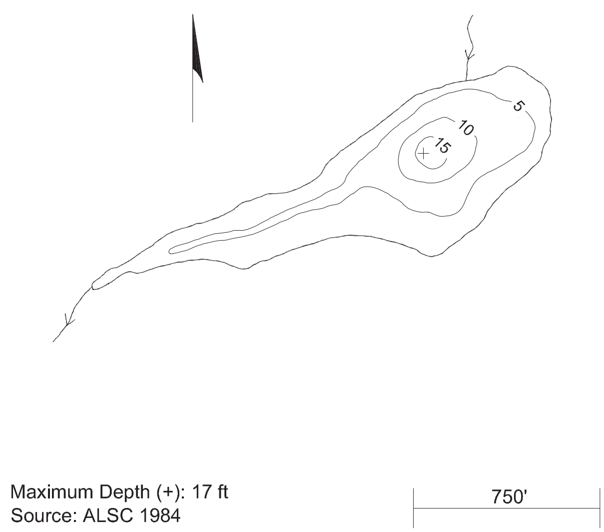


Figure 2. Bathymetry



since 1994 (Momen, B. et al. 2006). During 1999 and 2000 mass-balance studies at 3 ALTM lakes (Grass, Constable and G) included the installation of snow core plots in these watersheds (Figure 1). Grass Pond and Constable Pond were studied intensively for nitrogen solute sources and sinks in 1999-2000 (Ito, M. et al. 2006).

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b). Ito and others (2006) conducted a study of surficial geology and soils in the Grass Pond and Constable Pond (040777) watersheds. This involved the development of four soils pits and five seismic lines to determine extent of till deposits within the Grass Pond watershed.

Deposition: The nearest NADP deposition monitoring site is 21 km northeast at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 6 km east at Nick's Lake.

Watershed: Grass Pond and its watershed lie on biotite and/or hornblende granite gneiss with low to no ANC (Roy, K. M. et al. 1997). Till comprises 45% of the watershed and the remainder of the watershed (above 580 m) is exposed bedrock (APA 2001). The highest elevation in the watershed is 684 m. The watershed has a maximum relief of 135 m. In 1984, the ALS characterized the shoal water substrate as 70% muck/silt/organic and 30% boulders (ALSC 1985).

Land cover/use: In 1984, 85% of the watershed was covered in deciduous-coniferous mixed forest and 5% was covered in shrub-sampling vegetation (ALSC 1985). Wetland area covers approximately 14.7 ha comprising 5.4% of the watershed. The predominant wetland types are forested needle-leaf evergreen and forested broad-leaf deciduous occupying 2.2% and 1.6% of the watershed, respectively (ALSC 2003). The lake and its watershed occur totally within the Ha-De-Ron-Dah Wilderness of the NYS Forest Preserve. There is a small foot trail that leads to the shoreline from the south.

Table 1. Lake Chemistry

040706			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	76.20	127.00	106.15	70.60	98.84	79.02	$\mu eq\ L^{-1}$
NO_3^-	1.31	54.35	26.30	0.00	39.06	16.92	$\mu eq\ L^{-1}$
Cl^-	5.08	11.56	7.87	5.32	8.56	6.85	$\mu eq\ L^{-1}$
F^-	3.63	5.58	4.72	4.01	5.26	4.55	$\mu eq\ L^{-1}$
ANC	-15.98	96.39	23.81	-12.37	70.05	30.18	$\mu eq\ L^{-1}$
DIC	21.65	238.94	92.00	37.47	159.02	81.67	$\mu mol\ L^{-1}$ -C
DOC	182.58	413.53	331.16	231.78	420.50	328.36	$\mu mol\ L^{-1}$ -C
SiO_2	63.08	196.39	99.33	82.72	176.75	105.93	$\mu mol\ L^{-1}$
Ca^{2+}	57.89	152.20	87.91	43.91	109.29	73.28	$\mu eq\ L^{-1}$
Mg^{2+}	16.46	43.61	30.58	11.52	39.50	24.17	$\mu eq\ L^{-1}$
Na^+	15.22	61.33	36.72	18.70	51.76	34.98	$\mu eq\ L^{-1}$
K^+	5.63	14.32	8.61	2.30	11.00	6.16	$\mu eq\ L^{-1}$
NH_4^+	0.39	7.48	2.04	-0.11	2.99	0.94	$\mu eq\ L^{-1}$
AL_TD	3.93	25.42	11.94	0.21	20.98	8.96	$\mu mol\ L^{-1}$
AL_TM	1.59	19.31	7.93	2.08	10.45	4.54	$\mu mol\ L^{-1}$
AL_OM	1.31	5.86	3.12	1.70	4.19	2.78	$\mu mol\ L^{-1}$
AL_IM	0.00	14.63	4.92	0.23	6.60	1.76	$\mu mol\ L^{-1}$
LABPH	4.67	6.31	5.29	4.82	6.47	5.48	
AIREQPH	4.66	7.15	5.32	4.81	7.11	5.52	
TRUECOLOR	15	40	23	25	35	28	Pt Co
SCONDUCT	18.46	30.10	23.09	16.48	25.40	18.98	$\mu S\ cm^{-1}$

Table 2. Lake Characteristics

Parameter	Value
Elevation	549 m
Maximum depth	5.2 m
Mean depth	1.5 m
Volume	$7.8 \times 10^4\ m^3$
Surface area	5.3 ha
Watershed area	272 ha
Watershed ratio	0.02
Hydraulic retention time (year)	0.04
Watershed	Oswegatchie/ Black
County, Town	Herkimer, Webb
USGS Quadrangle	Thendara
Land use classification	Ha-De-Ron-Dah Wilderness

Figure 3. Chemistry Time Series

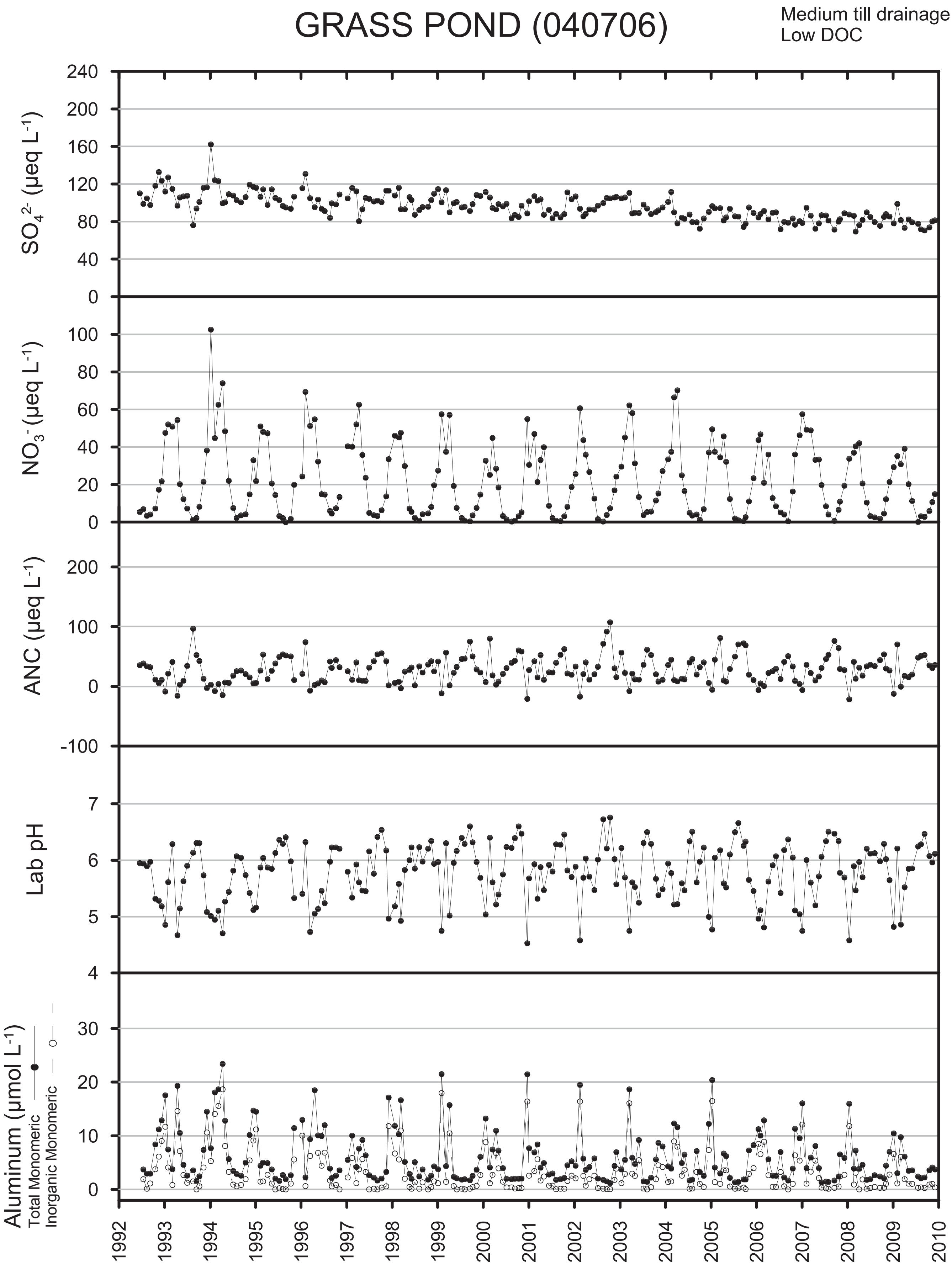


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-99	Brook trout	13	94	315	1279	13
May-99	Central mudminnow	3	50	60	5	3
May-99	Common shiner	23	82	94	167	32
May-99	N. redbelly dace	25	58	75	68	59
May-99	Creek chub	14	61	133	101	14
May-99	White sucker	31	125	346	2649	56
September-84	Brook trout	18	108	290	1520	18
September-84	Central mudminnow	1	81	81	7	1
September-84	Common shiner	2	155	158	110	2
September-84	Creek chub	9	166	191	-	9
September-84	White sucker	26	165	321	-	62

Watershed disturbance: The 1916 fire protection source data show nearly 60% of the watershed as burned over. This area was primarily found in the south. The remaining area is shown as 40% waste and denuded lands. In the 1950 November storm, 14% of the watershed was 50 to 100% blowdown. The July 1995 microburst storm caused 0 to 30% change in tree crowns in 99% of the watershed and 60 to 100% change in 1% of the watershed (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Bath, D. W. 2003. Long term monitoring pond descriptions. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Dixit,S.S., Cumming,B.F., Birks,H.J.B., Smol,J.P., Kingston,J.C., Uutala,A.J., Charles,D.F., and Camburn,K.E. 1993. Diatom assemblages from Adirondack lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Ito,M., Mitchell,M.J., Driscoll,C.T., Newton,R.M., Johnson,C.E., and Roy,K.M. 2006. Controls on surface water chemistry in two lake watersheds in the Adirondack region of New York: differences in nitrogen solute sources and sinks. Hydrological Processes 21: 1249-1264.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Sullivan,T.J., Charles,D.F., Bernert,J.A., McMartin,B., Vaché,K.B., and Zehr,J. 1999. Relationship between landscape characteristics, history, and lakewater acidification in the Adirondack Mountains, New York. Water, Air, and Soil Pollution 112: 407-427.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

This page intentionally left blank.

Middle Branch Lake 040707

Lat. 43° 41' 52'' N Long. 075° 06' 08'' W

Lake: Middle Branch Lake lies in the Oswegatchie-Black watershed at 496 m. This 17.0 ha headwater lake has many seepage areas on the shoreline fringe. An inlet stream enters near the outlet on the southern end of the watershed (Figure 1.). The irregularly shaped lake has a single elongated deep basin reaching a maximum depth reaching a maximum depth of 5.2 m (Figure 2).

Middle Branch Lake is classified as a thin till drainage lake, with low dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. This lake is accessed by helicopter.

Lake chemistry: Middle Branch Lake was sampled by ALS on 14 Aug. 1984 finding: Lab pH 6.87, ANC 18.4 µeq L^{-1}, SO_4^{2-} 104.1 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 98.31 µeq L^{-1}, Mg^{2+} 37.85 µeq L^{-1}, DOC 3.9 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 19 Sep 1984, the ALS found submergent vegetation covered 5% of the lake bottom. No species were identified. A dip net survey on that date found the following Insecta: Odonata Macromiidae, Ephemeroptera Heptageniidae, and Diptera Chironomidae. Also found were: Oligochae Unspecified and Crustacea Amphipoda Unspecified. The ALS found the lake isothermal on 14 Aug 1984 (ALSC 1985). The AEAP reported an average value of chlorophyll a of 3.40 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: The earliest record shows brook trout stocking in 1931 (ALSC 1985). Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: Middle Branch Lake has been studied as part of the AEAP (Momen, B. et al. 1999; Momen, B. et al. 2006; Momen, B. and Zehr, J. P. 1998). Ito and others (2006) evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 – 2000 (Ito, M. et al. 2006).

Figure 1. Catchment

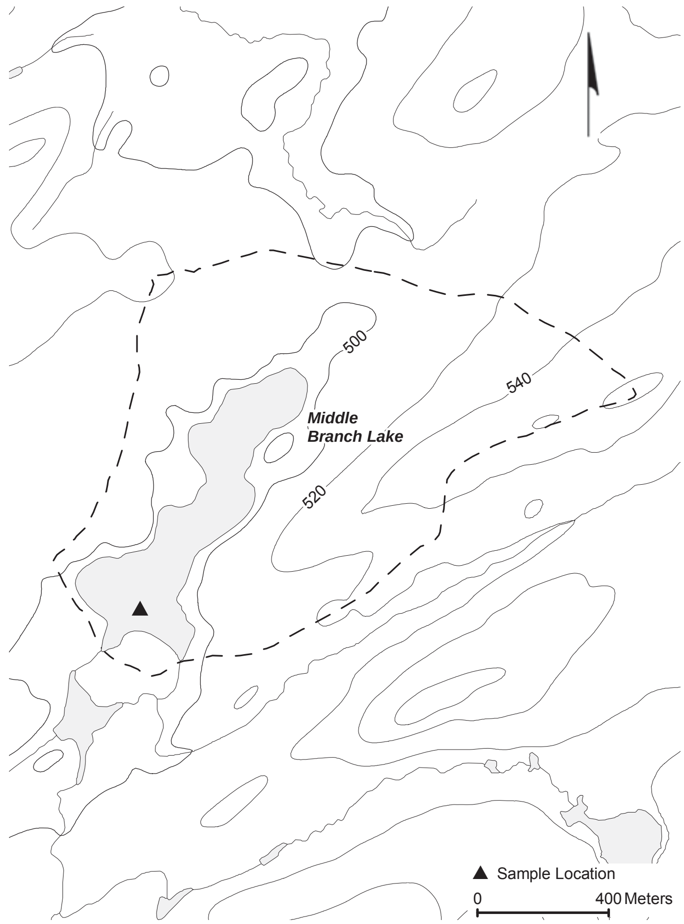
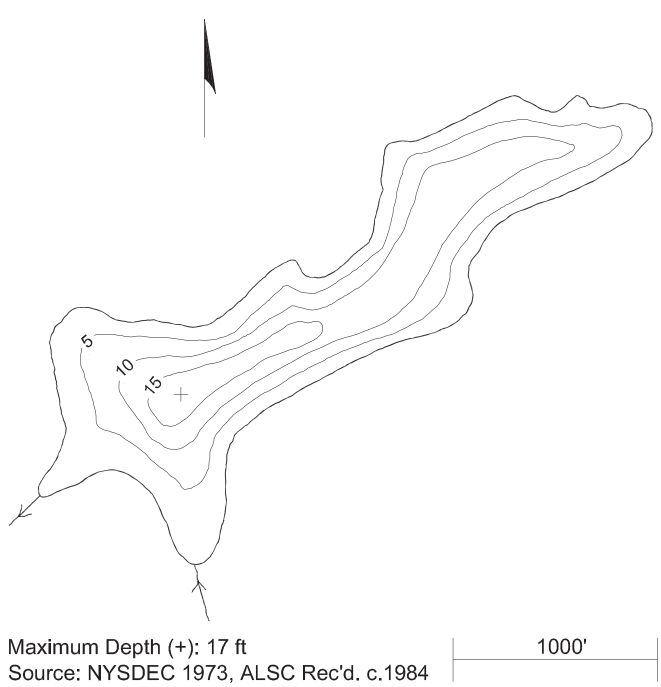


Figure 2. Bathymetry



Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 23 km northeast at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 9 km east at Nick's Lake.

Watershed: Middle Branch Lake and its watershed lies on biotite and hornblende granite gneiss with little to no ANC (Roy, K. M. et al. 1997). Till overlays 100% of the watershed. Basal till is found in the immediate area around the lake. There is a small area of organic hydric soils between the inlet and outlet. Shallow soils occur above 520 m (APA 2001). The highest elevation in the watershed is 560 m and it has a maximum relief of 64 m. In 1984, the ALS found the shoal water substrate comprised of 80% sand and gravel, and 20% boulder/rubble (ALSC 1985).

Land cover/use: In 1984, deciduous forest covered 90% of the watershed while the remaining 10% was deciduous-coniferous mixed forest (ALSC 1985). Total wetland area is 23.8 ha comprising 18.4% of the watershed (Roy, K. M. et al. 1996). The predominant wetland vegetation types are: forested needle-leaf evergreen and forested broad-leaf deciduous covering 9.6% and 6.7% of the watershed respectively. Wetlands appear in the seepage areas along the north shore of the lake. The watershed occurs within the Ha-De-Ron-Dah Wilderness (NYSDEC 1995). A trail runs along the northwestern edge of the pond leading to a lean-to and a number of primitive campsites.

Table 1. Lake Chemistry

040707			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	86.19	104.72	95.47	60.73	80.28	68.91	µeq L^{-1}
NO_3^-	-0.27	20.48	9.67	0.00	11.66	4.20	µeq L^{-1}
Cl^-	6.49	9.59	8.05	6.00	8.12	6.88	µeq L^{-1}
F^-	3.63	5.16	4.40	3.51	4.98	4.23	µeq L^{-1}
ANC	25.39	62.63	42.72	18.81	69.32	52.81	µeq L^{-1}
DIC	44.13	209.81	108.91	59.94	240.61	112.61	µmol L^{-1} -C
DOC	285.73	380.31	328.18	293.56	434.36	379.65	µmol L^{-1} -C
SiO_2	66.57	108.68	85.14	74.64	112.01	91.68	µmol L^{-1}
Ca^{2+}	76.35	103.30	93.36	62.88	88.00	81.59	µeq L^{-1}
Mg^{2+}	27.98	41.14	33.89	19.75	33.65	29.73	µeq L^{-1}
Na^+	27.84	38.71	33.77	24.36	38.71	35.12	µeq L^{-1}
K^+	0.51	9.98	7.51	4.60	7.93	6.84	µeq L^{-1}
NH_4^+	-0.44	4.32	1.79	-0.86	3.22	0.80	µeq L^{-1}
AL_TD	0.59	7.15	4.10	1.59	9.45	4.02	µmol L^{-1}
AL_TM	0.40	5.08	2.53	1.68	4.93	2.52	µmol L^{-1}
AL_OM	0.47	3.15	2.03	1.54	3.45	2.19	µmol L^{-1}
AL_IM	0.00	2.26	0.89	0.00	1.48	0.35	µmol L^{-1}
LABPH	5.64	6.60	6.02	5.35	6.69	6.04	
AIREQPH	6.14	6.93	6.46	5.58	6.90	6.42	
TRUECOLOR	20	35	28	25.00	50	39	Pt Co
SCONDUCT	19.50	21.39	20.36	16.08	20.12	18.07	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	496 m
Maximum depth	5.2 m
Mean depth	2.1 m
Volume	36.3 x 10^4 m^3
Surface area	17.0 ha
Watershed area	129.6 ha
Watershed ratio	0.13
Hydraulic retention time (year)	0.37
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Thendara
Land use classification	Ha-De-Ron-Dah Wilderness

Figure 3. Chemistry Time Series

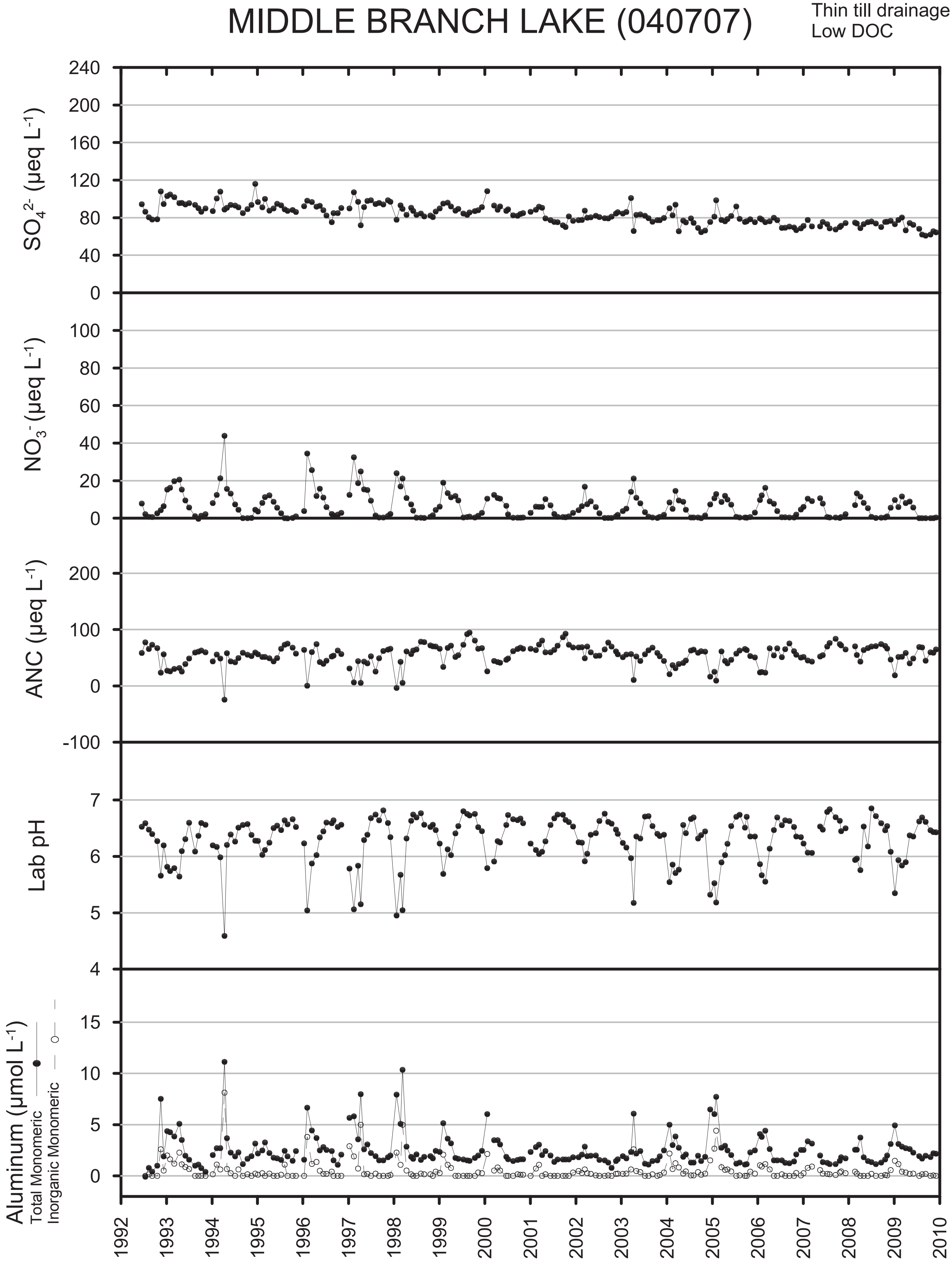


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	950	21
1981	Brook trout	990	31
1982	Brook trout	1100	8
1983	Brook trout	1100	40
1984	Brook trout	814	19
1985	Brook trout	1210	27
1986	Brook trout	1100	14
1987	Brook trout	1100	9
1988	Brook trout	1100	13
1989	Brook trout	1210	13
1990	Brook trout	1100	47
1991	Brook trout	1100	16
1992	Brook trout	1100	26
1993	Brook trout	1100	39
1994	Brook trout	870	29
1995	Brook trout	1120	62
1996	Brook trout	1200	50
1997	Brook trout	1260	52
1998	Brook trout	1260	36
2000	Brook trout	1200	34
2001	Brook trout	1070	34
2002	Brook trout	1200	63
2003	Brook trout	1200	63
2004	Brook trout	1200	63
2005	Brook trout	1200	63
2006	Brook trout	1320	47

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-04	Brook trout	12	176	322	1535	12
June-04	Golden shiner	25	78	115	194	375
June-04	Common shiner	8	29	134	119	8
June-04	Fathead minnow	25	75	85	147	30
June-04	Blacknose dace	16	53	64	58	16
June-04	Creek chub	20	85	168	618	20
June-04	White sucker	23	90	477	8020	59
June-04	Pumpkinseed	27	60	125	181	431
September-84	Brook trout	8	200	370	1920	8
September-84	Central mudminnow	1	89	89	7	1
September-84	Golden shiner	2	92	102	18	2
September-84	Common shiner	4	145	150	140	4
September-84	Creek chub	2	75	220	125	2
September-84	White sucker	17	168	345	1890	50
September-84	Pumpkinseed	2	100	115	45	2

Disturbance: The 1916 fire protection source data show 89.2% of the watershed as burned over and 1% logged for softwood only with considerable amounts of slash. The watershed was undisturbed in the November 1950 blowdown storm. The July 1995 microburst storm caused a 0 to 30% change in tree crowns throughout the entire watershed (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in Summer Chemistry Linked to Productivity in Lakes Recovering from Acid Deposition in the Adirondack Region of New York. Ecosystems 9: 1306-1317.

Momen,B. and Zehr,J.P. 1998. Watershed classification by discriminant analyses of lakewater-chemistry and terrestrial characteristics. Ecological Applications 8: 497-507.

Momen,B., Zehr,J.P., Boylen,C.W., and Sutherland,J.W. 1999. Determinants of summer nitrate concentration in a set of Adirondack lakes, New York. Water, Air, & Soil Pollution 111: 19-28.

New York State Department of Environmental Conservation 1995. HA-DE-RON-DAH Wilderness Unit Management Plan First Five Year Revision.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

This page intentionally left blank.

Lake Rondaxe 040739

Lat. 43° 45' 23'' N Long. 074° 54' 59'' W

Lake: Lake Rondaxe lies in the Oswegatchie-Black watershed at 524 m. The lake is part of the Moose River flow. Its primary tributary is from Dart Lake (040750), which includes the Big Moose Lake (040752) watershed. A secondary inflow drains from Moss Lake (040746), which includes the Bubb Lake (040748) watershed. The watershed includes nearly 60 ponded sub-watersheds and is the largest lake by watershed area in the ALTM Program (Roy, K. M. et al. 1996). A metal dam, reconstructed in the summer of 2007, is at the outlet. Lake Rondaxe has two islands and small areas of floating bogs (ALSC 1987). The maximum depth is 10.1 m (Figures 1 and 2).

Lake Rondaxe is classified as a thin till chain drainage lake, with low dissolved organic carbon. The lake is considered sensitive to acidification. This is one of the original ALS lakes monitored on a monthly basis since June 1982.

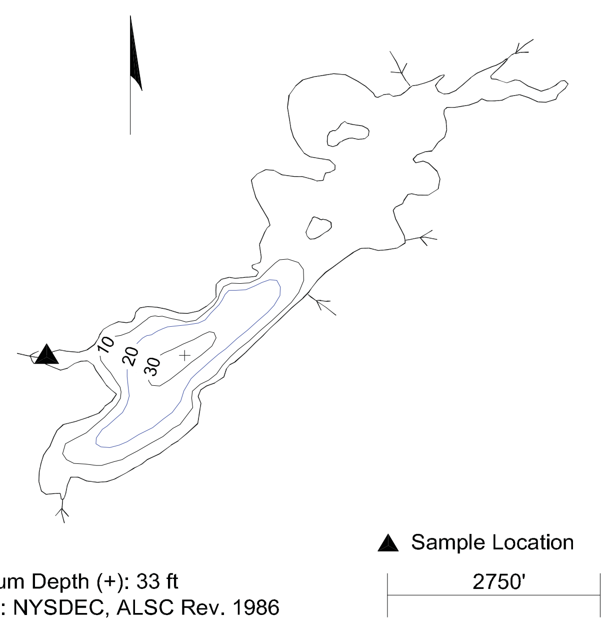
Lake chemistry: Lake Rondaxe was sampled during the ALS on 29 Jul 1986 finding: Lab pH 6.14, ANC 27.5 μeq L^{-1}, SO_4^{2-} 116.18 μeq L^{-1}, NO_3 3.07 μeq L^{-1}, Ca^{2+} 97.81 μeq L^{-1}, Mg^{2+} 30.45 μeq L^{-1}, DOC 3.7 mg L^{-1}-C (ALSC 1987). Table 1 summarizes recent water chemistry taken at the outlet. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 29 Jul 1986, the ALS found submergent plants occupied 20% of the lake bottom. Emergent and floating vegetation occupied 15% and 5% of the surface, respectively. Plants identified were: Sparganium spp., Carex spp., Pontederia spp., Juncus spp., Nuphar spp., Nymphaea spp., Brasenia spp., Nymphoides spp., and Utricularia spp. On 6 Oct.1986 ALS collected the following Insecta: Odonata Libellulidae and Coenagriidae; Hemiptera Notonectidae and Gerridae; and Diptera Chironomidae, in a dip-net survey. Also found were Crustacea Decapoda Astacidae (ALSC 1987). The lake was thermally stratified between 3 and 4 m on 29 Jul 1986 (ALSC 1987). The average value of chlorophyll a was 2.20 μg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: The NYSDEC first stocked Lake Rondaxe with lake trout in 1929. From 1931 to 1951 intermittent stocking of brook trout occurred. In 1951 and 1952, small mouth bass were added. In the recent past both small mouth and largemouth bass were stocked by the lake association. There is no recent history of stocking. Refer to Table 3 for recent fish netting history.

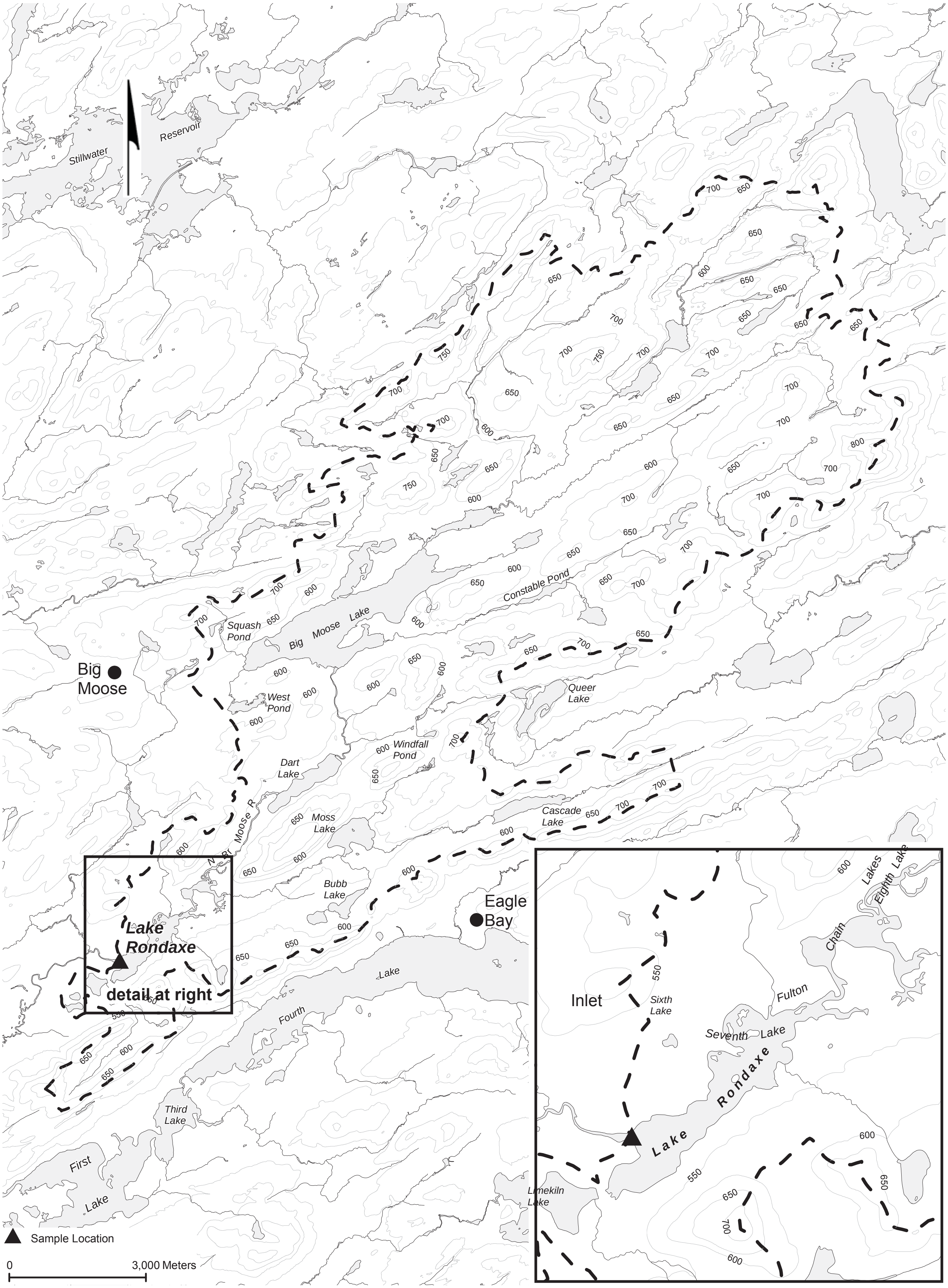
Intensive studies: The RILWAS and NBMR studied the lake in the early 1980s (Newton, R. M. et al. 1987; Driscoll, C. T. et al. 1987; Schofield, C. L. and Driscoll, C. T. 1987; Driscoll, C. T. and Newton, R. M. 1985). Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). NBMR evaluated the recovery of fisheries in this water in 2000 (Raynal, D. J. et al. 2004). The AEAP has a current study at the lake (Momen, B. et al. 2006). The Mercury Response Project studied changes in mercury in fish populations at this site. The lake was originally sampled on 8 Oct 1992 and resurveyed on 3 Oct 2005 (Dittman, J. A. and Driscoll, C. T. 2009). Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C.

Figure 1. Bathymetry



Maximum Depth (+): 33 ft
Source: NYSDEC, ALSC Rev. 1986

Figure 2. Catchment



T. et al. 1995). Common loons were surveyed for mercury content in 1998-2000 (Schoch, N. and Evers, D. C. 2002) and again in 2003-2004 (Schoch, N. et al. 2004). Lake Rondaxe was a study watershed for an Adirondack/Catskill comparison during 1992-2001 (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005).

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b). The NBMR study sampled this watershed for soils, mineralogy and chemistry of surficial materials (Newton, R. M. et al. 1987).

Deposition: The nearest NADP deposition monitoring site is 6 km northeast at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 10 km southwest at Nick's Lake.

Watershed: Lake Rondaxe lies on undivided metasedimentary rock and related migmatite with medium to high ANC. The majority of the watershed lies on biotite and/or hornblende granite gneiss with low to no ANC (Roy, K. M. et al. 1997). Till accounts for 65% of the watershed, while bedrock accounts for 14%, outwash sand and gravel 19%, and kame deposits 1.4%. The area proximal to the lake is mostly glacial outwash (APA 2001). The highest elevation in the watershed is 850 m. The watershed has a maximum relief of 326 m. In 1986, the ALS found the shoal water substrate to be comprised of 35% sand/gravel with 65% muck/silt/organic (ALSC 1987).

Land cover/use: In 1986, the ALS described the watershed as: 70% deciduous-coniferous mixed forest; 20% coniferous forest; 5% deciduous forest and 5% shrub/sapling vegetation. The immediate shoreline of the lake was 60% deciduous-conifer mix, 15% developed, 18% coniferous forest, 5% sand-gravel beach and 2% wetland areas (ALSC 1987). Total wetland area is 1726 ha and comprises 12.2% of the watershed. Wetlands are associated with inlets. The dominant wetland type is forested needle-leaf evergreen (ALSC 2003). A majority of the watershed lies within the Pigeon Lake Wilderness to the north, while a small portion on the southern boundary lies within the Fulton Chain Wild Forest according to the Adirondack Park Agency Land Use and Development Plan. The shoreline of the lake is privately owned with a mix of Moderate Use Intensity and Resource Management lands. The shoreline is approximately 15 % developed with roads and private residences (Roy, K. M. et al. 1997).

Watershed disturbance: The 1916 fire protection source data reveal 86.3% of the watershed as green timber of virgin and second growth with no slash; 6.8% of the watershed as logged for softwoods only with considerable amounts of slash; 0.1% as logged for both softwood and hardwood with much slash; and 0.5% is shown as a burned over area. Portions of the Lake Rondaxe watershed were disturbed by the November 1950 storm in which 0.9% received 25 to 50% blowdown and 21.6% of the area 50 to 100% blowdown damage. The July 1995 microburst storm damaged 92.6% of the area with 0-30% change in tree crowns, 5.5% with a 30-60% change, and 1.9% with 60-100% change (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

Table 1. Lake Chemistry

040739			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	97.85	130.75	112.50	63.77	83.78	71.57	µeq L^{-1}
NO_3^-	6.68	32.09	19.20	1.24	16.16	8.17	µeq L^{-1}
Cl^-	8.46	11.56	9.85	8.86	11.99	9.60	µeq L^{-1}
F^-	4.26	5.90	4.97	3.67	4.87	4.17	µeq L^{-1}
ANC	13.41	74.16	35.74	26.11	76.25	45.38	µeq L^{-1}
DIC	25.81	159.85	82.49	57.45	123.22	84.21	µmol L^{-1}-C
DOC	207.64	350.42	271.38	302.97	430.18	348.09	µmol L^{-1}-C
SiO_2	71.73	123.32	93.21	58.34	109.34	79.33	µmol L^{-1}
Ca^{2+}	86.33	138.73	114.82	78.85	101.08	88.49	µeq L^{-1}
Mg^{2+}	30.45	43.61	35.32	23.04	32.25	27.04	µeq L^{-1}
Na^+	23.92	37.41	29.98	23.92	31.32	29.02	µeq L^{-1}
K^+	6.39	9.46	8.63	5.63	7.16	6.51	µeq L^{-1}
NH_4^+	-0.33	2.88	1.35	-0.78	2.44	0.79	µeq L^{-1}
AL_TD	1.22	13.08	6.21	1.72	9.64	5.45	µmol L^{-1}
AL_TM	0.08	8.88	3.61	1.79	4.26	2.78	µmol L^{-1}
AL_OM	-0.38	3.72	1.94	1.74	3.11	2.27	µmol L^{-1}
AL_IM	0.00	5.16	1.78	0.00	1.48	0.54	µmol L^{-1}
LABPH	5.53	6.98	5.97	5.81	6.59	6.14	
AIREQPH	5.75	7.04	6.24	6.24	6.90	6.56	
TRUECOLOR	10	30	20	30	45	38	Pt Co
SCONDUCT	20.31	26.29	22.92	16.87	20.14	18.28	µS cm^{-1}

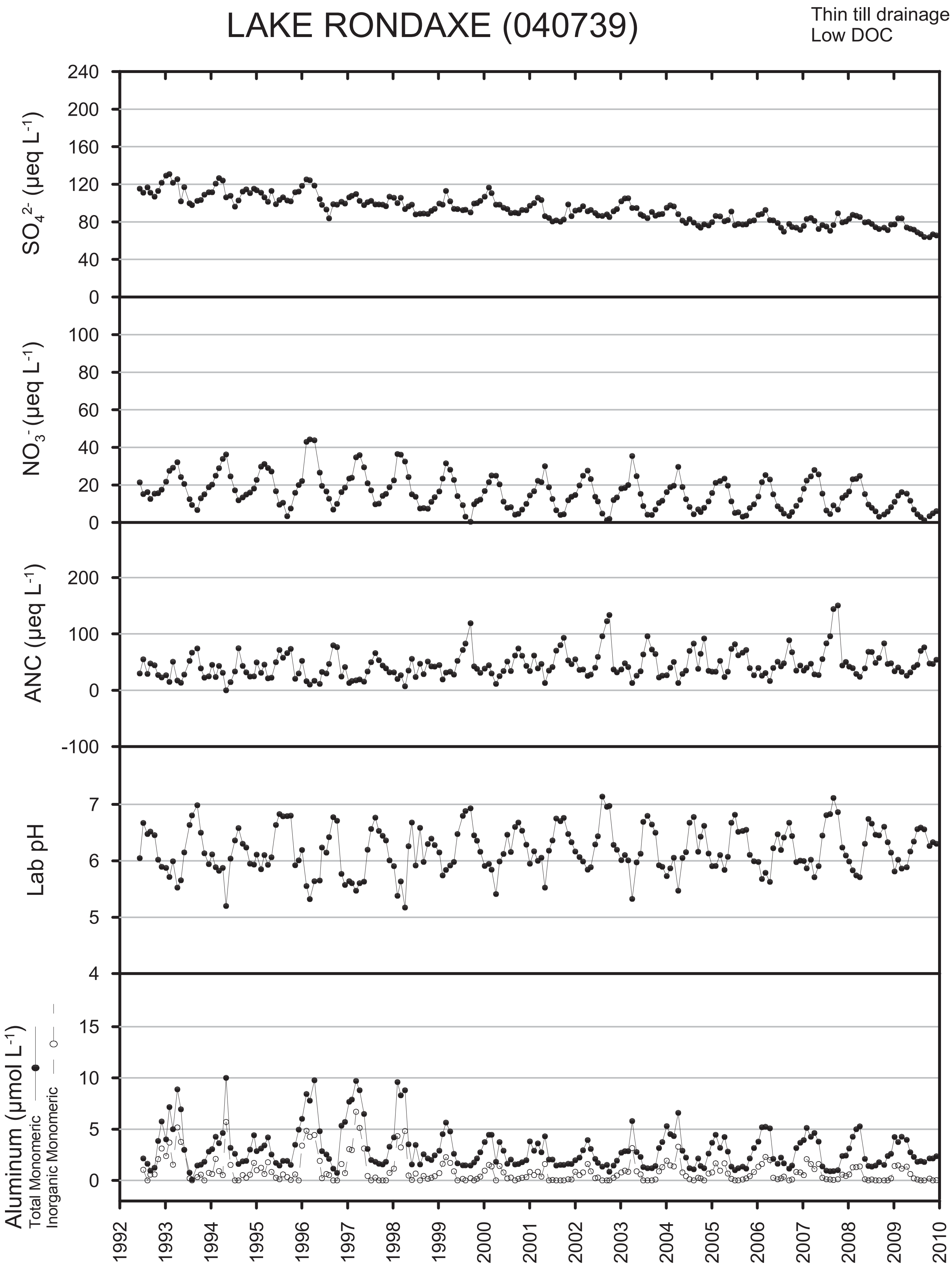
Table 2. Lake Characteristics

Parameter	Value
Elevation	524 m
Maximum depth	10.1 m
Mean depth	3.0 m
Volume	273.3 x 10^4 m^3
Surface area	90.5 ha
Watershed area	14,155.6 ha
Watershed ratio	0.01
Hydraulic retention time (year)	0.03
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Eagle Bay
Land use classification	Private and Pigeon Lake Wilderness and Fulton Chain Wild Forest

Table 3. Netting History

Date		Number	Length	Length	Weight	Total
Month-Year	Species	Measured	Min (mm)	Max (mm)	Grams	Number
October-00	Brook trout	1	490	490	1231	1
October-00	Golden shiner	35	80	175	304	35
October-00	Common shiner	19	37	153	-	19
October-00	Creek chub	8	101	246	611	8
October-00	White sucker	37	159	435	8700	103
October-00	Brown bullhead	38	96	250	2382	73
October-00	Banded killifish	1	87	87	4	1
October-00	Pumpkinseed	3	104	126	73	3
October-00	Smallmouth bass	1	313	313	456	1
October-00	Largemouth bass	3	67	320	529	3
October-00	Yellow perch	44	110	264	198	44
October-86	Atlantic salmon	1	155	155	110	1
October-86	Brook trout	1	185	185	60	1
October-86	Common shiner	5	95	167	857	42
October-86	Creek chub	16	166	205	1020	16
October-86	White sucker	25	175	385	4920	135
October-86	Brown bullhead	25	135	295	2190	25
October-86	Banded killifish	2	43	50	3	2
October-86	Rock bass	6	90	211	575	6
October-86	Pumpkinseed	6	152	175	430	6

Figure 3. Chemistry Time Series



References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1986 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns,D.A., McHale,M.R., Driscoll,C.T., and Roy,K.M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Dittman,J.A. and Driscoll,C.T. 2009. Factors influencing changes in mercury concentrations in lake water and yellow perch (*Perca flavescens*) in Adirondack lakes. Biogeochemistry 93: 179-196.

Dixit,S.S., Cumming,B.F., Birks,H.J.B., Smol,J.P., Kingston,J.C., Uutala,A.J., Charles,D.F., and Camburn,K.E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Driscoll,C.T., Yatsko,C.P., and Unangst,F.J. 1987. Longitudinal and temporal trends in the water chemistry of the North Branch of the Moose River. Biogeochemistry 3: 37-61.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in Summer Chemistry Linked to Productivity in Lakes Recovering from Acid Deposition in the Adirondack Region of New York. Ecosystems 9: 1306-1317.

Newton,R.M., Weintraub,J., and April,R. 1987. The relationship between surface water chemistry and geology in the North Branch of the Moose River. Biogeochemistry 3: 21-35.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of Atmospheric Deposition of Sulfur, Nitrogen, and Mercury on Adirondack Ecosystems. New York State Energy Research and Development Authority No. Final 04-03.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schoch, N., Evers, D., Simonin, H., Glennon, Michale, and Adams, David D. 2004. Long-Term Monitoring and Assessment of Mercury Based on Integrated Sampling Efforts Using the Common Loon, Prey Fish, Water, and Sediment. Report to the New York State Energy Research and Development Authority, Albany, NY.

Schoch, N. and Evers, D. C. 2002. Monitoring Mercury in Common Loons: New York Field Report, 1998-2000. BioDiversity Research Institute No. BRI 2001-01.

Schofield,C.L. and Driscoll,C.T. 1987. Fish species distribution in relation to water quality gradients in the North Branch of the Moose River Basin. Biogeochemistry 3: 63-85.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

This page intentionally left blank.

Moss Lake 040746

Lat. 43° 46’ 52’’ N   Long. 074° 51’ 11’’ W

Lake: Moss Lake lies in the Oswegatchie-Black watershed at 536 m. It has four inlets, one of which drains from Cascade Lake (040747) (Figure 1). The uncontrolled outlet flows into Lake Rondaxe (040739) approximately 2600 m downstream. The lake has a maximum depth of 15.2 m (Figure 2).

Moss Lake is classified as a medium till chain drainage lake, with low dissolved organic carbon. The lake is considered moderately sensitive to acidification. This is one of the original ALS lakes monitored on a monthly basis since June 1982. Spring melt weekly sampling has been ongoing since 2000.

Lake chemistry: Moss Lake was sampled during the ALS on 28 Jul1986 finding: Lab pH 6.80, ANC 72.5 µeq L^{-1}, SO_4^{-2} 132.21 µeq L^{-1}, NO_3^- 4.05 µeq L^{-1}, Ca^{2+} 128.25 µeq L^{-1}, Mg^{2+} 41.97 µeq L^{-1}, DOC 4.6 mgL^{-1}-C (ALSC 1987). Table 1 summarizes recent ALTM chemistry taken at the outlet. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 28 Jul 1986, submergent aquatic plants occupied 10% of the lake bottom. Identified were: Sparganium spp., Potamogeton spp., Scripus spp., Pontederia spp., Eriocaulon spp., Nuphar spp., Nymphaea spp., Utricularia spp. and Lobelia spp. On 23 Sep 1986, emergent and floating plants each occupied 1% of the surface. Submergent vegetation covered 1% of the bottom. A dip-net survey on the same date found the following Insecta: Odonata Coenagriidae, Cordulegastridae, Gomphidae and Aeshnidae; Diptera Chironomidae; and Hemiptera Gerridae. Also found were Crustacea Amphipoda Unspecified; Hirudinea Unspecified; and Demospong Haplosclerina Spongillidae (ALSC 1987).

The lake was thermally stratified between 6 and 8 m on 28 Jul 1986 (ALSC 1987). Bukavecas and Shaw (1998) found phosphorus as the limiting nutrient and chlorophyll a averages of 1.76 µg L^{-1} in 1990 and 1991 (Bukaveckas, P. and Shaw, W. 1998). The AEAP reported an average value of chlorophyll a of 2.84 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: The earliest records show Moss Lake stocked with brook and lake trout in 1898. Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Figure 1. Catchment

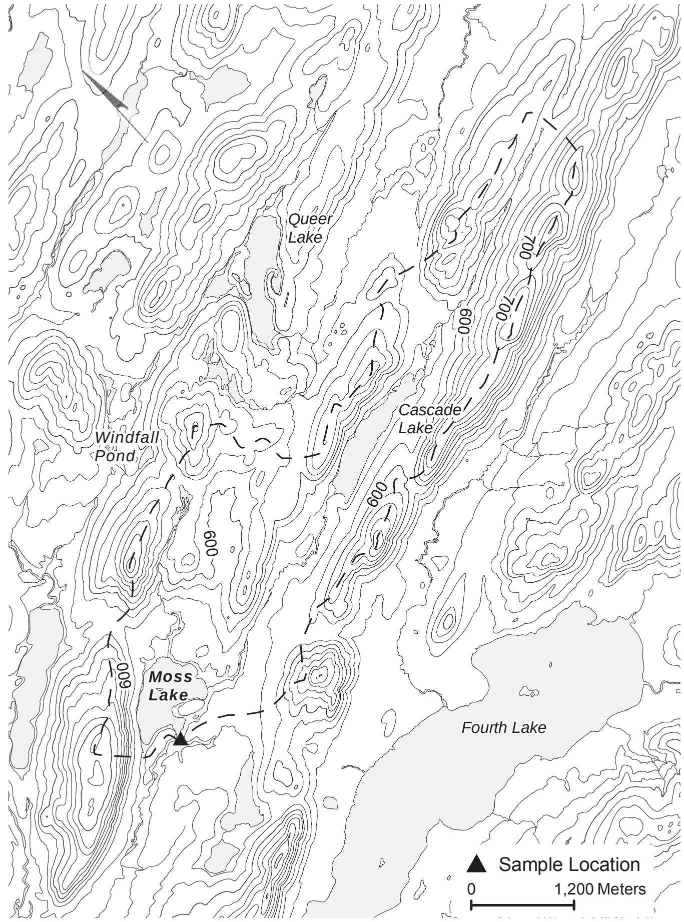
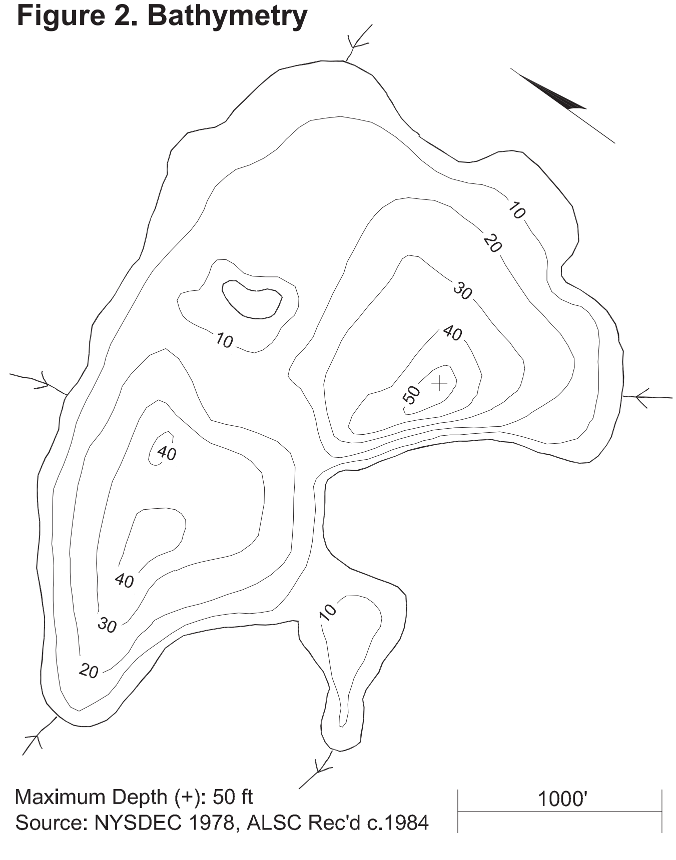


Figure 2. Bathymetry



Intensive studies: The RILWAS and NBMR studied the lake in the early 1980s (Newton, R. M. et al. 1987; Driscoll, C. T. et al. 1987; Schofield, C. L. and Driscoll, C. T. 1987; Driscoll, C. T. and Newton, R. M. 1985). Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Moss Lake was used as a comparison lake in the LAMP study (Heinemann, J. et al. 1985). A phytoplankton and zooplankton experiment was conducted in 1990 (Bukaveckas, P. and Shaw, W. 1998). The AEAP has studied the lake since 1994 (Momen, B., et al. 2006). During 1986 and 1987 snowmelt, Schaefer and Driscoll (1993) evaluated episodic acidification at the outlet. Moss Lake was studied by the Mercury Response Project to evaluate mercury in fish. The lake was sampled on 6 Oct 1992 and 27 Sep 2006 (Dittman, J. A. and Driscoll, C. T. 2009). Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995). NBMR evaluated the recovery of fisheries in this water in 2000 (Raynal, D. J. et al. 2004). Common loons were surveyed for mercury content in 1998 - 2000 (Schoch, N. and Evers, D. C. 2002) and again in 2003 - 2004 (Schoch, N. et al. 2004). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: The NBMR study sampled this watershed for soils, mineralogy and chemistry of surficial materials (Newton, R. M., Weintraub, J., and April, R. 1987). General soils maps are available for the area (NYSDEC 1992). A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006b; Sullivan, T. J. et al. 2006a).

Deposition: The nearest NADP deposition monitoring site is located in a clearing on the lake's east shore. The nearest NYSDEC wet deposition monitoring site is 15 km southwest at Nick's Lake.

Watershed: The northern area of the watershed is underlain by interlayered metasedimentary rock and granitic gneiss with medium to high ANC. The main body of the watershed (60%), in which Moss Lake lies, is underlain by biotite and/or hornblende granite gneiss with low-to-no ANC. The watershed south of the inlet from Cascade Lake along Moss Lake is undivided metasedimentary rock and related migmatite with medium to high ANC. There is a small band (12%) of charnockite, mangerite, pyroxene-quartz syenite gneiss, with low-to-no ANC, that extends

Table 1. Lake Chemistry

040746			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	106.81	143.03	120.63	69.76	96.03	82.98	µeq L^{-1}
NO_3^-	12.52	39.03	22.37	3.70	23.15	11.50	µeq L^{-1}
Cl^-	9.03	12.97	10.72	9.77	12.99	11.36	µeq L^{-1}
F^-	5.95	7.26	6.40	4.66	6.76	5.94	µeq L^{-1}
ANC	26.72	88.42	62.10	41.48	107.13	82.21	µeq L^{-1}
DIC	72.43	207.31	121.55	94.91	171.51	124.59	µmol L^{-1}-C
DOC	216.30	446.09	297.78	278.19	391.30	315.41	µmol L^{-1}-C
SiO_2	88.04	147.29	119.23	81.72	140.80	105.90	µmol L^{-1}
Ca^{2+}	111.78	177.16	141.60	88.33	134.17	121.16	µeq L^{-1}
Mg^{2+}	32.92	50.20	43.41	25.51	42.96	38.44	µeq L^{-1}
Na^+	27.40	44.80	35.12	26.53	43.06	37.46	µeq L^{-1}
K^+	5.88	11.25	9.74	5.88	8.72	7.97	µeq L^{-1}
NH_4^+	0.00	2.61	1.16	-0.52	1.55	0.28	µeq L^{-1}
AL_TD	1.07	10.45	5.21	0.94	6.67	3.30	µmol L^{-1}
AL_TM	0.69	7.47	2.87	1.46	3.93	2.26	µmol L^{-1}
AL_OM	0.48	3.91	1.80	1.64	3.34	2.15	µmol L^{-1}
AL_IM	0.19	3.56	1.07	0.00	1.07	0.20	µmol L^{-1}
LABPH	5.61	6.82	6.22	5.95	6.88	6.39	
AIREQPH	6.03	7.19	6.59	6.54	7.16	6.89	
TRUECOLOR	10	30	20	25	35	30	Pt Co
SCONDUCT	23.65	30.13	26.80	18.38	25.77	23.55	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	536 m
Maximum depth	15.2 m
Mean depth	5.7 m
Volume	259.8 x 10^4 m^3
Surface area	45.7 ha
Watershed area	1234.6 ha
Watershed ratio	0.04
Hydraulic retention time (year)	0.28
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Eagle Bay
Land use classification	Fulton Chain Wild Forest and Pigeon Lake Wilderness

Figure 3. Chemistry Time Series

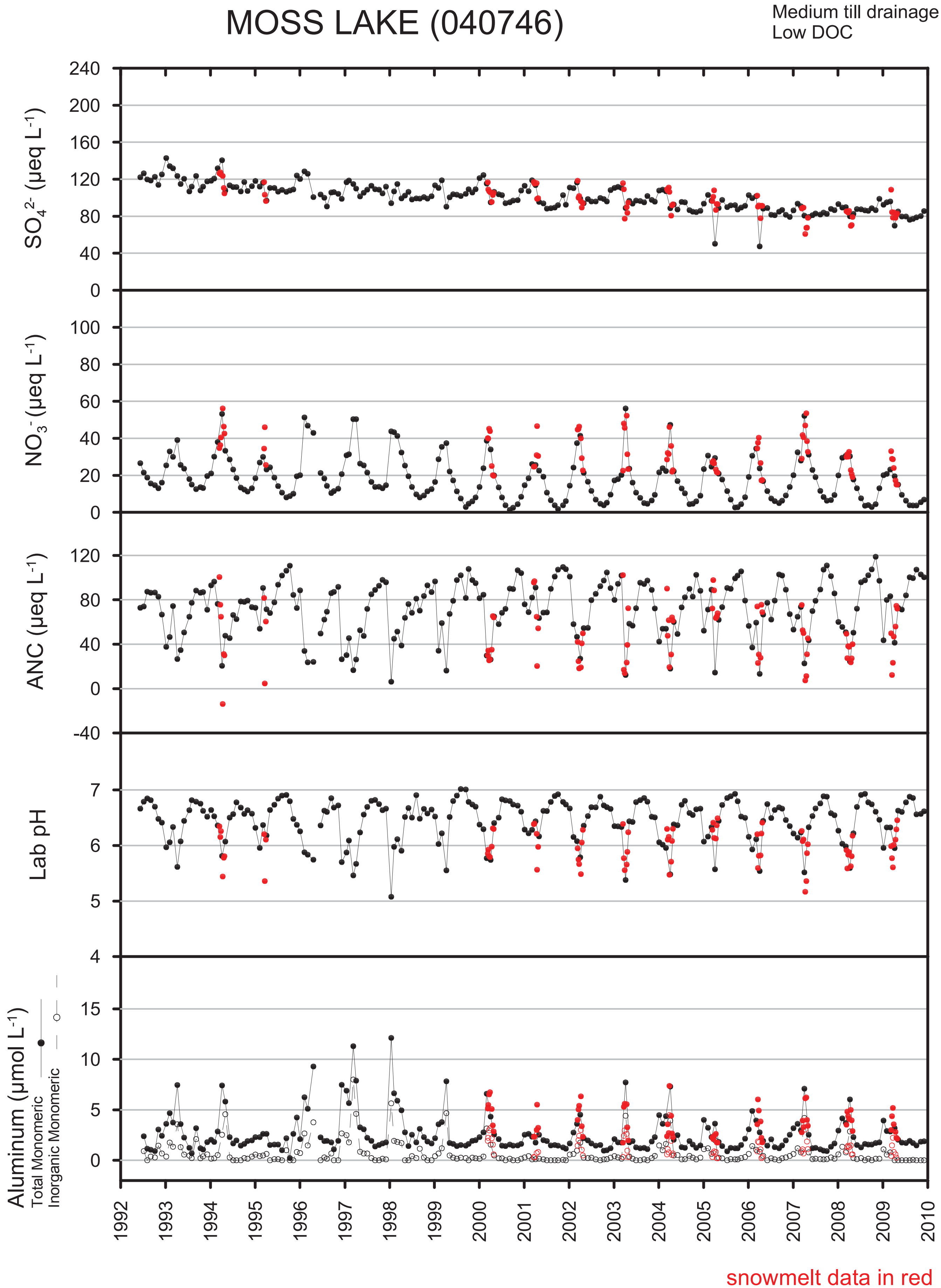


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1986	Lake trout	6000	14
1986	Brook trout	2500	82
1987	Brook trout	33500	105
1988	Brook trout	5000	8
1989	Lake trout	3700	99
1990	Lake trout	1000	45
1992	Brook trout	4000	143
1993	Lake trout	3000	294
1994	Brook trout	7500	379
1995	Lake trout	2000	421
1998	Lake trout	2000	52

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
August-00	Brook trout	3	266	330	1030	3
August-00	Lake trout	1	625	625	2600	1
August-00	Central mudminnow	1	89	89	8	1
August-00	Golden shiner	25	85	109	215	30
August-00	Common shiner	29	28	150	188	101
August-00	Creek chub	35	54	110	206	82
August-00	White sucker	26	200	450	9396	47
August-00	Brown bullhead	10	75	233	466	10
August-00	Pumpkinseed	39	21	115	-	40
August-00	Largemouth bass	5	84	93	41	5
August-00	Yellow perch	73	105	284	-	73
September-86	Brook trout	12	176	335	1565	12
September-86	Central mudminnow	1	96	96	9	1
September-86	Golden shiner	1	97	97	10	3
September-86	Common shiner	22	86	162	659	22
September-86	White sucker	25	177	456	7325	85
September-86	Brown bullhead	12	113	228	1100	12
September-86	Pumpkinseed	1	129	129	40	1
September-86	Yellow perch	25	142	235	1350	329

the length of the southern boundary of the watershed (Roy, K. M. et al. 1997). The watershed is composed of 66% till; 23.0% outwash sand and gravel, 0.7% kame deposits, with 10.3% exposed bedrock (ALSC 2003). Glacial tills comprise the low lying areas surrounding Moss Lake. Basal tills occur in the wetland areas draining Cascade Lake and the wetlands of an unnamed pond to the north. Rock outcrops and shallow (<50 cm) soils occur above 600 m. The highest elevation in the watershed is 740 m at Cascade Mountain. The watershed has a maximum relief of 204 m. In 1986, the ALS found the shoal water substrate comprised of 74% sand and gravel, 25% bedrock/rubble/boulder, and 1% muck/silt (ALSC 1987).

Land cover/use: In 1986, deciduous-coniferous mixed forest covered 80% of the watershed, and the remaining cover was 17% deciduous forest and 3% shrub/sapling/wetland. The immediate shoreline vegetation was primarily deciduous-coniferous mixed forest (78%) with shrub/sapling (10%) and a small area of wetland (1%) near an inlet (ALSC 1987). Wetland area totals 117.8 ha and comprised 9.5% of the watershed (Roy, K. M. et al. 1996) The predominant wetland types are forested needle-leaf evergreen (5%) and scrub/shrub broad-leaf deciduous (3.5%). A portion of these wetlands (29.8 ha) are associated with Cascade Lake. Virgin forest comprises 27.5% of the watershed and is located on the eastern half of Cascade Lake's watershed (ALSC 2003). The pond and southern watershed lie in the Fulton Chain Wild Forest. The watershed north of the Big Moose Road lies in the Pigeon Lake Wilderness. A trail exists around the lake, and numerous primitive campsites exist along the shore. There is a wooden foot bridge across the outlet and the pond is wheelchair accessible.

Watershed disturbance: The 1916 fire protection source data show 93.7% of the watershed as green timber with no slash. In 1950, the watershed was moderately impacted by a November storm that caused 50 to 100% blowdown in 13.2% of the watershed and 25 to 50% blowdown in 3.5% of the watershed. A July 1995 micro-burst storm moderately damaged 93.2% of the area with 0-30% change in tree crowns, and more heavily damaged 6.8% of the area with 30 - 60% change in tree crowns (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

ALSC 1987. Adirondack Lakes Survey 1986 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Bukaveckas,P. and Shaw,W. 1998. Phytoplankton responses to nutrient and grazer manipulations among northeastern lakes of varying pH. Canadian Journal of Fisheries and Aquatic Sciences 55: 958-966.

Dittman,J.A. and Driscoll,C.T. 2009. Factors influencing changes in mercury concentrations in lake water and yellow perch (*Perca flavescens*) in Adirondack lakes. Biogeochemistry 93: 179-196.

Dixit,S.S., Cumming,B.F., Birks,H.J.B., Smol,J.P., Kingston,J.C., Uutala,A.J., Charles,D.F., and Camburn,K.E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack Lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Driscoll,C.T., Yatsko,C.P., and Unangst,F.J. 1987. Longitudinal and temporal trends in the water chemistry of the North Branch of the Moose River. Biogeochemistry 3: 37-61.

Heinemann, J., Gloss, S., Schofield, C., Whitehead, D., Bukaveckas, P., DePinto, J., Young, T., Driscoll, C., and Staubitz, W. 1985. Lake Acidification Mitigation Project (LAMP). Electric Power Research Institute No. 1397-03-85-CR Volume I.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology 41: 5191-5197.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in Summer Chemistry Linked to Productivity in Lakes Recovering from Acid Deposition in the Adirondack Region of New York. Ecosystems 9: 1306-1317.

New York State Department of Environmental Conservation 1992. Pigeon Lake Wilderness Area Unit Management Plan, Ray Brook, NY.

Newton,R.M., Weintraub,J., and April,R. 1987. The relationship between surface water chemistry and geology in the North Branch of the Moose River. Biogeochemistry 3: 21-35.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of Atmospheric Deposition of Sulfur, Nitrogen, and Mercury on Adirondack Ecosystems. New York State Energy Research and Development Authority No. Final 04-03.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schaefer,D.A. and Driscoll,C.T. 1993. Identifying sources of snowmelt acidification with a watershed mixing model. Water, Air, and Soil Pollution 67: 345-365.

Schoch, N., Evers, D., Simonin, H., Glennon, Michale, and Adams, David 2004. Long-Term Monitoring and Assessment of Mercury Based on Integrated Sampling Efforts Using the Common Loon, Prey Fish, Water, and Sediment. Report to New York State Energy Research and Development Authority, Albany, NY.

Schoch, N. and Evers, D. C. 2002. Monitoring Mercury in Common Loons: New York Field Report, 1998-2000. BioDiversity Research Institute No. BRI 2001-01, Falmouth, ME.

Schofield,C.L. and Driscoll,C.T. 1987. Fish species distribution in relation to water quality gradients in the North Branch of the Moose River Basin. Biogeochemistry 3: 63-85.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Cascade Lake 040747 & Cascade Lake Stream 040747A

Lat. 43° 47’ 21’’ N Long. 074° 48’ 46’’ W

Lake: Cascade Lake lies in the Oswegatchie-Black watershed at 557m. This 40.4 ha headwater lake has one inlet. It drains through an unnamed 3.4 ha pond approximately 300 m downstream, and continues for another 2 km into Moss Lake (040746) and ultimately into the North Branch of the Moose River (Figure 1). In 1984, an active beaver dam was noted at the outlet (ALSC 1985). The lake reaches a maximum depth of 6.1 m (Figure 2).

Cascade Lake (040747) is classified as a medium till chain drainage lake, with low dissolved organic carbon. The lake is considered moderately sensitive to acidification. Cascade Lake Stream (Station 1, 040747A) is one of 17 original ALTM sites monitored on a monthly basis since June 1982. The sampling site is about 2 km downstream from the outlet of the lake, near Big Moose Road. Sampling at the upstream Cascade Lake site (Station 1, 040747) has been ongoing since June 1993.

Lake chemistry: Cascade Lake (040747) was sampled during the ALS on 09 Aug 1984 finding: Lab pH 6.70, ANC 54.7 µeq L^{-1}, SO_4^{2-} 128.67 µeq L^{-1}, NO_3^- 3.72 µeq L^{-1}, Ca^{2+} 126.25 µeq L^{-1}, Mg^{2+} 40.32 µeq L^{-1}, DOC 2.5 mg L^{-1} -C (ALSC 1985). Table 1 summarizes recent ALTM chemistry taken at Cascade Lake Stream. Monthly plots of the major analytes are shown in Figure 3.

Aquatic Biota: During the summers of 1983 and 1984, the Adirondack Biota Project found average lake chlorophyll a values of 2.20 and 1.96 µg L^{-1} respectively. Average total phosphorus values were 5 and 6 µg L^{-1}; and Secchi depths were 5.5 and 4.3 m. During May, July, and November 1984, the phytoplankton community was dominated by Dinobryon bavaricum, Merismopedia tenuissima, and Cyclotella glomerata respectively. Kellicottia longispina was the dominant rotifer in May and November, but in July Conochilus hippocrepis was most prominent. Diaptomus minutus was the dominant crustacean zooplankton during all three months (Sutherland, J. W. 1989). In 2003, the average lake chlorophyll a was 1.28 µg L^{-1} (Momen, B. et al. 2006).

On 11 Jun 1984, the ALS macrophyte survey of the lake found Utricularia spp. A dip-net survey on that day identified Crustacea Decapoda Astacidae (ALSC 1985).

Figure 1. Catchment

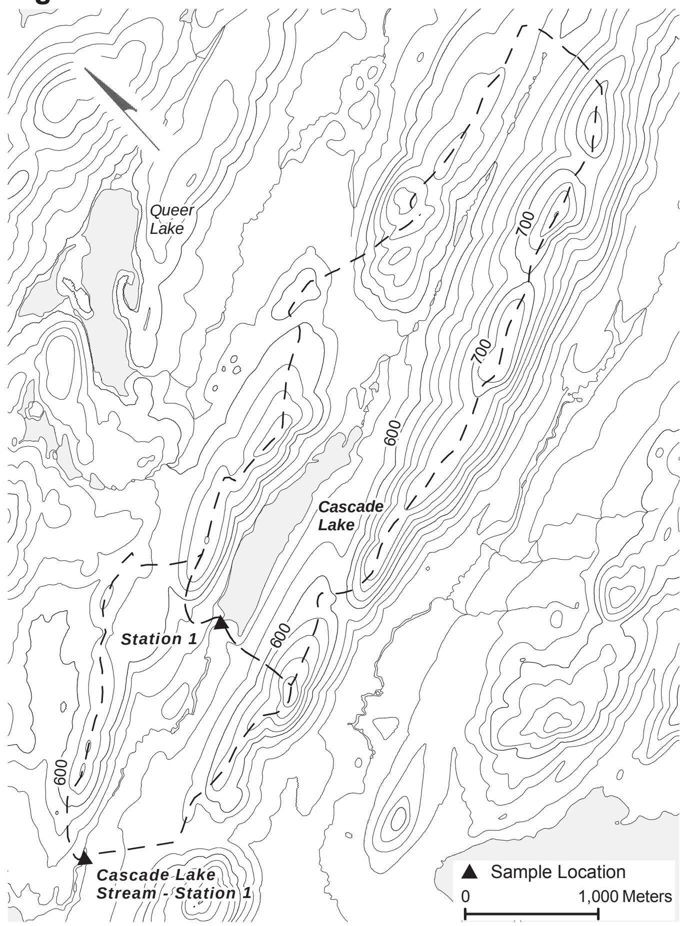
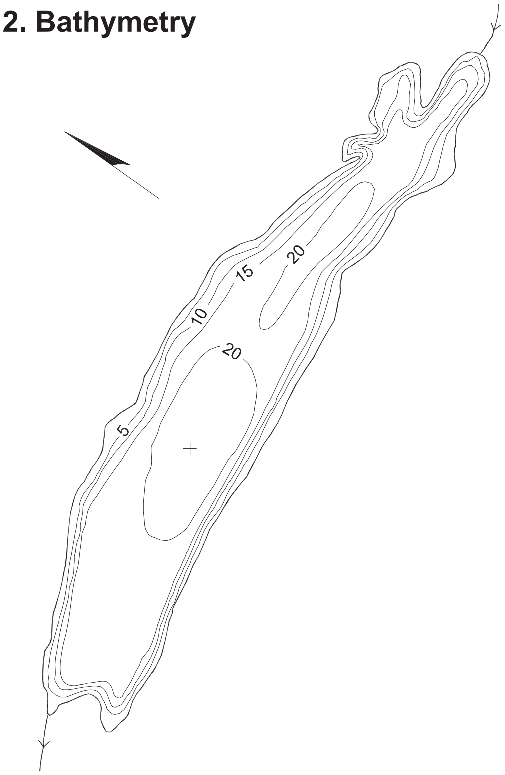


Figure 2. Bathymetry



Maximum Depth (+): 20 ft
Source: ALSC 1984

1500'

Fisheries: The NYSDEC stocked brook trout in the lake from 1964-1979 (ALSC 1985). The ALTM surveyed the lake. Refer to Table 3 for netting history.

Intensive studies: Cascade Lake was surveyed during 1982-1984 as part of the DEC Biota Project (Sutherland, J. W. 89). The RILWAS and NBMR studied the Cascade Lake and Cascade Lake Stream in the early 1980s (Newton, R. M. et al. 1987; Driscoll, C. T. et al. 1987; Schofield, C. L. and Driscoll, C. T. 1987; Driscoll, C. T. and Newton, R. M. 1985). During 1986 and 1987 snowmelt, Schaefer and Driscoll (1993) evaluated episodic acidification at the outlet. NBMR evaluated the recovery of fisheries in this water in 2000 (Raynal, D. J. et al. 2004). The lake has been studied by the AEAP since 1994 (Momen, B. et al. 2006). Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995).

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006b; Sullivan, T. J. et al. 2006a). The NBMR study sampled nine sites within this watershed for soils, mineralogy and chemistry of surficial materials (Newton, R. M. et al. 1987).

Deposition: The nearest NADP deposition monitoring site is 3 km west at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 18 km southwest at Nick's Lake.

Watershed: The Cascade Lake Stream watershed lies predominately (65%) on biotite and/or hornblende granite gneiss with low to no ANC. Smaller areas of interlayered metasedimentary rock and granitic gneiss (1%) and undivided metasedimentary rock and related migmatite (14%), both with medium to high ANC, are found in the northern and southwestern portions respectively. Charnockite, magerite, and pyroxene-quartz syenite gneiss, with no to low ANC, compose approximately 20% of the watershed along the southern boundary (Roy, K. M. et al. 1997). Till comprises 78% of the watershed while 12% of the watershed is exposed bedrock found at elevations above 600 m in the southeast. The remaining 10% is classified as outwash sand and gravel and

Table 1. Lake/ Stream Chemistry (Station 1)

040747A			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	106.60	132.21	121.19	74.73	101.28	83.85	μeq L^{-1}
NO_3^-	15.29	46.29	25.86	6.70	27.85	14.55	μeq L^{-1}
Cl^-	7.62	10.72	9.26	6.78	12.46	8.93	μeq L^{-1}
F^-	5.53	8.84	6.58	4.53	6.95	5.68	μeq L^{-1}
ANC	8.69	184.64	87.62	48.15	125.91	87.23	μeq L^{-1}
DIC	73.27	210.64	139.80	85.75	161.52	124.00	μmol L^{-1} -C
DOC	230.20	530.51	290.27	230.75	359.08	313.33	μmol L^{-1} -C
SiO_2	75.56	167.10	132.64	96.59	148.79	111.82	μmol L^{-1}
Ca^{2+}	118.77	208.10	157.86	101.30	141.72	122.65	μeq L^{-1}
Mg^{2+}	32.92	68.30	49.51	30.45	46.23	39.25	μeq L^{-1}
Na^+	24.36	53.94	39.95	26.53	49.15	38.36	μeq L^{-1}
K^+	8.70	11.77	10.25	5.37	9.46	7.67	μeq L^{-1}
NH_4^+	0.00	2.00	0.79	-0.50	1.12	0.25	μeq L^{-1}
AL_TD	1.74	10.34	5.30	1.56	7.97	4.27	μmol L^{-1}
AL_TM	0.96	7.10	2.84	1.82	3.41	2.34	μmol L^{-1}
AL_OM	0.84	7.78	2.83	1.82	2.82	2.20	μmol L^{-1}
AL_IM	0.00	3.14	0.48	0.00	0.59	0.17	μmol L^{-1}
LABPH	5.71	7.14	6.30	6.05	6.80	6.43	
AIREQPH	5.81	7.41	6.59	6.58	7.26	6.95	
TRUECOLOR	15	45	22	25.00	45	32	Pt Co
SCONDUCT	23.65	35.88	29.17	19.70	27.66	23.90	μS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	557 m
Maximum depth	6.1 m
Mean depth	4.2 m
Volume	171.9 x 10^4 m^3
Surface area	40.4 m
Watershed area	498.8 ha
Watershed ratio	0.08
Hydraulic retention time (year)	0.46
Watershed	Oswegatchie/ Black
County, Town	Herkimer, Inlet
USGS Quadrangle	Eagle Bay
Land use classification	Pigeon Lake Wilderness

Figure 3. Chemistry Time Series / Station 1

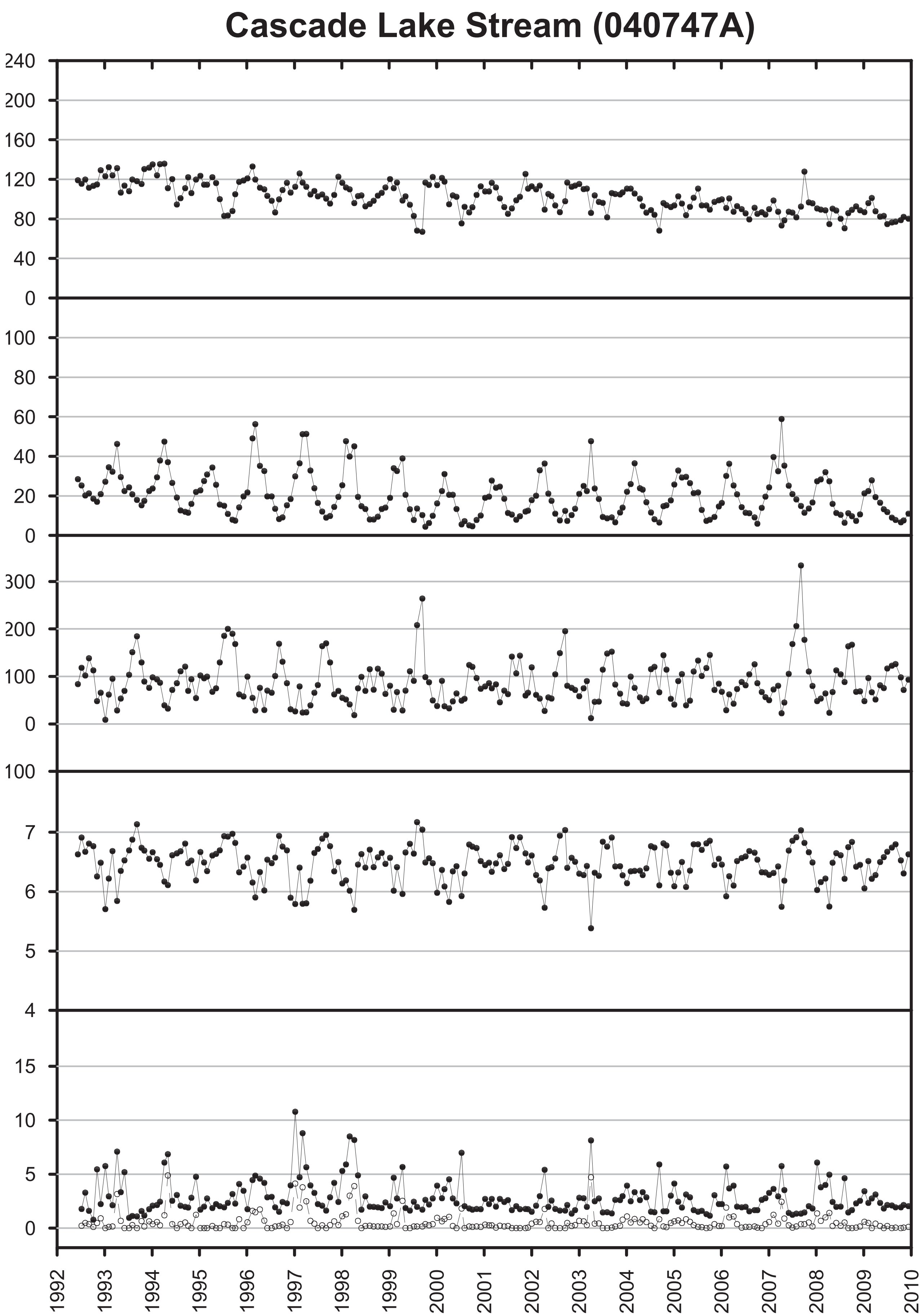


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-99	Brook trout	3	200	319	562	3
June-99	Golden shiner	28	80	125	243	52
June-99	Common shiner	33	90	142	373	136
June-99	Creek chub	8	90	192	195	8
June-99	White sucker	25	190	463	11819	56
June-99	Brown bullhead	9	180	218	717	9
June-99	Pumpkinseed	10	57	134	228	10
June-99	Yellow perch	31	80	270	1855	231
June-84	Brook trout	5	133	287	572	5
June-84	White sucker	68	-	-	13250	68
June-84	Brown bullhead	9	-	-	750	9
June-84	Yellow perch	135	-	-	6210	135

contains a majority of the outlet stream. Basal tills are found along the southern shoreline and areas to the northeast along the inlet stream (APA 2001). Cascade Mountain, at 762 m, is the highest elevation in the watershed. The watershed has a maximum relief of 205 m. In 1984, the ALS found the shoal water substrate around the lake comprised of 80% rubble and gravel; 15% sand; 3% muck/silt and 2% boulders (ALSC 1985).

Land cover/use: In 1984, the ALS described the watershed as: 60% deciduous forest and 40% coniferous forest (ALSC 1985). Virgin forest stands dominate the eastern portion of the watershed (ALSC 2003). The immediate shoreline is primarily a deciduous-coniferous forest mix (90%) with some shrub/sapling areas (10%) (ALSC 1985). Total wetland area is 29.8 ha and comprises 6.0% of the watershed (Roy, K. M. et al. 1996). The predominant wetland types are forested needle-leaf evergreen and scrub/shrub broad-leaf deciduous covering 2.7% and 2.1% of the watershed, respectively. These wetlands occur primarily along the inlet stream. The lake and its watershed lie in the Pigeon Lake Wilderness. A trail goes around the lake and there are a number of primitive campsites on the shoreline.

Watershed disturbance: The 1916 fire protection source data show 92.1% of the Cascade Lake watershed as virgin and second growth green timber with no slash. The watershed was moderately impacted by the November 1950 storm as 19.5% of the watershed incurred 50-100% blowdown, while 8.7% of the watershed incurred 25-50% blowdown. The July 1995 microburst storm also caused moderate forest damage that impacted 98.5% of the watershed with 0 to 30% change in tree crowns. The remaining 1.5% incurred 30-60% change in tree crowns (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack Lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Driscoll,C.T., Yatsko,C.P., and Unangst,F.J. 1987. Longitudinal and temporal trends in the water chemistry of the North Branch of the Moose River. Biogeochemistry 3: 37-61.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in Summer Chemistry Linked to Productivity in Lakes Recovering from Acid Deposition in the Adirondack Region of New York. Ecosystems 9: 1306-1317.

Newton,R.M., Weintraub,J., and April,R. 1987. The relationship between surface water chemistry and geology in the North Branch of the Moose River. Biogeochemistry 3: 21-35.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of Atmospheric Deposition of Sulfur, Nitrogen, and Mercury on Adirondack Ecosystems. New York State Energy Research and Development Authority No. Final 04-03.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Final Report to EPA, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. U.S. Environmental Protection Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schaefer,D.A. and Driscoll,C.T. 1993. Identifying sources of snowmelt acidification with a watershed mixing model. Water, Air, and Soil Pollution 67: 345-365.

Schofield,C.L. and Driscoll,C.T. 1987. Fish species distribution in relation to water quality gradients in the North Branch of the Moose River Basin. Biogeochemistry 3: 63-85.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Sutherland, J. W. 1989. Field Surveys of the Biota and Selected Water Chemistry Parameters in 50 Adirondack Mountain Lakes. New York State Department of Environmental Conservation Final Report, Albany, NY.

Bubb Lake & Bubb Lake Stream 040748

Lat. 43° 46’ 29’’ N Long. 074° 50’ 49’’ W

Lake: Bubb Lake lies in the Oswegatchie-Black watershed at 554 m. This 18.2 ha lake has two inlets on the western shore. The primary inlet originates from Sis Lake (040749), while the secondary inlet is intermittent (ALSC 1987). The lake drains north into the North Branch of the Moose River approximately 4 km downstream (Figure 1). In 1986, an active beaver dam was noted at the outlet (ALSC 1987). Bubb Lake reaches a maximum depth of 4.3 m (Figure 2).

Bubb Lake is a thin till chain drainage lake, with low dissolved organic carbon. It is considered sensitive to acidification. The Bubb Lake Stream site (Station 1) is one of the 17 original ALTM sample sites and has been monitored monthly since June 1982. Station 1 is 1100 m downstream from the lake, immediately upstream of the confluence with the outlet of Moss Lake (040746). The ALTM began collecting a monthly sample at the outlet of the lake (Station 2) in June 1993 (Figure 1). Since March 2002, Station 2 has been monitored on a weekly basis during snowmelt.

Lake chemistry: Bubb Lake was sampled during the ALS on 28 Jul 1986 finding: pH 6.59, ANC 53.8 µeq L^{-1}, SO_4^{2-} 109.51 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 85.83 µeq L^{-1}, Mg^{2+} 33.74 µeq L^{-1}, DOC 3.8 mg L^{-1}-C (ALSC 1987). Table 1 summarizes recent ALTM chemistry taken at the Bubb Lake Stream site. Monthly plots of the major analytes collected at Station 1 are shown in Figure 3. Plots of the major analytes collected at Station 2 including weekly snowmelt (red) are shown in Figure 4.

Aquatic biota: On 20 May 1986, the ALS macrophyte survey found: Sparganium spp., Dulichium spp., Carex spp. Eriocaulon spp. and Lobelia spp. On the same day a dip-net survey identified the following Insecta: Ephemeroptera Ephemerellidae; Odonata Coenagriidae and Aeshnidae; Trichoptera Limnephilidae; Diptera Chironomidae; Hemiptera Corixidae; and Coleoptera Helodidae and Chrysomelidae. Also found were Crustacea Decapoda Astacidae and Branchiob Unspecified. A second macrophyte survey on 28 Jul 1986 identified the following species: Sparganium spp., Sagittaria spp., Dulichium spp, Carex spp., Eriocaulon spp., Pontederia spp., Nymphaea spp. and Brasenia spp. The ALS found the lake isothermal on 28 Jul 1986 (ALSC 1987).

Figure 1. Catchment

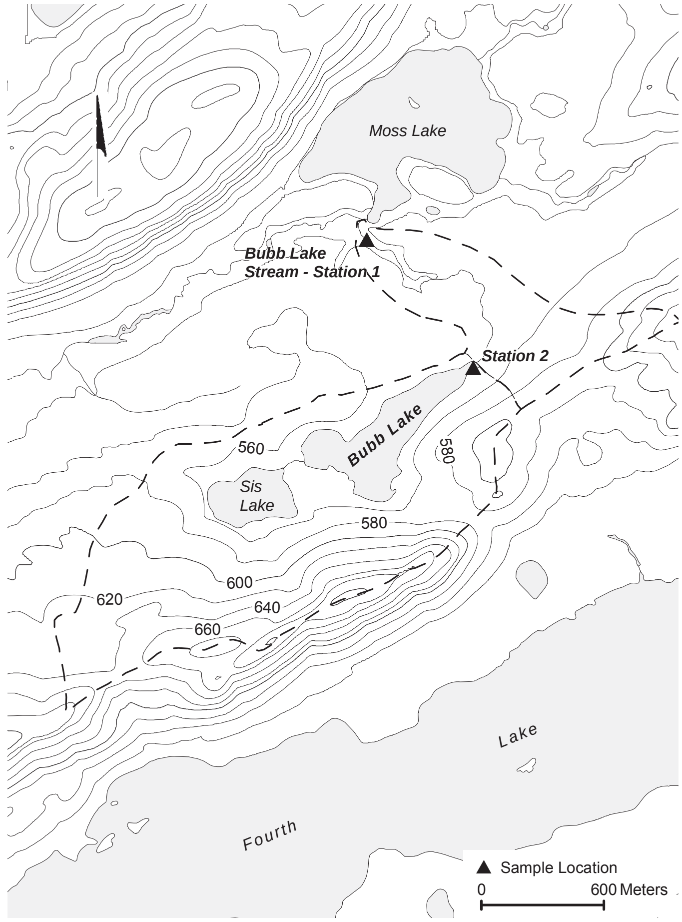
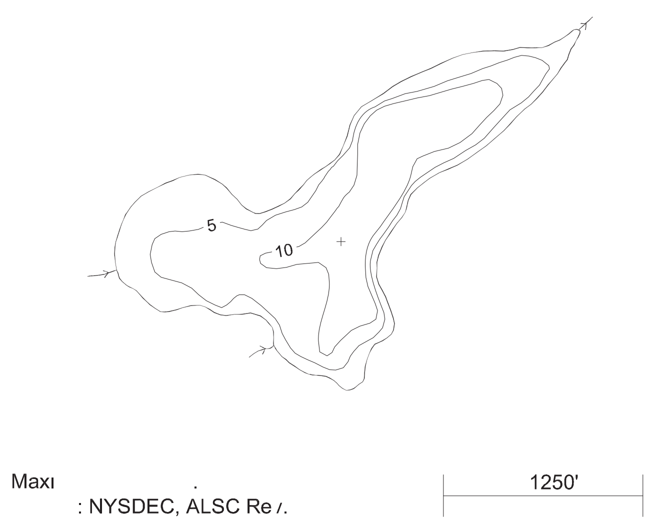


Figure 2. Bathymetry



Fisheries: NYSDEC stocked brook trout in the lake from 1934 to 1986 (ALSC 1987). The NYSDEC treated the lake with rotenone in 1983 and in 2000 (ALSC 2003). The fish barrier dam was rebuilt on the lake outlet in 1999 (Bath, D. W. 2003). Refer to Tables 3 and 4 for recent stocking and netting histories.

Intensive studies: Bubb Lake was sampled during the RILWAS and NBMR studies in the early 1980s (Newton, R. M. et al. 1987; Driscoll, C. T. et al. 1987; Schofield, C. L. and Driscoll, C. T. 1987; Driscoll, C. T. and Newton, R. M. 1985). Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995). This area was a study watershed for the Adirondack/Catskill comparison conducted from 1992 through 2001 (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005). NBMR evaluated the recovery of fisheries in Bubb Lake in 2000 (Raynal, D. J. et al. 2004).

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b). The NBMR study sampled this watershed for soils, mineralogy, and chemistry of surficial materials (Newton, R. M. et al. 1987).

Deposition: The nearest NADP deposition monitoring site is 2 km north at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 15 km southwest at Nick's Lake.

Watershed: The Bubb Lake Stream watershed is primarily (88%) underlain by charnockite, mangerite, pyroxene-quartz syenite gneiss with low to no ANC (Roy, K. M. et al. 1997). Till comprises 74 % of the watershed while outwash sand and gravel covers 4.5% in the area immediately upstream of Station 1. The remaining 21% is exposed bedrock found above 600 m in the southern portion of the watershed above the headwater Sis Lake (APA

Table 1. Lake/Stream Chemistry (Station 1)

040748			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	86.61	119.92	105.64	72.12	82.93	76.50	µeq L^{-1}
NO_3^-	1.15	34.68	13.79	1.18	18.08	7.74	µeq L^{-1}
Cl^-	6.21	8.74	7.83	6.39	8.64	7.27	µeq L^{-1}
F^-	3.21	5.58	4.58	3.28	4.63	3.96	µeq L^{-1}
ANC	15.48	51.17	34.23	34.77	54.55	45.20	µeq L^{-1}
DIC	43.29	104.90	71.18	66.60	83.26	76.21	µmol L^{-1} -C
DOC	193.15	406.96	261.64	242.52	355.09	281.61	µmol L^{-1} -C
SiO_2	30.12	101.36	67.64	38.61	72.90	53.83	µmol L^{-1}
Ca^{2+}	89.33	124.76	101.39	77.49	90.82	84.10	µeq L^{-1}
Mg^{2+}	26.33	41.14	35.52	27.16	31.06	29.46	µeq L^{-1}
Na^+	20.01	33.93	29.72	26.53	33.06	30.89	µeq L^{-1}
K^+	5.63	10.23	8.80	6.65	8.70	7.54	µeq L^{-1}
NH_4^+	-0.44	3.27	1.06	-0.64	3.05	0.42	µeq L^{-1}
AL_TD	1.45	6.93	3.95	0.91	8.34	3.08	µmol L^{-1}
AL_TM	0.84	3.59	2.08	1.56	2.74	2.02	µmol L^{-1}
AL_OM	0.73	2.15	1.34	1.63	2.26	1.95	µmol L^{-1}
AL_IM	0.04	1.48	0.74	0.00	0.67	0.14	µmol L^{-1}
LABPH	5.70	6.52	6.13	6.13	6.55	6.34	
AIREQPH	5.87	6.81	6.36	6.53	6.90	6.71	
TRUECOLOR	15	40	20	25	30	28	Pt Co

Table 2. Lake Characteristics

Parameter	Value
Elevation	554 m
Maximum depth	4.3 m
Mean depth	2.1 m
Volume	38.5 x 10^4 m^3
Surface area	18.2 ha
Watershed area	199.1 ha
Watershed ratio	0.09
Hydraulic retention time (year)	0.25
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Eagle Bay
Land use classification	Fulton Chain Wild Forest

Figure 3. Chemistry Time Series / Station 1

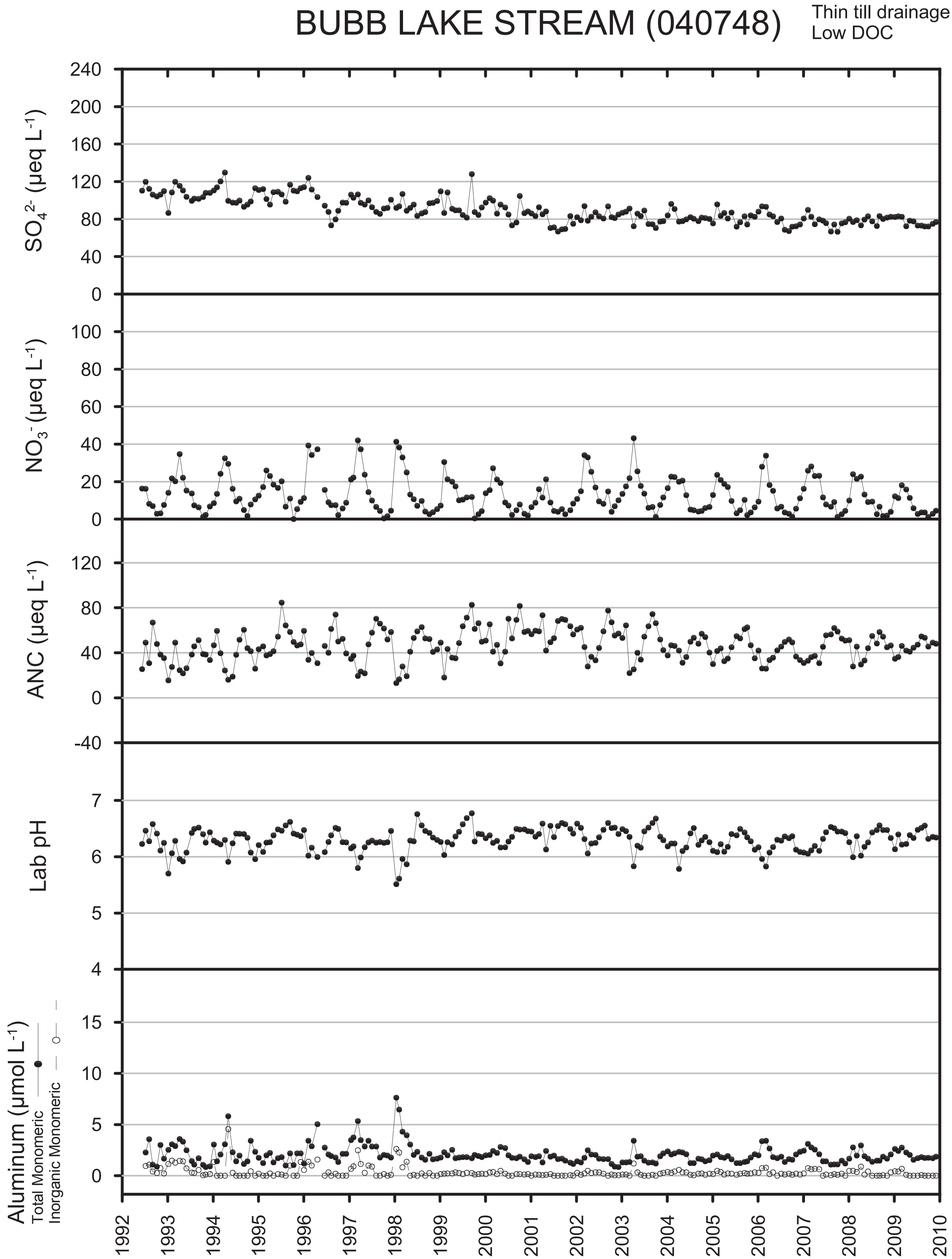


Figure 4. Chemistry Time Series / Station 2

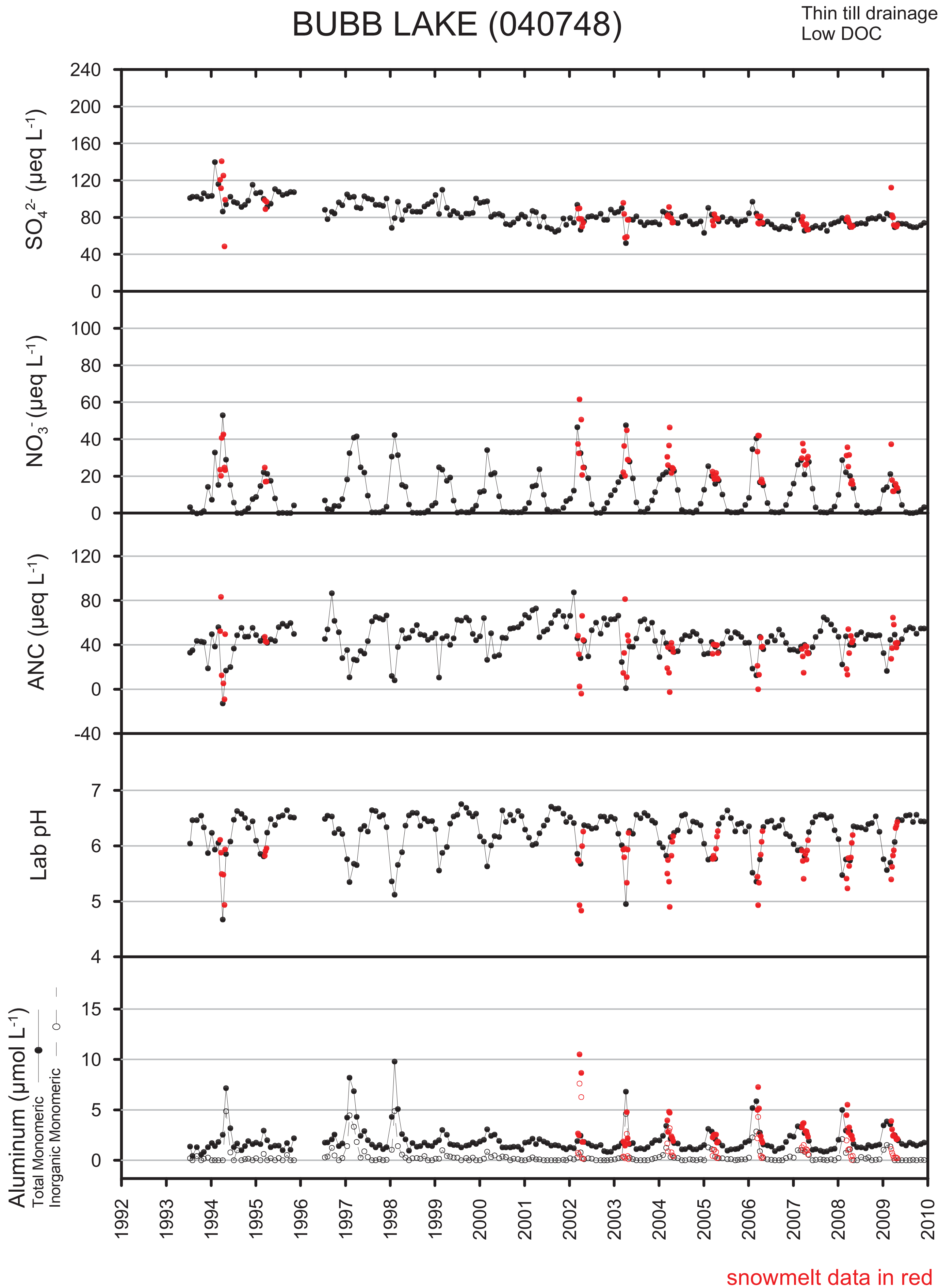


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	2850	34
1981	Brook trout	2160	68
1984	Brook trout	2076	77
1985	Brook trout	2640	59
1986	Brook trout	2400	73
1987	Brook trout	2400	21
1988	Brook trout	2400	26
1989	Brook trout	2640	28
1990	Brook trout	2400	103
1991	Brook trout	2400	35
1992	Brook trout	2400	58
1993	Brook trout	2400	86
1994	Brook trout	1900	63
1995	Brook trout	1860	-
1996	Brook trout	2000	83
1997	Brook trout	2100	87
1998	Brook trout	2100	60
1999	Brook trout	2000	-
2001	Brook trout	2575	-
2002	Brook trout	1800	-
2003	Brook trout	1800	-
2004	Brook trout	800	-
2005	Brook trout	500	18
2006	Brook trout	800	31

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
September-95	Creek chub	27	93	188	472	41
September-95	White sucker	1	445	445	1000	1
September-95	Brown bullhead	37	70	255	2408	435
September-95	Pumpkinseed	26	55	136	454	28
September-95	Yellow perch	30	92	255	2012	83
May-86	Brook trout	25	175	375	6050	41
May-86	Central mudminnow	1	65	65	3	1
May-86	Brown bullhead	33	63	289	1745	68

2001). The highest point in the watershed is an unnamed mountain that rises to 705 m directly south of Sis Lake. The watershed has a maximum relief of 151 m. In 1986, the ALS described the shoal water substrate around the lake as 50% boulder/rubble/bedrock, 10% sand and 40% muck/silt (ALSC 1987).

Land cover/use: In 1986, deciduous-conifer mixed forest covered 85% of the Bubb Lake watershed, deciduous forest 10%, and coniferous forest 5%. The immediate shoreline was characterized as 78% deciduous-conifer mixed forest, 20% coniferous, and 2% wetland (ALSC 1987). Total wetland area is 13.0 ha comprising 6.5% of the watershed (Roy, K. M. et al. 1996). The watershed occurs within the Moose River Plains Wild Forest. A foot trail crosses the outlet of the lake and parallels the northern and western shores.

Watershed disturbance: The 1916 fire protection source data reveal nearly 84% of the Bubb Lake watershed as green timber with no slash, with a small area (3.1%) between Sis and Bubb as burned over with some slash. The November 1950 blowdown affected 92.1% of the watershed with 50-100% change in tree crowns. The July 1995 microburst resulted in 0-30% change in tree crowns over the entire watershed (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survery Corporation (ALSC 1987). Adirondack Lakes Survey 1986 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Bath, D. W. 2003. Long term monitoring pond descriptions. White Paper: Adirondack Lakes Survey Corporation, Ray Brook, NY.

Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns,D.A., McHale,M.R., Driscoll,C.T., and Roy,K.M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Dixit,S.S., Cumming,B.F., Birks,H.J.B., Smol,J.P., Kingston,J.C., Uutala,A.J., Charles,D.F., and Camburn,K.E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack Lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Driscoll,C.T., Yatsko,C.P., and Unangst,F.J. 1987. Longitudinal and temporal trends in the water chemistry of the North Branch of the Moose River. Biogeochemistry 3: 37-61.

Newton,R.M., Weintraub,J., and April,R. 1987. The relationship between surface water chemistry and geology in the North Branch of the Moose River. Biogeochemistry 3: 21-35.

NYS DEC. Icing Zones. 1998. New York State Department of Environmental Conservation, Albany, NY.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of Atmospheric Deposition of Sulfur, Nitrogen, and Mercury on Adirondack Ecosystems. New York State Energy Research and Development Authority No. Final 04-03.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schofield,C.L. and Driscoll,C.T. 1987. Fish species distribution in relation to water quality gradients in the North Branch of the Moose River Basin. Biogeochemistry 3: 63-85.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

This page intentionally left blank.

Dart Lake 040750

Lat. 43° 47' 36'' N   Long. 074° 52' 16'' W

Lake: Dart Lake lies in the Oswegatchie-Black watershed at 537 m. The 51.8 ha lake receives most of its flow from the outlet of Big Moose Lake (040752) and its confluence with the tributaries of Townsend (040751) and Windfall (040750A) ponds. The uncontrolled outlet flows west, becoming the North Branch of Moose River flowing into Lake Rondaxe (040739). Dart Lake reaches a maximum depth of 17.7 m (Figures 1 & 2).

Dart Lake is classified as a thin till chain drainage lake, with low dissolved organic carbon. The lake is considered sensitive to acidification. This is one of the original ALS lakes monitored on a monthly basis since June 1982.

Lake chemistry: Dart Lake was sampled during the ALS on 31 Jul 1986 finding: Lab pH 5.27, ANC 4.8 µeq L^{-1}, SO_4^{2-} 108.26 µeq L^{-1}, NO_3^- 3.07 µeq L^{-1}, Ca^{2+} 92.32 µeq L^{-1}, Mg^{2+} 28.80 µeq L^{-1}, DOC 4.0 mg L^{-1} -C (ALSC 1987). Table 1 summarizes recent ALTM chemistry taken at the outlet. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 31 Jul 1986, the ALS found submergent aquatic plants occupied 5% of the lake bottom and emergent and floating vegetation occupied 5% and 10% of the lake surface, respectively. Identified were: Nuphar spp.; Nymphaea spp.; Nymphoides spp.; Lobelia spp.; Callitriche spp.; Juncus spp.; Dulichium spp.; Equisetum spp.; Eleocharis spp.; Scirpus spp.; Eriocaulon spp.; and several Algae. On 22 Sep 1986, a dip-net survey found the following Insecta: Odonata Coenagriidae; Hemiptera Gerridae; and Megaloptera Sialidae. The ALS found the lake thermally stratified between 8 and 10 m on 31 Jul 1986 (ALSC 1987). Bukavecas and Shaw (1998) found phosphorus as the limiting nutrient and chlorophyll a averaged 0.90 µg L^{-1} during 1990 and 1991. The AEAP reported the average value of chlorophyll a was 1.6 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: There are no records of fish stocking in Dart Lake. Refer to Table 3 for recent netting history.

Intensive studies: The lake was sampled during the RILWAS and NBMR studies in the early 1980s (Newton, R. M. et al. 1987; Driscoll, C. T. et al. 1987; Schofield, C. L. and Driscoll, C. T. 1987; Driscoll, C. T. and Newton, R. M. 1985). Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). During 1985, Dart Lake was used as a comparison lake for the LAMP study on acidification mediation (Heinemann, J. et al. 1985; Driscoll C. T. and Schafran, G. C. 1984) and was evaluated for episodic acidification biweekly from October 1981 - November 1982 to analyze flow-path relationships (Schafran, G. C. and Driscoll, C. T. 1988; Schafran, G. C. and Driscoll, C. T. 1993) and variations in aluminum chemistry (Schafran, G. C. and Driscoll, C. T. 1987). A phytoplankton and zooplankton experiment was conducted in 1990 (Bukaveckas, P. and Shaw, W. 1998). Arbutus Lake and Dart Lake were analyzed in the early 1990s for nitrogen and carbon isotopic compostion in seston and sediment (Owen, J. S. et al. 1999). Dart Lake was a study watershed for the Adirondack/Catskill comparison during 1992 - 2001 (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005). The lake has been studied by the AEAP (Momen, B., 2006). Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995). The NBMR study evaluated the recovery of fisheries in this water in 2000 (Raynal, D. J. et al. 2004).

Figure 1. Bathymetry

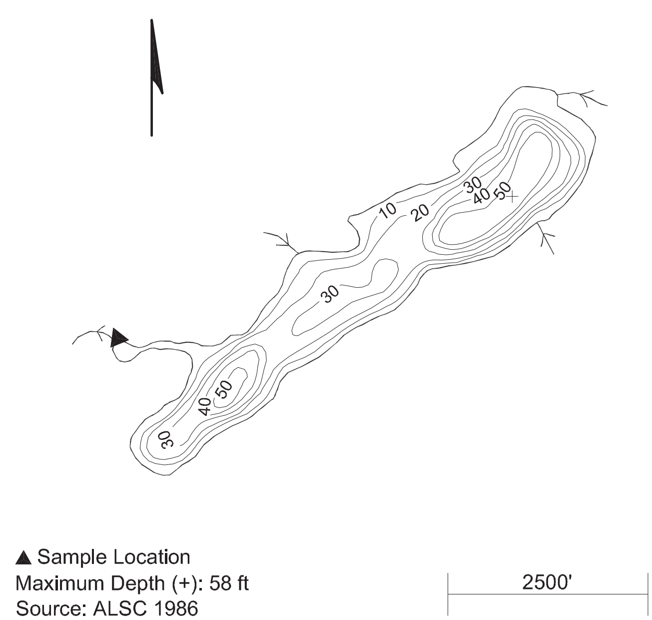


Figure 2. Catchment

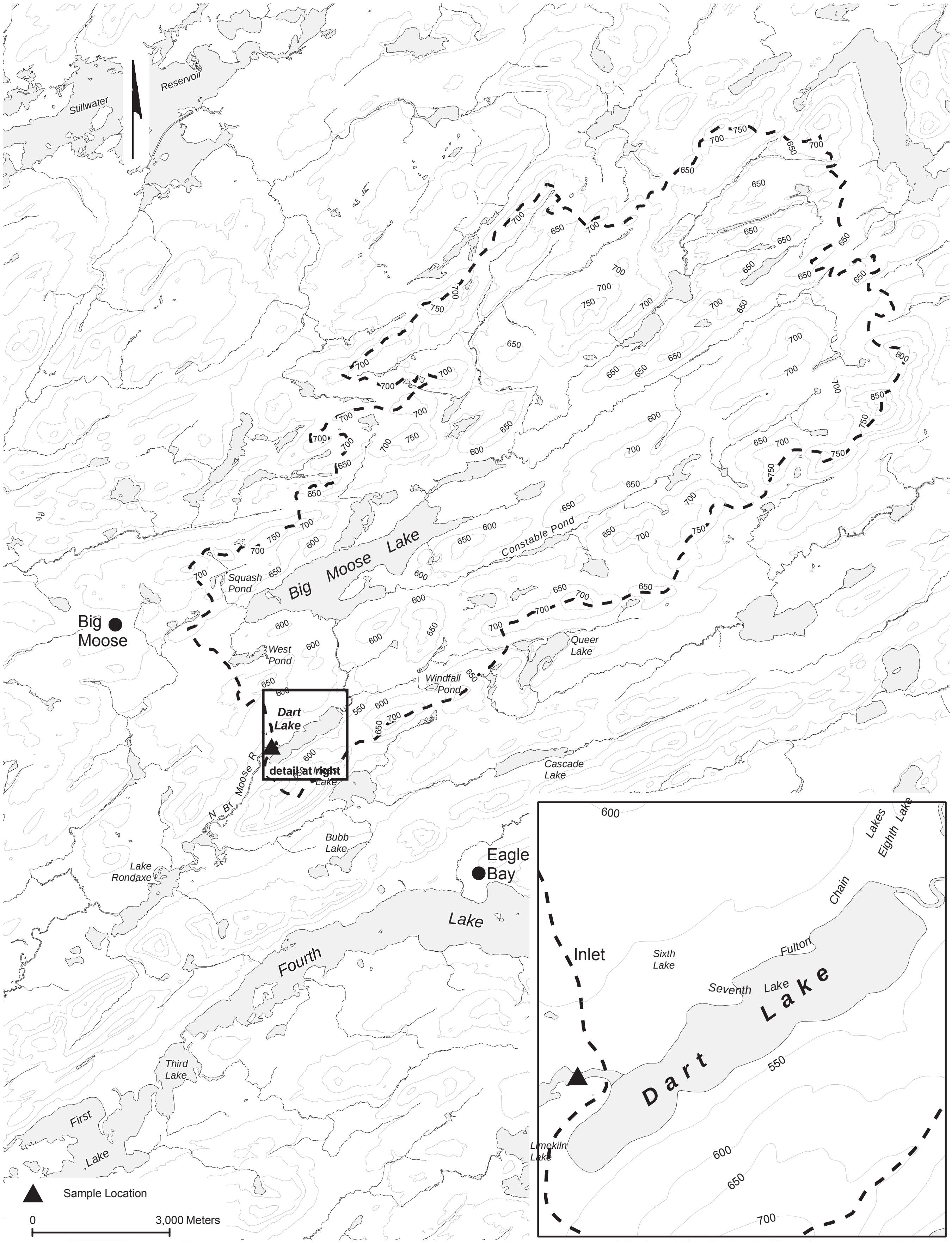


Table 1. Lake Chemistry

040750			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	103.27	134.08	117.96	62.72	82.15	69.09	µeq L^{-1}
NO_3^-	14.48	27.58	19.72	2.39	14.67	7.96	µeq L^{-1}
Cl^-	8.18	11.28	9.31	8.75	12.50	9.50	µeq L^{-1}
F^-	3.26	4.58	3.85	2.96	3.47	3.19	µeq L^{-1}
ANC	-6.93	10.70	4.14	9.94	34.19	21.96	µeq L^{-1}
DIC	18.32	86.59	39.69	36.63	69.10	52.96	µmol L^{-1} -C
DOC	222.88	399.96	299.44	332.36	461.74	386.91	µmol L^{-1} -C
SiO_2	61.58	93.20	75.55	48.24	85.88	67.20	µmol L^{-1}
Ca^{2+}	73.36	103.30	91.82	67.37	75.77	71.79	µeq L^{-1}
Mg^{2+}	21.39	28.80	25.92	18.10	21.39	19.91	µeq L^{-1}
Na^+	16.96	26.97	22.98	20.88	26.97	23.53	µeq L^{-1}
K^+	5.37	8.95	8.10	4.60	6.39	5.62	µeq L^{-1}
NH_4^+	-0.17	2.44	1.07	-0.81	2.27	0.98	µeq L^{-1}
AL_TD	3.22	16.42	9.23	3.72	11.64	7.29	µmol L^{-1}
AL_TM	1.88	12.82	6.67	1.92	6.00	3.53	µmol L^{-1}
AL_OM	0.48	4.37	2.12	1.61	3.60	2.53	µmol L^{-1}
AL_IM	1.14	8.45	4.55	0.08	3.04	1.00	µmol L^{-1}
LABPH	4.97	5.69	5.28	5.45	6.28	5.77	
AIREQPH	5.00	5.82	5.34	5.47	6.40	5.89	
TRUECOLOR	5	30	20	30	50	40	Pt Co
SCONDUCT	18.98	25.34	21.53	15.24	17.81	16.00	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	537 m
Maximum depth	17.7 m
Mean depth	7.3 m
Volume	380.7 x 10^4 m^3
Surface area	51.8 ha
Watershed area	10,804.5 ha
Watershed ratio	0.01
Hydraulic retention time (year)	0.05
Watershed	Oswegatchie/ Black
County, Town	Herkimer, Webb
USGS Quadrangle	Eagle Bay
Land use classification	Private - Resource Management and Rural Use

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b). The NBMR study sampled this watershed for soils, mineralogy, and chemistry of surficial materials (Newton, R.M. et al. 1987).

Deposition: The nearest NADP deposition monitoring site is 2 km southeast at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 15 km southwest at Nick's Lake.

Watershed: The Dart Lake watershed lies on interlayed metasedimentary rock and granitic gneiss with medium to high ANC and is overlain by basal and glacial tills (Roy, K. M. et al. 1997). Till predominates 70.4% of the watershed while shallow soils and bedrock outcrops (12.5%) are found at the higher elevations above 600 m. Outwash sand and gravel comprise 16.6% of the watershed and are found mostly along the lower elevations of Big Moose Lake; a small band of kame deposits (0.4%) exists near the outlet of Big Moose Lake. Glacial outwash patches appear along the main inlet to Big Moose, along the mid southern shore of Big Moose and along the north shoreline of Dart Lake (APA 2001). A lookout tower once sat on West Mountain, the watersheds highest elevation at 850 m. The maximum relief is 313 m. In 1986, the ALS found the shoal water substrate comprised of 28% bedrock/boulder/rubble and 72% sand and gravel (ALSC 1987).

Land cover/use: In 1986, the ALS reported the watershed cover as: 50% deciduous forest; 43% deciduous-conifer mix; 5% shrub-sapling; 1% open grass; and 1% developed (ALSC 1987). Wetlands covered 1412 ha, or 13.1% of the watershed. The predominant wetland cover types are forested needle-leaved evergreen (778 ha) and scrub/shrub broad leaf deciduous (519 ha) that are interspersed along the tributary channels. A small wetland is associated with the shoreline near the inlet (Roy, K. M., et al. 1996).

Figure 3. Chemistry Time Series

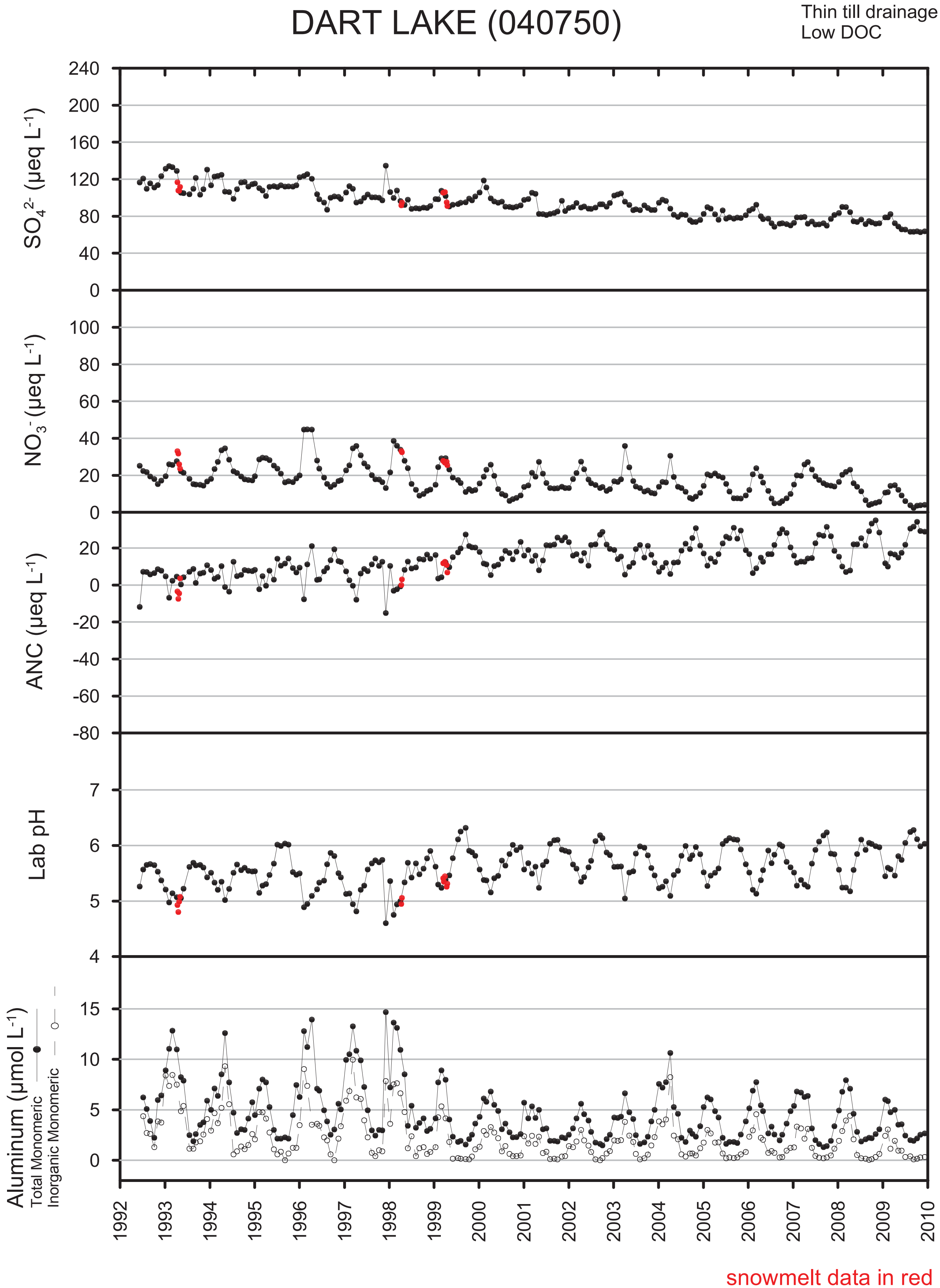


Table 3. Fish Netting

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
September-00	Common shiner	5	148	157	202	5
September-00	Creek chub	3	92	98	22	3
September-00	White sucker	48	90	432	14664	72
September-00	Brown bullhead	30	144	262	2493	30
September-00	Banded killifish	30	23	78	-	30
September-00	Rock bass	4	114	181	255	4
September-00	Pumpkinseed	3	65	112	70	3
September-00	Yellow perch	16	130	343	1643	16
September-86	Brook trout	3	243	422	1310	3
September-86	Golden shiner	1	122	122	20	1
September-86	Common shiner	3	89	92	23	3
September-86	Creek chub	7	100	177	266	7
September-86	White sucker	30	175	428	8060	120
September-86	Brown bullhead	25	168	288	3910	62
September-86	Banded killifish	9	81	99	69	9
September-86	Yellow perch	25	153	221	1335	71

Dart Lake is located on a mix of public and private land. The northwestern section is classified as Rural Use, and has a YMCA camp with numerous cabins, buildings, and a developed beach. A gravel road extends the length of the lake through the camp property. The steeper south shore is classified as Resource Management. Parts of the immediate watershed lie in the Fulton Chain Wild Forest and in the Pigeon Lake Wilderness (Roy, K. M., et al. 1997).

Watershed disturbance: The 1916 fire protection source data show 85% of the watershed as green timber with no slash while 9% was logged for softwood with a considerable amount of slash. Less than 1% of the watershed was burned over. The November 1950 storm data reveal that 20% of the watershed was severely damaged (50 to 100% blowdown) and less than 1% of the watershed was moderately damaged (25 to 50% blowdown). The July 1995 micro-burst storm source data show 91.1% of the watershed with low damage (0-30% change in crowns), 6.5% with moderate damage (30 to 60% change in crowns) and 2.4% with severe damage (60 to 100% change in crowns) (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1986 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Bukaveckas,P. and Shaw,W. 1998. Phytoplankton responses to nutrient and grazer manipulations among northeastern lakes of varying pH. Canadian Journal of Fisheries and Aquatic Sciences 55: 958-966.

Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns,D.A., McHale,M.R., Driscoll,C.T., and Roy,K.M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Dixit,S.S., Cumming,B.F., Birks, H.J.B., Smol,J.P., Kingston,J.C., Uutala,A.J., Charles,D.F., and Camburn,K.E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack Lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T. and Schafran,G.C. 1984. Short-term changes in the base neutralizing capacity of an acid Adirondack lake, New York. Nature 310: 308-310.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Driscoll,C.T., Yatsko,C.P., and Unangst,F.J. 1987. Longitudinal and temporal trends in the water chemistry of the North Branch of the Moose River. Biogeochemistry 3: 37-61.

Heinemann, J., Gloss, S., Schofield, C., Whitehead, D., Bukaveckas, P., DePinto, J., Young, T., Driscoll, C., and Staubitz, W. 1985. Lake Acidification Mitigation Project (LAMP). Electric Power Research Institute No. 1397-03-85-CR Volume I, General Research Corporation, Palo Alto, CA.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

Newton,R.M., Weintraub,J., and April,R. 1987. The relationship between surface water chemistry and geology in the North Branch of the Moose River. Biogeochemistry 3: 21-35.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Owen,J.S., Mitchell,M.J., and Michener,R.H. 1999. Stable nitrogen and carbon isotopic composition of seston and sediment in two Adirondack lakes. Canadian Journal of Fisheries and Aquatic Sciences 56: 2186-2192.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of Atmospheric Deposition of Sulfur, Nitrogen, and Mercury on Adirondack Ecosystems. New York State Energy Research and Development Authority No. Final 04-03.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schafran,G.C. and Driscoll,C.T. 1987. Spatial and temporal variations in aluminum chemistry of a dilute, acidic lake. Biogeochemistry 3: 105-119.

Schafran,G.C. and Driscoll,C.T. 1988. Relationships between seepage chemistry and flow path through the near-shore sediments of an acidic lake. Verh.Internat.Verein.Limnol. 23: 2262-2266.

Schafran,G.C. and Driscoll,C.T. 1993. Flow path-composition relationships for groundwater entering an acidic lake. Water Resources Research 29: 145-154.

Schofield,C.L. and Driscoll,C.T. 1987. Fish species distribution in relation to water quality gradients in the North Branch of the Moose River Basin. Biogeochemistry 3: 63-85.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

This page intentionally left blank.

Windfall Pond & Windfall Pond Stream 040750A

Lat. 43° 48’ 18’’ N   Long. 074° 49’ 53’’ W

Lake: Windfall Pond lies in the Oswegatchie-Black River watershed at 591 m. Two spring-seeps on the southern and eastern shorelines were noted as inlet sources in 1985 (ALSC 1986). In 1985, the outlet was uncontrolled (ALSC 1986). Beaver activity has increased over the past few years and a series of small beaver dams are now found along the outlet stream. Approximately 350 m downstream from the pond, a tributary that drains a chain of unnamed ponds enters the outlet stream (Figure 1). Windfall Pond is a 2.4 ha headwater lake and has a maximum depth of 6.1 m (Figure 2).

Windfall Pond is classified as a carbonate influenced drainage lake. The pond is considered insensitive to acidification. Windfall Pond Stream (Station 1) is one of the original 17 ALTM sites, monitored on a monthly basis since June 1982. Station 1 is located approximately 2 km downstream from the lake on the upstream side of a culvert that runs under the Big Moose Road (Figure 1). The ALTM began collecting a monthly sample at Windfall Pond (Station 2) in June 1993.

Lake chemistry: Windfall Pond was sampled during the ALS on 30 Jul 1985 finding: Lab pH 7.39, ANC 149.2 µeq L^{-1}, SO_4^{2-} 130.75 µeq L^{-1}, NO_3^- 4.85 µeq L^{-1}, Ca^{2+} 254.51 µeq L^{-1}, Mg 45.26 µeq L^{-1} , DOC 3.3 mg L^{-1}-C (ALSC 1986). Table 1 summarizes recent water chemistry taken at Windfall Pond Stream (Station 1). Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 06 Jun 1985, submergent aquatic plants occupied 10% of the lake bottom. Floating and emergent vegetation occupied 15% and 5% respectively of the lake surface. ALS identified Dulichium spp., Nuphar spp., Nymphaea spp. and Utricularia spp. A dip-net survey on the same date found the following Insecta: Odonata Libellulidae and Gomphidae and Diptera Unspecified. On 30 Jun 1985, a thermocline was found between 4 and 5 m (ALSC 1986). In August 1975, NYSDOH found total phosphorus of 18.4 mg m^{-3} and total chlorophyll a of 7.27 µg L^{-1} (Wood, L. W. 1978). In 2003, the AEAP reported an average value of chlorophyll a of 4.3 µg L^{-1} (Momen, B. et al. 2006).

Figure 1. Catchment

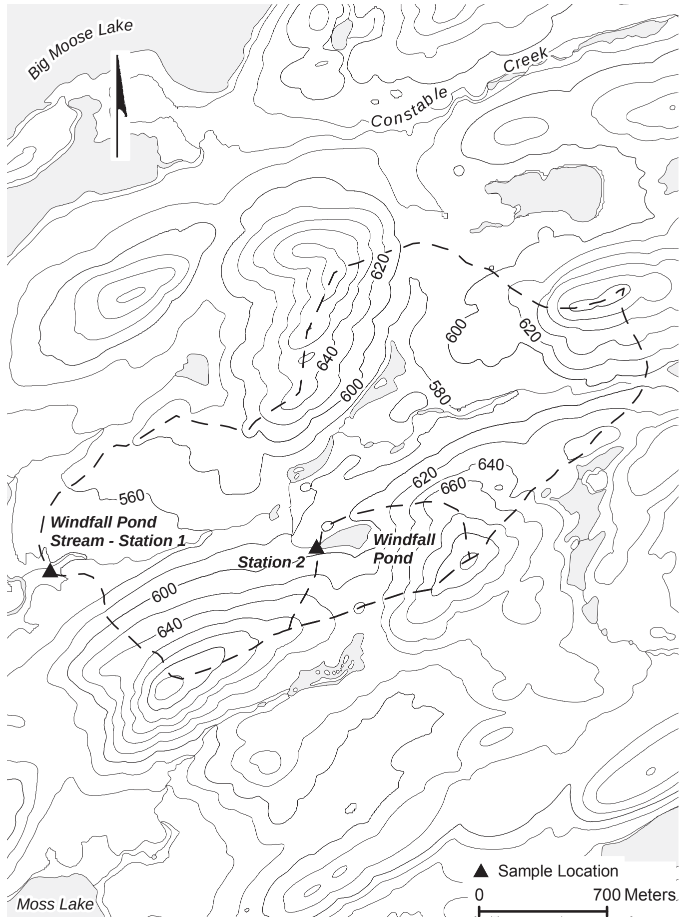
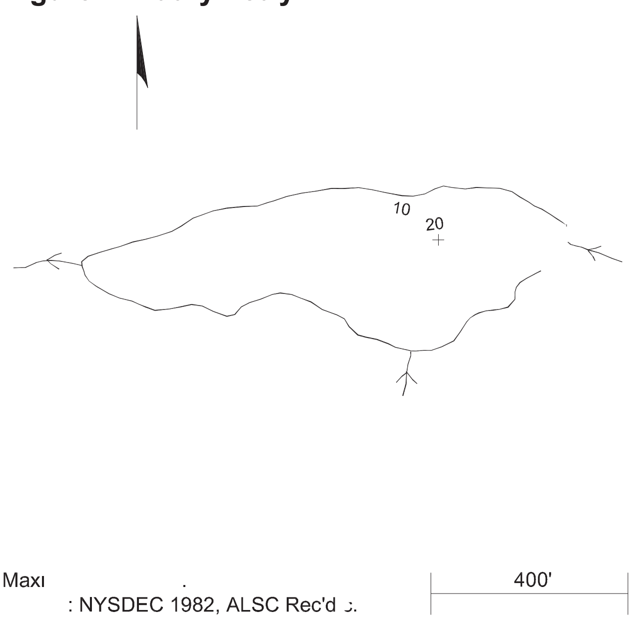


Figure 2. Bathymetry



Fisheries: There is no record of fish stocking in Windfall Pond. The ALTM has surveyed the lake. Refer to Table 3 for netting history.

Intensive studies: NYSDOH conducted a limnological survey of Windfall Pond in August 1975 (Wood, L. W. 78). The RILWAS and NBMR studies surveyed the lake and its watershed in the early 1980s (Newton, R. M. et al. 1987; Driscoll, C. T. et al. 1987; Schofield, C. L. and Driscoll, C. T. 1987; Driscoll, C. T. and Newton, R. M. 1985). Diatom stratigraphies were developed from sediment cores in the late 1980s (Charles, D. F. et al. 1990). Diatoms were evaluated for use as environmental indicators for the EMAP-Surface Water project in 1991 (Dixit, S. S. and Smol, J. P. 1994). The lake has been studied by the AEAP since 1994 (Momen, B. 2006). This was a study watershed for the Adirondack/Catskill comparison in 1992-2001 (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005). Fisheries recovery since the NBMR survey was evaluated in this water in 2000 (Raynal, D. J. et al. 2004).

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 2 km southwest at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 18 km southwest at Nick's Lake.

Watershed: The Windfall Pond Stream watershed lies on interlayered metasedimentary rock and granitic gneiss, having medium to high ANC (Roy, K. M. et al. 1997). Till overlies 71% of the watershed. Exposed bedrock appear on the higher portions of the watershed to the south, while a small area (13%) to the western side contains outwash sand and gravel. Basal soils predominate throughout the watershed. The small chain of unnamed ponds (that contribute to Windfall Pond Stream) lie in organic hydric soils, which make up 10% of the watershed. Shallow

Table 1. Lake/Stream Chemistry (Station 1)

040750A			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	95.15	153.86	129.55	46.37	102.44	77.79	µeq L^{-1}
NO_3^-	4.42	40.64	19.06	1.91	32.20	10.41	µeq L^{-1}
Cl^-	5.92	11.28	8.39	5.21	8.04	7.02	µeq L^{-1}
F^-	4.84	6.74	5.69	3.86	5.67	4.53	µeq L^{-1}
ANC	1.32	108.08	44.15	28.92	120.36	56.50	µeq L^{-1}
DIC	33.30	156.52	81.45	47.46	148.24	86.65	µmol L^{-1} -C
DOC	244.11	443.67	336.97	258.34	691.61	437.98	µmol L^{-1} -C
SiO_2	80.72	146.13	101.19	61.58	126.82	85.90	µmol L^{-1}
Ca^{2+}	104.30	194.12	142.27	92.32	147.21	114.30	µeq L^{-1}
Mg^{2+}	27.98	56.78	42.17	25.51	46.06	32.93	µeq L^{-1}
Na^+	15.66	26.97	20.99	16.96	25.66	20.31	µeq L^{-1}
K^+	3.58	12.28	6.99	2.81	6.65	5.02	µeq L^{-1}
NH_4^+	-0.55	2.77	0.99	-0.66	4.77	0.74	µeq L^{-1}
AL_TD	4.63	13.82	8.53	5.05	10.34	7.49	µmol L^{-1}
AL_TM	1.30	10.16	4.30	2.01	4.48	3.49	µmol L^{-1}
AL_OM	1.39	14.46	3.89	1.70	3.48	2.74	µmol L^{-1}
AL_IM	0.00	5.06	1.15	0.00	1.41	0.76	µmol L^{-1}
LABPH	5.11	6.70	5.82	5.91	6.78	6.22	
AIREQPH	5.18	7.24	5.96	6.12	7.24	6.53	
TRUECOLOR	20	45	29	25	90	47	Pt Co
SCONDUCT	20.81	30.71	25.46	17.25	26.07	20.17	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	591 m
Maximum depth	6.1 m
Mean depth	3.2 m
Volume	7.8 x 10^4 m^3
Surface area	2.4 ha
Watershed area	41.1 ha
Watershed ratio	0.06
Hydraulic retention time (year)	0.25
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Eagle Bay
Land use classification	Pigeon Lake Wilderness

Figure 3. Chemistry Time Series

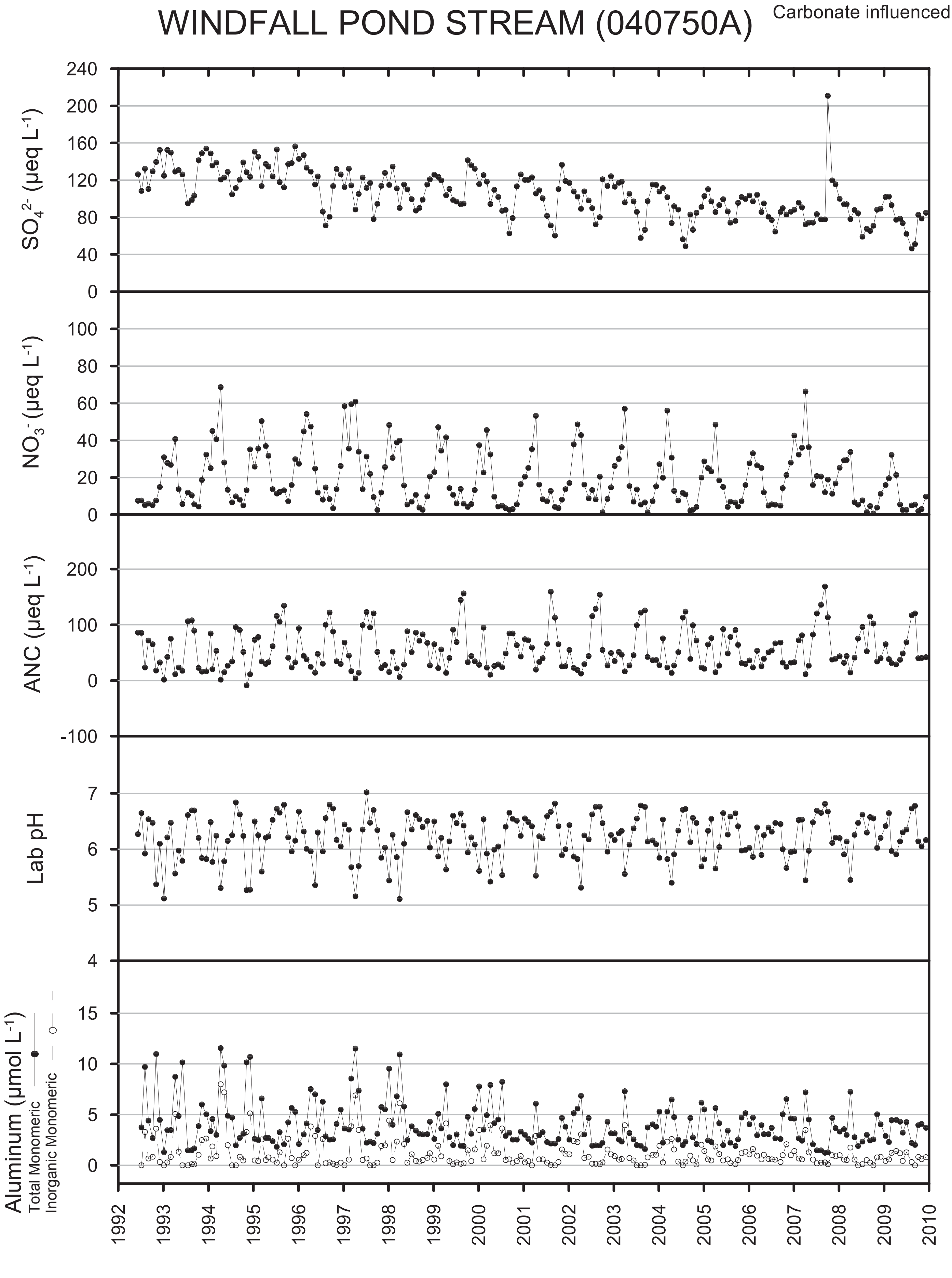


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-95	Northern redbelly dace	3	60	62	8	3
May-95	Blacknose dace	25	54	67	60	37
May-95	Creek chub	29	64	134	316	46
May-95	White sucker	21	158	450	3664	21
June-85	Brook trout	1	305	305	390	1
June-85	Northern redbelly dace	25	48	56	25	105
June-85	Blacknose dace	25	57	66	50	179
June-85	Creek chub	2	69	86	10	2
June-85	White sucker	12	164	275	905	16

(<0.5 m) soils and rock outcrops appear above the 600 m elevation (APA 2001). The highest elevation in the watershed is 722 m. The maximum relief is 131 m. In 1985, the ALS found the shoal water substrate comprised of 15% bedrock/boulder, 40% sand/rubble and 45% muck/silt/organic (ALSC 1986).

Land cover/use: In 1985, the ALS described the watershed as: 90% deciduous forest and 10% deciduous-coniferous mixed forest. The immediate shoreline consisted of 65% coniferous forest, 10% wetland, 10% deciduous forest, and 15% open grass (ALSC 86). Total wetland area is 2.0 ha and comprises 5% of the watershed (Roy, K. M. et al. 1996). Scrub/shrub broad-leaf deciduous wetland occurs in a contiguous band along two thirds of the shoreline (APA 2001). The entire watershed lies within the Pigeon Lake Wilderness. There is a hiking trail that follows the outlet stream up to the pond.

Watershed disturbance: The 1916 fire protection source data show 100% of the Windfall Pond watershed as green timber with no slash. Logging was thought to have occurred in the 1890s, but no records of any major watershed disturbances were found (Charles, D. F. et al. 1990). The July 1995 microburst storm damaged 99% of the watershed with 0 to 30% change in dominant and co-dominant crowns, less than 1% of the remaining watershed revealed 30-60% damage (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1986. Adirondack Lakes Survey 1985 Field Studies Report Volumes 6-10. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill mountains. New York State Energy Research and Development Authority No. 05-03.

Burns,D.A., McHale,M.R., Driscoll,C.T., and Roy,K.M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Charles,D.F., Binford,M.W., Furlong,E.T., Hites,R.A., Mitchell,M.J., Norton,S.A., Oldfield,F., Paterson,M.J., Smol,J.P., Uutala,A.J., White,J.R., Whitehead,D.R., and Wiese,R.J. 1990. Paleoecological investigation of recent lake acidification in the Adirondack Mountains, N.Y. Journal of Paleolimnology 3: 195-241.

Dixit,S.S. and Smol,J.P. 1994. Diatoms as indicators in the environmental monitoring and assessment program-surface waters (EMAP-SW). Environmental Monitoring and Assessment 31: 275-306.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yatsko,C.P., and Unangst,F.J. 1987. Longitudinal and temporal trends in the water chemistry of the North Branch of the Moose River. Biogeochemistry 3: 37-61.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in Summer Chemistry Linked to Productivity in Lakes Recovering from Acid Deposition in the Adirondack Region of New York. Ecosystems 9: 1306-1317.

Newton,R.M., Weintraub,J., and April,R. 1987. The relationship between surface water chemistry and geology in the North Branch of the Moose River. Biogeochemistry 3: 21-35.

NYS DEC. Icing Zones. 1998. New York State Department of Environmental Conservation, Albany, NY.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of Atmospheric Deposition of Sulfur, Nitrogen, and Mercury on Adirondack Ecosystems. New York State Energy Research and Development Authority No. Final 04-03.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. U.S. Environmental Protection Agency No. Final, to U.S. Environmental Protection Agency, Ray Brook, NY.

Schofield,C.L. and Driscoll,C.T. 1987. Fish species distribution in relation to water quality gradients in the North Branch of the Moose River Basin. Biogeochemistry 3: 63-85.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Wood, L. W. 1978. Limnology of remote lakes in the Adirondack region of New York State with emphasis on acidification problems. New York State Department of Health, Albany, NY.

Big Moose Lake 040752

Lat. 43° 39' 04'' N Long. 074° 51' 19'' W

Lake: Big Moose Lake is the largest lake in the ALTM program. This glacially scoured water body lies in the Oswegatchie-Black watershed at 558 m. Thirty-eight lakes drain into Big Moose Lake including three ALTM waters (Squash, West and Constable) and one TIME lake (Upper Sister). The uncontrolled outlet of Big Moose Lake flows south through Dart Lake (040750) and then onto the North Branch of Moose River. Big Moose Lake reaches a maximum depth of 21.3 m (Figures 1 and 2).

Big Moose Lake is a thin till chain drainage lake, with low dissolved organic carbon. It is considered sensitive to acidification. This is one of the original ALTM lakes monitored on a monthly basis since June 1982. Spring melt weekly sampling has been ongoing since 1998.

Lake chemistry: Big Moose Lake was not sampled during the 1984-87 ALS, but was sampled as part of the ELS (1A1-103) on 16 Oct 1984 finding: pH 5.24, ANC 5.2 µeq L^{-1}, SO_4^{2-} 132.4 µeq L^{-1}, NO_3^- 18.4 µeq L^{-1}, Ca^{2+} 91.3 µeq L^{-1}, Mg^{2+} 26.1 µeq L^{-1}, DOC 2.35 mg L^{-1}-C (Kanciruk, P. et al. 1986). Table 1 summarizes recent ALTM chemistry taken at the outlet. Monthly plots of the major analytes appear in Figure 3.

Aquatic biota: On 16 Oct 1984, the ELS survey found: Secchi depth 6.0 m; no measureable total phosphorus; and the lake thermally mixed, i.e. difference between surface and bottom temperatures less than 4 °C (Kanciruk, P. et al. 1986).

Fisheries: NYSDEC stocks the lake. The ALTM survey on 25 Sep 2000 netted several species. Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: Big Moose Lake was sampled during the RILWAS and NBMR studies in the early 1980s (Newton, R. M. et al. 1987; Driscoll, C. T. et al. 1987; Schofield, C. L. and Driscoll, C. T. 1987; Driscoll, C. T. and Newton, R. M. 1985). Diatom stratigraphies were developed from sediment cores in the late 1980s (Charles, D. F. et al. 1990). Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Sullivan and others (1996) evaluated landscape changes with sediment records. Big Moose Lake was one of 20 Adirondack lakes studied to evaluate regional trends in chrysophyte-inferred lake water pH changes (Cumming, B. F. et al. 1994;Smol, J. P. et al. 1998). It was one of 25 Adirondack lakes studied within the Mercury Response Project, samples were taken on 05 Oct 1992 and 26 Sep 2005 (Dittman, J. A. and Driscoll, C. T. 2009). Historical rates of mercury deposition were analyzed using sediment cores from 1982-1983 (Lorey, P. and Driscoll, C. T. 1999) and 1998 (Raynal, D. J. et al. 2004). Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995). Moose Lake was sampled by the Statewide Monitoring of Mercury in Fish project in 2003 (Simonin, H. et al. 2008) and by the Cooperative Loon Project in 2003 - 2004 (Schoch, N. et al. 2004). The lake has been studied by the AEAP (Momen, B. et al. 2006).

Figure 1. Bathymetry

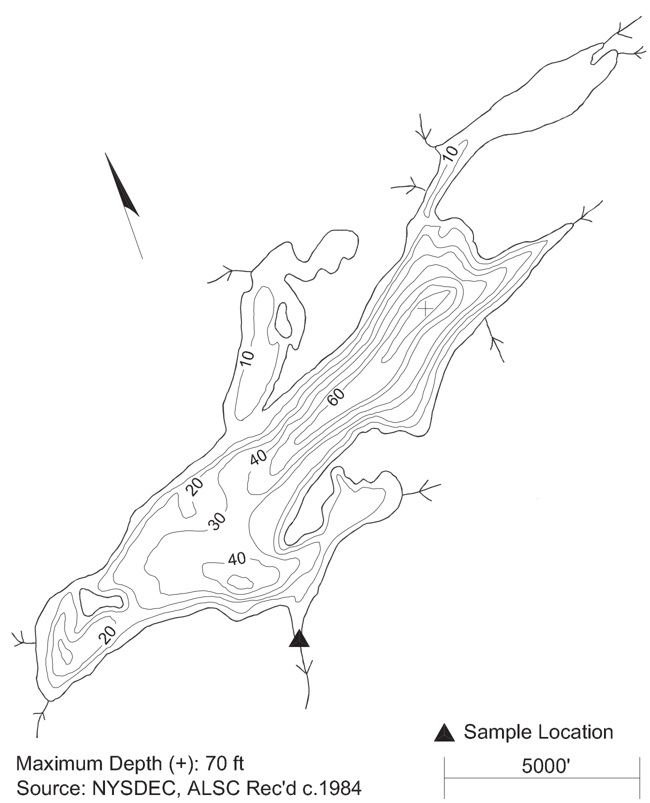


Figure 2. Catchment

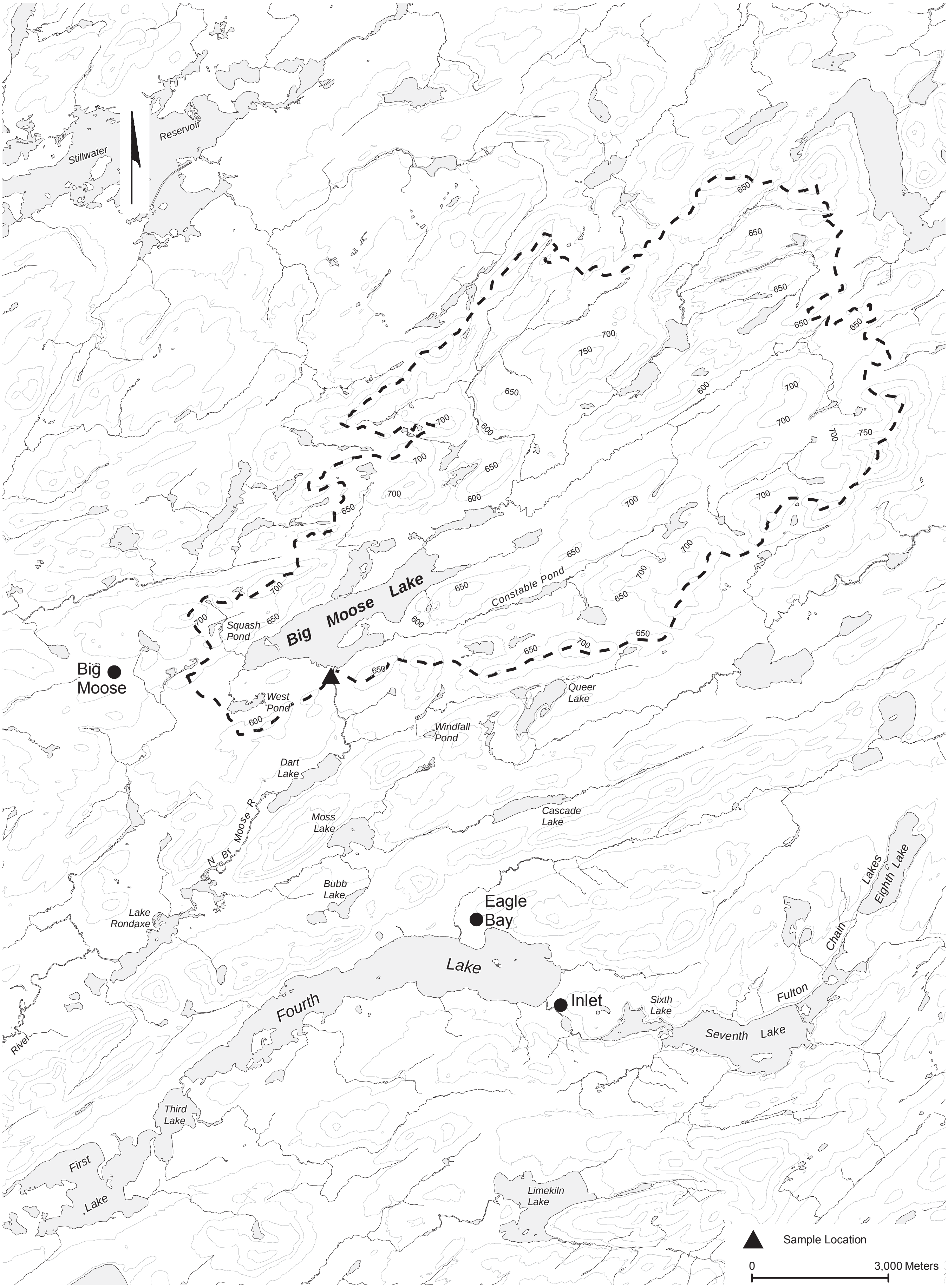
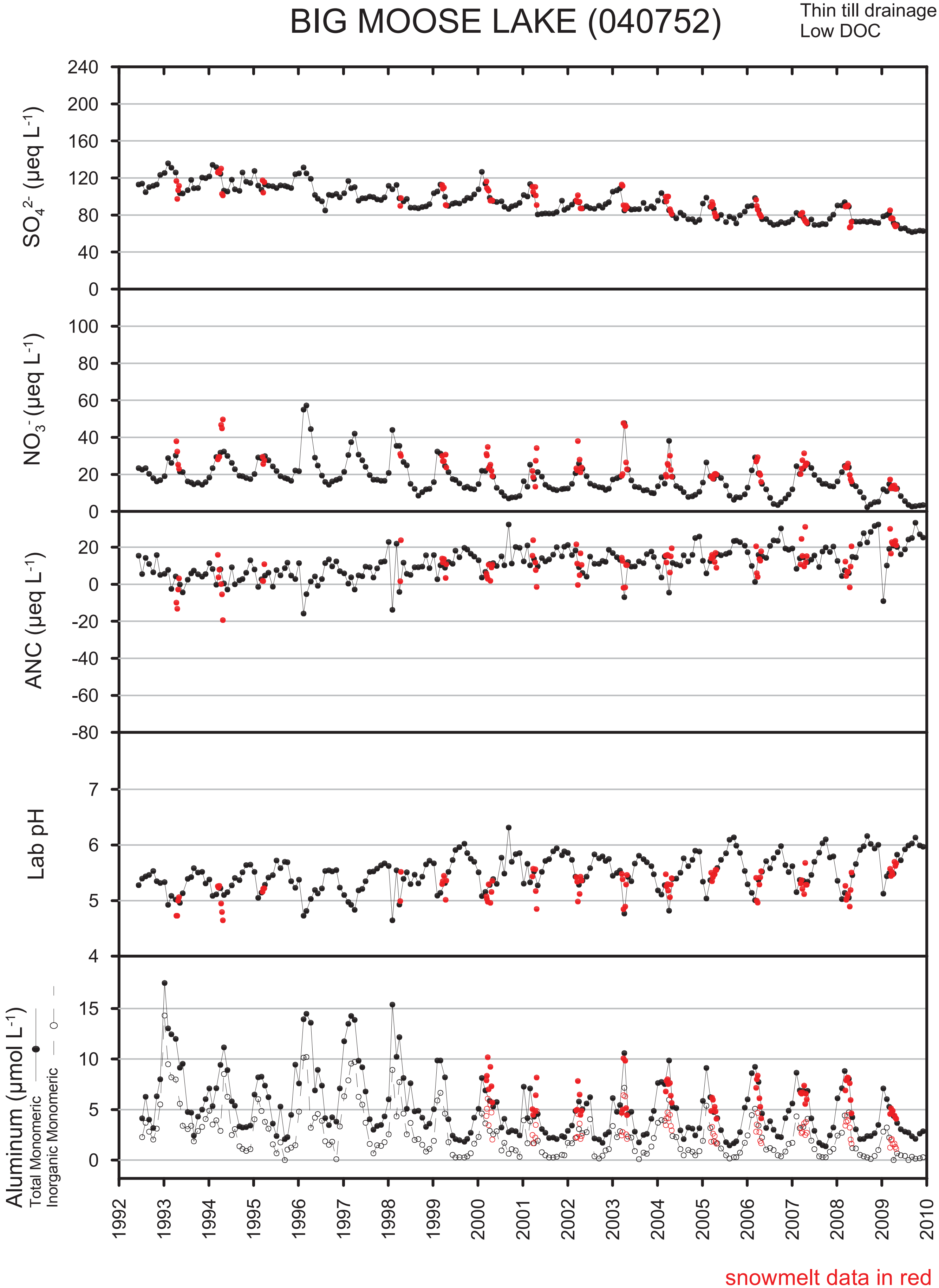


Figure 3. Chemistry Time Series



Soils: The NBMR study sampled this watershed for soils, mineralogy and chemistry of surficial materials (Newton, R. M. et al. 1987). A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 3 km southwest at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 18 km south at Nick's Lake.

Watershed: The Big Moose Lake watershed is underlain primarily by biotite and hornblende granite gneiss having low to no ANC. Areas of inter-layered metasedimentary rock (medium to high ANC) occur in the southern portion of the watershed. The northern portion of the watershed is dominated by charnockite, mangerite, pyroxene-quartz syenite gneiss, with low to no ANC (Roy, K. M. et al. 1997). The watershed area is overlain primarily by basal till. The Big Moose Lake shoreline is primarily outwash sand and gravel. Exposed bedrock predominates at the higher elevations (> 650 m). The highest elevation in the watershed is West Mountain at 850 m. The maximum relief is 292 m.

Land cover/use: The Big Moose Lake watershed is primarily forested (75%) with coniferous and deciduous-coniferous mixed forest. The area has 1310 ha of wetland that comprises 13.6% of the watershed (Roy, K. M. et al. 1996). The watershed is a mixture of public and private lands. The Pigeon Lake Wilderness comprises part of the watershed in the south and east, while the Fulton Chain Wild Forest lies in a smaller portion to the west. Shorelines of several of the larger lakes are privately owned, and generally fall within the Resource Management classification. The shoreline of Big Moose Lake is a combination of Rural and Low to Moderate Intensity uses**.** A majority of the shoreline is developed with a mix of seasonal and year-round residences (ALSC 2003).

Table 1. Lake Chemistry

040752			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	103.27	135.75	117.36	61.66	81.69	68.80	µeq L^{-1}
NO_3^-	14.37	30.16	19.92	2.65	14.79	7.66	µeq L^{-1}
Cl^-	7.05	10.72	8.79	7.93	10.96	8.86	µeq L^{-1}
F^-	3.00	4.42	3.65	2.68	3.43	3.05	µeq L^{-1}
ANC	-4.43	7.79	3.44	-9.12	33.24	19.20	µeq L^{-1}
DIC	14.99	129.88	55.37	29.14	111.56	61.26	µmol L^{-1} -C
DOC	211.39	405.71	307.45	340.91	483.22	404.12	µmol L^{-1} -C
SiO_2	52.26	100.36	74.44	46.77	88.87	66.10	µmol L^{-1}
Ca^{2+}	69.37	113.78	88.62	65.95	75.35	69.96	µeq L^{-1}
Mg^{2+}	19.75	27.16	24.82	18.10	21.39	19.09	µeq L^{-1}
Na^+	19.14	26.97	22.47	21.31	26.53	23.06	µeq L^{-1}
K^+	7.16	9.72	7.93	4.86	6.65	5.57	µeq L^{-1}
NH_4^+	0.22	3.27	1.48	-0.81	2.49	0.74	µeq L^{-1}
AL_TD	2.15	18.27	10.02	4.35	13.16	7.51	µmol L^{-1}
AL_TM	2.41	17.53	8.40	2.09	7.08	3.74	µmol L^{-1}
AL_OM	0.56	6.13	2.78	1.96	4.37	2.87	µmol L^{-1}
AL_IM	1.85	14.31	5.62	0.00	3.22	0.89	µmol L^{-1}
LABPH	4.92	5.58	5.21	5.12	6.13	5.65	
AIREQPH	4.98	5.57	5.27	5.21	6.40	5.79	
TRUECOLOR	10	30	22	30	50	41	Pt Co
SCONDUCT	17.33	26.79	21.52	14.45	18.12	15.83	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	558 m
Maximum depth	21.3 m
Mean depth	6.8 m
Volume	3488.2 x 10^4 m^3
Surface area	512.5 ha
Watershed area	9643.8 ha
Watershed ratio	0.05
Hydraulic retention time (year)	0.48
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Eagle Bay
Land use classification	Private, many classifications

Watershed disturbance: The 1916 fire protection source data show 83% of the watershed as green timber with no slash. Nearly 10% was logged for softwood with much slash and less than 1% was burned over. The watershed was moderately impacted by the November 1950 storm when 22.5% of the watershed incurred 50-100% blowdown. The July 1995 microburst storm damaged: 90% of the area with 0-30% change in tree crowns; 7.2% with 30-60% change; and 2.7% with 60-100% change (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1986	Brook trout	25000	986
1993	Brook trout	10000	154
1993	Lake trout	5000	495
1993	Lake trout	3000	297
1993	Brook trout	25000	116
1994	Brook trout	5000	296
1994	Brook trout	10000	333
1995	Lake trout	7500	-
1995	Brook trout	10940	-
1996	Brook trout	20000	2267
1997	Lake trout	4500	1142
1997	Brook trout	6000	144
1998	Brook trout	6200	153
1998	Lake trout	4000	104
1999	Brook trout	4000	-
2000	Brook trout	4000	-
2001	Brook trout	3560	-
2002	Brook trout	9000	-
2003	Lake trout	6800	-
2003	Brook trout	16000	-
2004	Brown trout	1700	-
2004	Brook trout	4000	-
2004	Lake trout	5000	-
2005	Brook trout	4000	-
2006	Brook trout	7400	624

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams
Sep-00	Brook trout	22	95	430	1840
Sep-00	Lake trout	5	198	556	-
Sep-00	Golden shiner	10	95	141	128
Sep-00	Common shiner	4	105	144	105
Sep-00	Creek chub	12	100	190	312
Sep-00	White sucker	41	213	435	15736
Sep-00	Brown bullhead	38	43	226	656
Sep-00	Banded killifish	47	25	61	-
Sep-00	Pumpkinseed	17	37	148	485
Sep-00	Largemouth bass	1	83	83	6
Sep-00	Yellow perch	81	87	363	-

References

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Charles,D.F., Binford,M.W., Furlong,E.T., Hites,R.A., Mitchell,M.J., Norton,S.A., Oldfield,F., Paterson,M.J., Smol,J.P., Uutala,A.J., White,J.R., Whitehead,D.R., and Wiese,R.J. 1990. Paleoecological investigation of recent lake acidification in the Adirondack Mountains, N.Y. Journal of Paleolimnology 3: 195-241.

Cumming,B.F., Davey,K.A., Smol,J.P., and Birks,H.J.B. 1994. When did acid-sensitive Adirondack lakes (New York, USA) begin to acidify and are they still acidifying? Canadian Journal of Fisheries and Aquatic Sciences 51: 1550-1568.

Dittman,J.A. and Driscoll,C.T. 2009. Factors influencing changes in mercury concentrations in lake water and yellow perch (*Perca flavescens*) in Adirondack lakes. Biogeochemistry 93: 179-196.

Dixit,S.S., Cumming,B.F., Birks,H.J.B., Smol,J.P., Kingston,J.C., Uutala,A.J., Charles,D.F., and Camburn,K.E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Driscoll,C.T., Yatsko,C.P., and Unangst,F.J. 1987. Longitudinal and temporal trends in the water chemistry of the North Branch of the Moose River. Biogeochemistry 3: 37-61.

Kanciruk, P., Eilers, J. M., McCord, R. A., Landers, D. H., Brakke, D. F., and Linthurst, R. A. 1986. Characteristics of Lakes in the Eastern United States: Volume III. Data Compendium of Site Characteristics and Chemical Variables. U.S. Environmental Protection Agency No. EPA/600/4-86/007c.

Lorey,P. and Driscoll,C.T. 1999. Historical trends of mercury deposition in Adirondack lakes. Environmental Science & Technology 33: 718-722.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

Newton,R.M., Weintraub,J., and April,R. 1987. The relationship between surface water chemistry and geology in the North Branch of the Moose River. Biogeochemistry 3: 21-35.

NYS DEC. Icing Zones 1998. New York State Department of Environmental Conservation, Albany, NY.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of atmospheric deposition of sulfur, nitrogen, and mercury on Adirondack ecosystems. New York State Energy Research and Development Authority No. Final 04-03.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schoch, N., Evers, D., Simonin, H., Glennon, Michale, and Adams, David 2004. Long-Term Monitoring and Assessment of Mercury Based on Integrated Sampling Efforts Using the Common Loon, Prey Fish, Water, and Sediment, Interim Report to the New York State Energy Research and Development Authority, Albany, NY.

Schofield,C.L. and Driscoll,C.T. 1987. Fish species distribution in relation to water quality gradients in the North Branch of the Moose River Basin. Biogeochemistry 3: 63-85.

Simonin, H., Loukmas, J., Skinner, L., and Roy, K. 2008. Strategic Monitoring of Mercury in New York State Fish: Final Report 08-11. New York State Energy Research and Development Authority No. Report 08-11.

Smol,J.P., Cumming,B.F., Dixit,A.S., and Dixit,S.S. 1998. Tracking recovery patterns in acidified lakes: A paleolimnological perspective. Restoration Ecology 6: 318-326.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Sullivan,T.J., McMartin,B., and Charles,D.F. 1996. Re-examination of the role of landscape change in the acidification of lakes in the Adirondack Mountains, New York. The Science of the Total Environment 183: 231-248.

This page intentionally left blank.

West Pond & West Pond Stream 040753

Lat. 43° 48’ 41’’ N Long. 074° 53’ 00’’ W

Lake: West Pond lies in the Oswegatchie-Black watershed at 581 m. The outlet of this 10.4 ha headwater lake flows north into Big Moose Lake 1 km downstream (Figure 1). A small inlet enters at the east shore of West Pond. Remnants of an old beaver dam at the lake outlet were reported in 1985 (ALSC 1986). Historically, beaver have been noted to be very active around this pond. Approximately 300 m downstream from the outlet, a barrier falls prevents immigration of fish from Big Moose Lake. The lake reaches a maximum depth is 5.2 m (Figure 2).

West Pond is classified as a thin till drainage lake with low dissolved organic carbon. The lake is considered sensitive to acidification. West Pond Stream (Station 1) is one of the original 17ALTM waters, monitored monthly since June 1982. Originally, Station 1 was located near Big Moose Road approximately 800 m downstream from the outlet of the lake. In September 1992, Station 1 was moved upstream to the base of the barrier falls approximately 300 m downstream from the outlet of the lake. In June 1993, additional monthly sampling began at the main lake outlet (Station 2). Weekly monitoring of West Pond (Station 2) during spring melt has been ongoing since 2000 (Figure 4).

Lake chemistry: West Pond was sampled during the ALS on 30 Jul 1985 finding: Lab pH 5.25, ANC -3.4 µeq L^{-1}, SO_4^{2-} 116.59 µeq L^{-1}, NO_3^- 0.81 µeq L^{-1}, Ca^{2+} 79.84 µeq L^{-1}, Mg^{2+} 22.22 µeq L^{-1}, DOC 4.9 mg L^{-1} -C (ALSC 1986). Table 1 summarizes recent water sample chemistry taken at West Pond Stream. Monthly plots of the major analytes are shown in Figure 3. Plots of the major analytes collected at Station 2 including weekly snowmelt (red) are shown in Figure 4.

Aquatic biota: On 5 Jun 1985, the ALS found submergent vegetation occupied 10% of the lake bottom. Emergent and floating vegetation occupied 5% and 1% respectively of the lake surface. Aquatic plants identified were: Vallisneria spp., Eriocaulon spp. and Nuphar spp. A dip-net survey on the same date found Insecta: Ephemeroptera Caenidae; Odonata Libellulidae and Aeshnidae; Hemiptera Corixidae and Gerridae; Trichoptera Limnephilidae; and Coleoptera Dytiscidae. Also found were: Crustacea Decapoda Unspecified and Pelecypod Veneroida Sphaeriidae. On 30 Jul 1985, the lake was isothermal (ALSC 1986). The AEAP reports an average value of chlorophyll a of 3.36 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Figure 1. Catchment

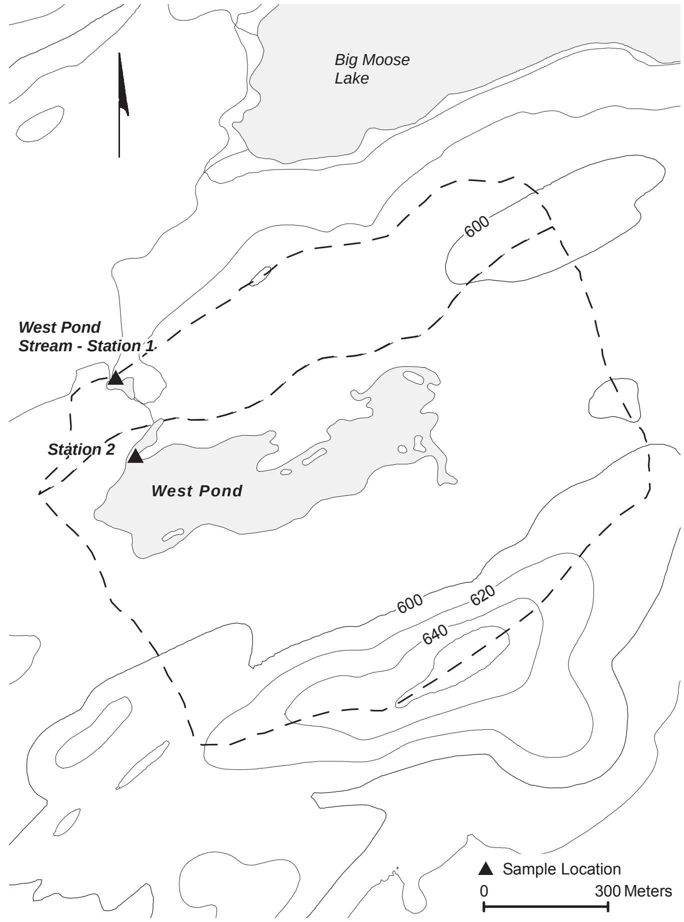
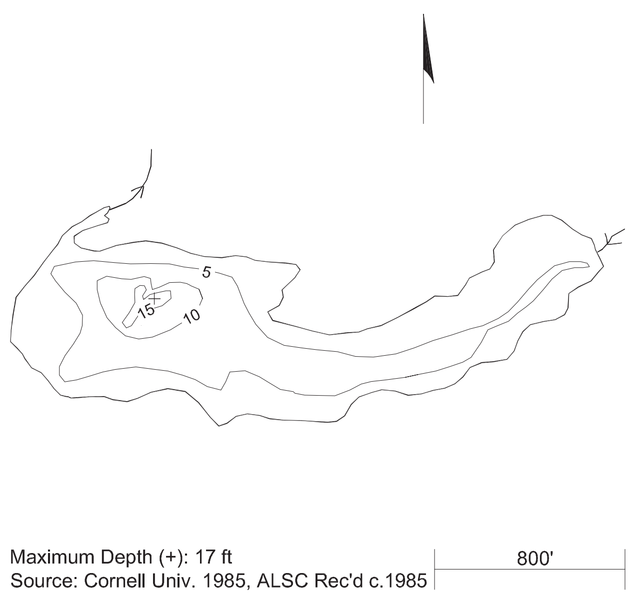


Figure 2. Bathymetry



Fisheries: Historic records indicate brook trout were last stocked in 1894 and 1897 (ALSC 1986). The ALTM has surveyed the lake. Refer to Table 3 for recent fish netting history.

Intensive studies: West Pond Stream was sampled during the RILWAS and NBMR studies in the early 1980s (Newton, R. M. et al. 1987; Driscoll, C. T. et al. 1987; Schofield, C. L. and Driscoll, C. T. 1987; Driscoll, C. T. and Newton, R. M. 1985). Diatom stratigraphies were developed from sediment cores in the late 1980s (Charles, D. F. et al. 1990). During 1986 and 1987 snowmelt, Schaefer and Driscoll (1993) evaluated episodic acidification in this watershed. Historical rates of mercury deposition were analyzed using sediment cores from 1982-1983 (Lorey, P. and Driscoll, C. T. 1999) and again in 1998 (Raynal, D. J. et al. 2004). Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995). The AEAP has studied the lake (Momen, B.et al. 2006). NBMR evaluated the recovery of fisheries in this water in 2000 (Raynal, D. J. et al. 2004). The Adirondack/Catskill comparison from 1992-2001 included this watershed (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005). Chen and others studied this watershed as a water with elevated concentrations of dissolved organic carbon (DOC) using the PnET-BGC model (Chen, L. and Driscoll, C. T. 2004; Chen, L. et al. 2004).

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b). The NBMR study sampled this watershed for soils, mineralogy, and chemistry of surficial materials (Newton, R. M. et al. 1987).

Deposition: The nearest NADP deposition monitoring site is 4 km southeast at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 16 km southwest at Nick's Lake.

Table 1. Lake / Stream Chemistry (Station 1)

040753			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	77.24	109.31	95.32	44.73	69.43	56.04	µeq L^{-1}
NO_3^-	2.31	27.10	9.31	0.00	11.13	3.72	µeq L^{-1}
Cl^-	2.82	10.44	6.51	2.41	7.30	4.80	µeq L^{-1}
F^-	3.21	4.84	4.07	2.69	4.07	3.46	µeq L^{-1}
ANC	-31.92	35.79	-1.59	-10.35	21.97	9.58	µeq L^{-1}
DIC	23.31	182.33	60.43	32.47	145.70	60.33	µmol L^{-1} -C
DOC	381.23	834.97	584.44	563.73	873.60	736.30	µmol L^{-1} -C
SiO_2	26.80	107.18	56.54	18.97	106.85	55.74	µmol L^{-1}
Ca^{2+}	59.88	99.81	75.19	48.90	68.87	57.08	µeq L^{-1}
Mg^{2+}	17.28	31.27	25.37	16.46	22.22	19.49	µeq L^{-1}
Na^+	15.66	30.01	22.37	18.27	25.23	21.62	µeq L^{-1}
K^+	3.84	9.46	6.16	0.99	5.63	3.38	µeq L^{-1}
NH_4^+	-0.17	10.09	3.07	-0.63	8.98	2.11	µeq L^{-1}
AL_TD	5.15	13.71	9.41	8.11	12.49	9.74	µmol L^{-1}
AL_TM	3.50	13.86	7.76	4.48	7.08	5.46	µmol L^{-1}
AL_OM	3.31	8.01	4.93	3.01	5.52	4.01	µmol L^{-1}
AL_IM	0.00	5.86	2.84	0.00	2.67	1.50	µmol L^{-1}
LABPH	4.42	5.98	4.89	4.84	5.51	5.08	
AIREQPH	4.48	6.29	4.91	4.86	5.75	5.11	
TRUECOLOR	30	90	66	90	140	108	Pt Co
SCONDUCT	17.16	29.75	21.48	14.09	19.00	15.77	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	581 m
Maximum depth	5.2 m
Mean depth	1.5 m
Volume	15.2 x 10^4 m^3
Surface area	10.4 ha
Watershed area	99.6 ha
Watershed ratio	0.10
Hydraulic retention time (year)	0.20
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Eagle Bay
Land use classification	Fulton Chain Wild Forest

Figure 3. Chemistry Time Series / Station 1

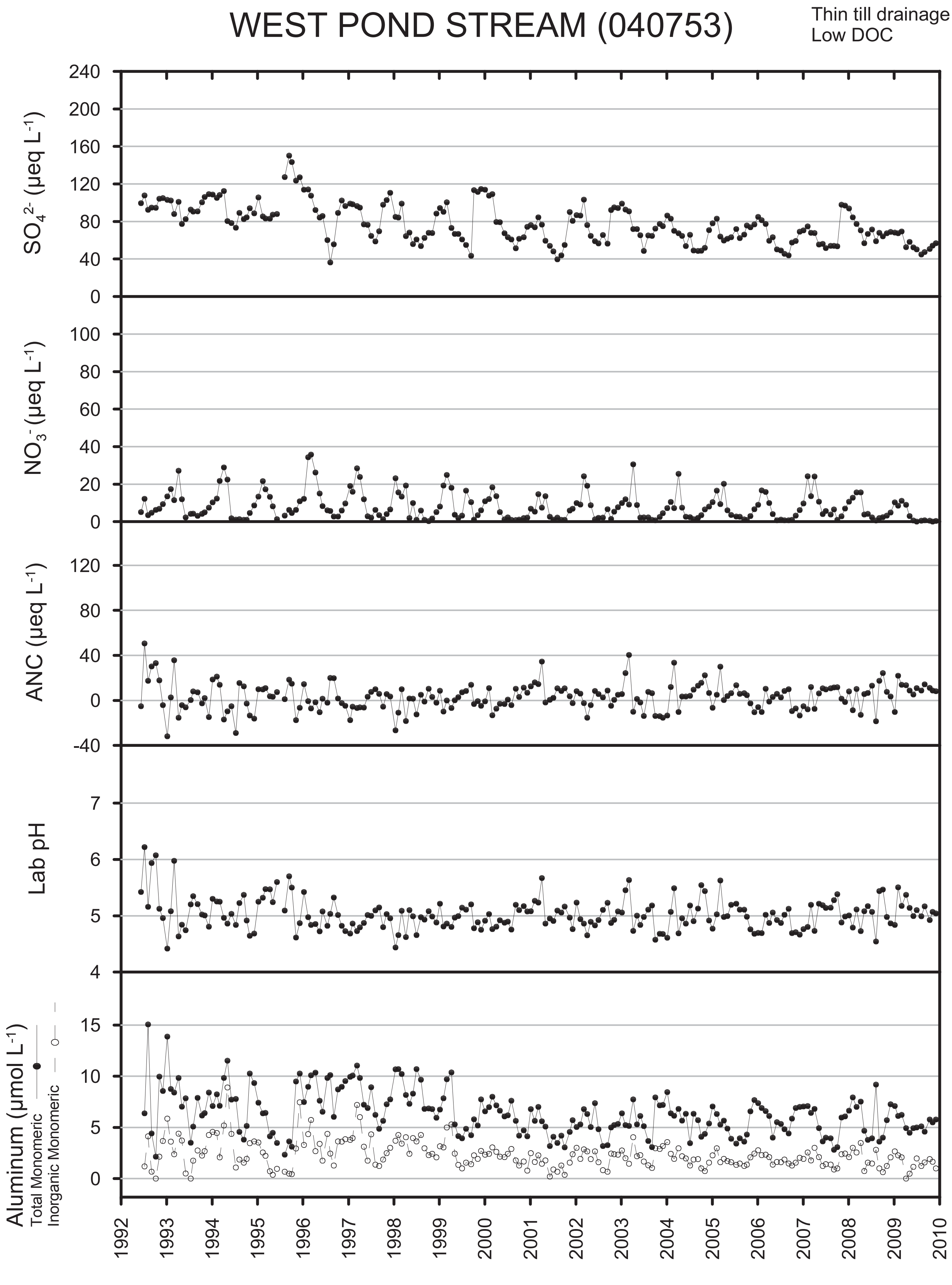


Figure 4. Chemistry Time Series / Station 2

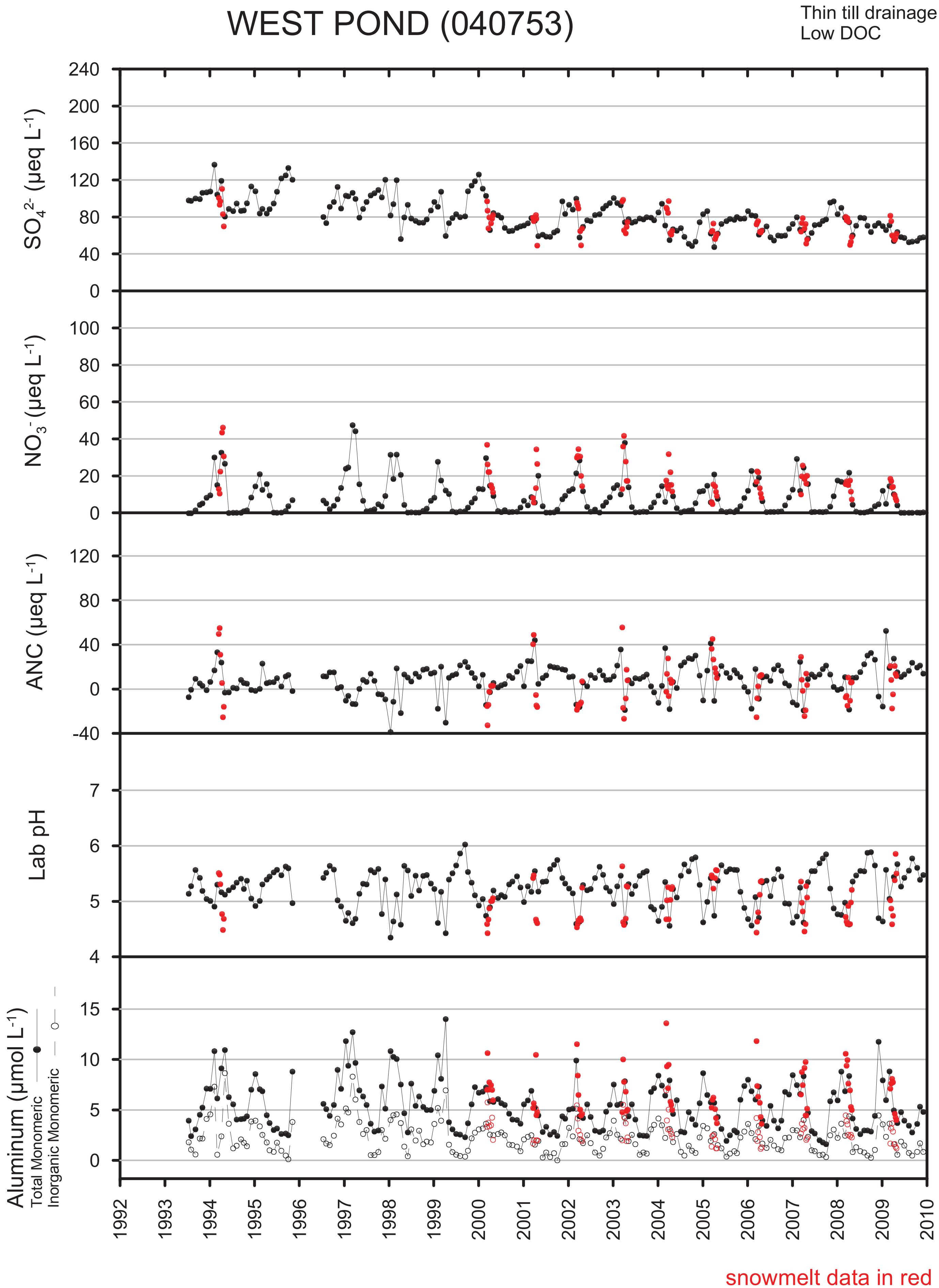


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-99	Brown bullhead	48	54	294	2659	48
June-85	Brook trout	11	173	235	1275	11
June-85	Brown bullhead	28	68	290	3100	58

Watershed: The West Pond Stream watershed is 70% underlain by interlayered metasedimentary rock and granitic gneiss, having medium to high ANC. The remaining 30% of the northern portion of the watershed is underlain by biotite and/or hornblende granite gneiss with low-to-no ANC (Roy, K. M. et al. 1997). Shallow (< 0.5 m) soils appear above 600 m elevation and make up 33% of the southern portion of the watershed. Basal till is found below 600 m and comprises a majority of the southern shoreline. The northern shoreline consists primarily of glacial outwash (APA 2001). The watershed has maximum elevation of 667 m. The maximum relief is 86 m. In 1985, the ALS characterized the shoal water substrate around the lake as 75% organic, 10% muck/silt and 15% bedrock/boulder/sand (ALSC 1986).

Land cover/use: In 1985, the ALS described the watershed as 80% deciduous-coniferous mixed forest and 20% coniferous forest. The immediate shoreline was 50% coniferous forest, 40% wetland and 10% deciduous-conifer mixed forest (ALSC 1986). Wetland area totals 21.8 ha and comprises 21.7% of the watershed (Roy, K. M. et al. 1996). Predominant wetland types are: scrub/shrub broad-leaf deciduous (11.7 ha); forested needle-leaf evergreen (6.9 ha) and broad-leaf deciduous (3.2 ha) (ALSC 2003). The lakeshore is nearly surrounded by a scrub shrub wetland fringe (Roy, K. M. et al. 1996).

The lake and 95% of the watershed occur within the Fulton Chain Wild Forest. A small area in the northeast is in private ownership and classified Low Intensity by the Adirondack Park Agency Land Use and Development Plan. A foot trail leads to the shoreline on the west side of the lake.

Watershed disturbance: The 1916 fire protection source data shows 88.3% of the West Pond watershed as green timber comprised of virgin and second growth with no slash. The July1995 microburst storm produced 0-to-30% change in dominant tree crowns over the entire watershed (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survery Corporation (ALSC) 1986. Adirondack Lakes Survey 1985 Field Studies Report Volumes 6-10. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns,D.A., McHale,M.R., Driscoll,C.T., and Roy,K.M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Charles,D.F., Binford,M.W., Furlong,E.T., Hites,R.A., Mitchell,M.J., Norton,S.A., Oldfield,F., Paterson,M.J., Smol,J.P., Uutala,A.J., White,J.R., Whitehead,D.R., and Wiese,R.J. 1990. Paleoecological investigation of recent lake acidification in the Adirondack Mountains, N.Y. Journal of Paleolimnology 3: 195-241.

Chen,L. and Driscoll,C.T. 2004. Modeling the response of soil and surface waters in the Adirondack and Catskill regions of New York to changes in atmospheric deposition and historical land disturbance. Atmospheric Environment 38: 4099-4109.

Chen,L., Driscoll,C.T., Gbondo-Tugbawa,S.S., Mitchell,M.J., and Murdoch,P.S. 2004. The application of an integrated biogeochemical model (PnET-BGC) to five forested watersheds in the Adirondack and Catskill regions of New York. Hydrological Processes 18: 2631-2650.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack Lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Driscoll,C.T., Yatsko,C.P., and Unangst,F.J. 1987. Longitudinal and temporal trends in the water chemistry of the North Branch of the Moose River. Biogeochemistry 3: 37-61.

Lorey,P. and Driscoll,C.T. 1999. Historical trends of mercury deposition in Adirondack Lakes. Environmental Science & Technology 33: 718-722.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

Newton,R.M., Weintraub,J., and April,R. 1987. The relationship between surface water chemistry and geology in the North Branch of the Moose River. Biogeochemistry 3: 21-35.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of atmospheric deposition of sulfur, nitrogen, and mercury on Adirondack ecosystems. New York State Energy Research and Development Authority No. Final 04-03, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schaefer,D.A. and Driscoll,C.T. 1993. Identifying sources of snowmelt acidification with a watershed mixing model. Water, Air, and Soil Pollution 67: 345-365.

Schofield,C.L. and Driscoll,C.T. 1987. Fish species distribution in relation to water quality gradients in the North Branch of the Moose River Basin. Biogeochemistry 3: 63-85.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

This page intentionally left blank.

Squash Pond & Squash Pond Stream 040754

Lat. 43° 49’ 32’’ N   Long. 074° 53’ 11’’ W

Lake: Squash Pond lies in the Oswegatchie-Black watershed at 653 m. The lake receives drainage from Silver Dollar Pond and Pocket Ponds (Figure 1). In 1986, the ALS noted that the lake outlet showed remnants of a concrete dam with a beaver dam built upon it (ALSC 1987). Approximately 600 m downstream, a natural barrier falls prevents immigration of fish from Big Moose Lake. The outlet stream continues another 300 m past the falls, becoming a tributary into Big Moose Lake on the northwestern shore (Figure 1). The lake reaches a maximum depth of 5.8 m (Figure 2).

Squash Pond is classified as a thin till drainage lake, with high dissolved organic carbon and considered sensitive to acidification. Squash Pond Stream (Station 1) is one of the 17 original ALTM lakes and has been monitored on a monthly basis since June 1982. Station 1 is approximately 600 m downstream from the pond outlet at the base of a barrier falls. The ALTM began collecting monthly samples from the outlet of Squash Pond (Station 2) in June 1993.

Lake chemistry: Squash Pond was sampled during the ALS on 28 Jul 1986 finding: Lab pH 4.36, ANC -45.8 µeq L^{-1}, SO_4^{2-} 87.65 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 30.94 µeq L^{-1}, Mg^{2+} 9.87 µeq L^{-1}, DOC 12.8 mg L^{-1} -C (ALSC 87). Table 1 summarizes recent water chemistry from Squash Pond Stream. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 28 May 1986, the ALS found submergent plants occupied 95% of the lake bottom. Plants found: Iris spp. and Utricularia spp. A dip-net survey on the same date identified the following Insecta: Odonata Coenagriidae, Libellulidae, and Aeshnidae; Trichoptera Phryganeidae and Polycentropodidae; Diptera Chironomidae and Unspecified; Coleoptera Dytiscidae and Gyrinidae; Hemiptera Gerridae; Ephemeroptera Leptophlebiidae; and Megaloptera Sialidae. The macrophyte survey on

Figure 1. Catchment

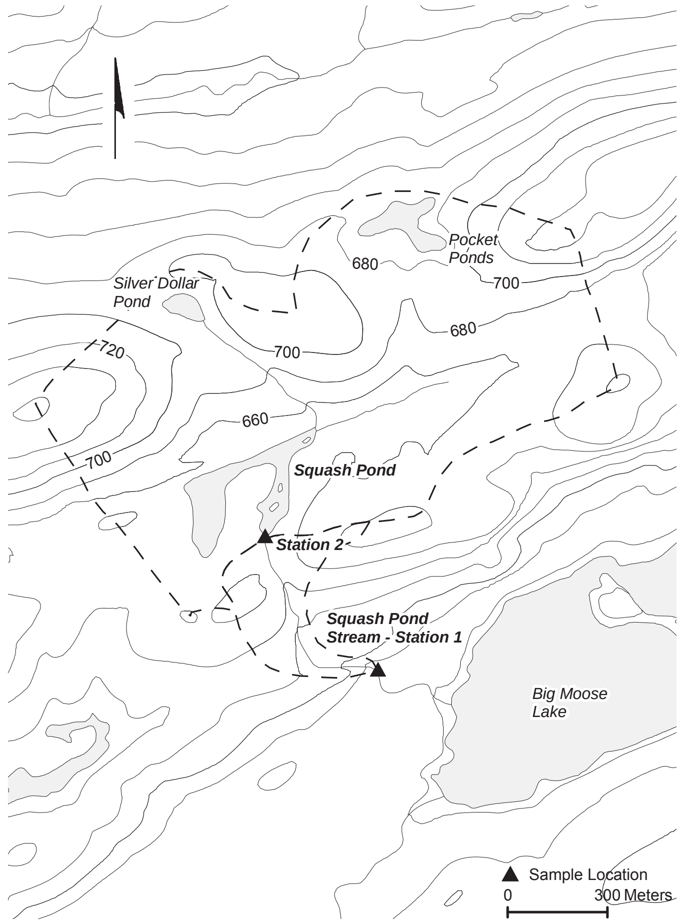
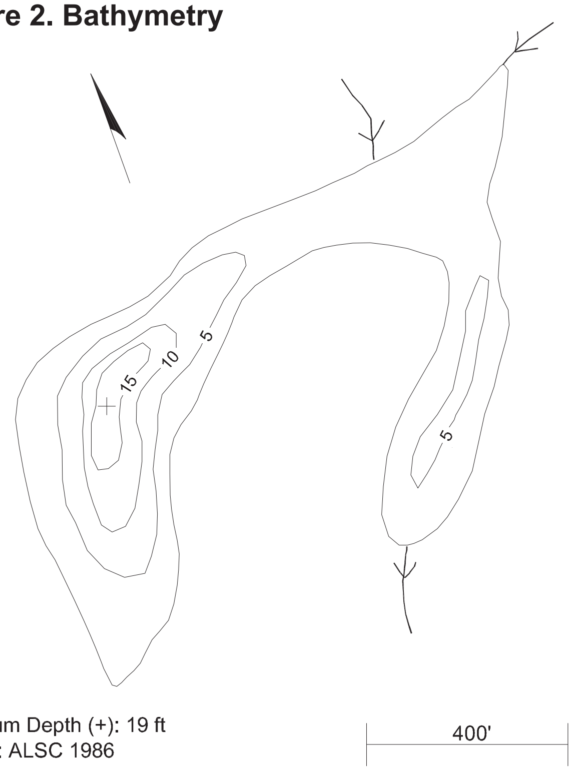


Figure 2. Bathymetry



Maximum Depth (+): 19 ft
Source: ALSC 1986

28 Jul 1986 found Utricularia spp., Nuphar sp., and Sphagnum spp. A thermocline was identified between 2 and 3 m on 28 Jul 1986 (ALSC 1987). The AEAP reported an average value of chlorophyll a of 2.92 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: The ALS surveyed the lake on 29 May 1986 and 17 Jun 1998. No fish were caught in either survey. Squash Pond has no history of stocking.

Intensive studies: The RILWAS and NBMR studies surveyed Squash Pond in the early 1980s (Newton, R. M. et al. 1987; Driscoll, C. T. et al. 1987; Schofield, C. L. and Driscoll, C. T. 1987; Driscoll, C. T. and Newton, R. M. 1985). During 1986 and 1987 snowmelt, Schaefer and Driscoll (1993) evaluated episodic acidification at Squash Pond Stream. The pond was one of 20 Adirondack lakes studied to evaluate regional trends in chrysophyte-inferred lake water pH changes (Cumming, B. F. et al. 1994; Smol, J. P. et al. 1998). Squash Pond was a study watershed for an Adirondack/Catskill comparison during 1992 - 2001 (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005). The lake has been studied by the AEAP (Momen, B. et al. 2006). Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995). NBMR evaluated the recovery of fisheries in this water in 2000 (Raynal, D. J. et al. 2004).

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b). The NBMR study sampled this watershed for soils, mineralogy, and chemistry of surficial materials (Newton, R. M. et al.1987).

Deposition: The nearest NADP deposition monitoring site is 5 km south at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 17 km southwest at Nick's Lake.

Watershed: The Squash Pond Stream watershed is entirely underlain by biotite and/or hornblende granite gneiss with low to no ANC (Roy, K. M. et al. 1997). Till overlies 99% of the watershed, with a small outcropping of outwash sand and gravel around the southern tip of the outlet (APA 2001). The highest elevation in the watershed is 760 m. The maximum relief is 107 m. In 1986, the ALS characterized the shoal water substrate as 98% muck/silt/organic and 2% boulders (ALSC 1987).

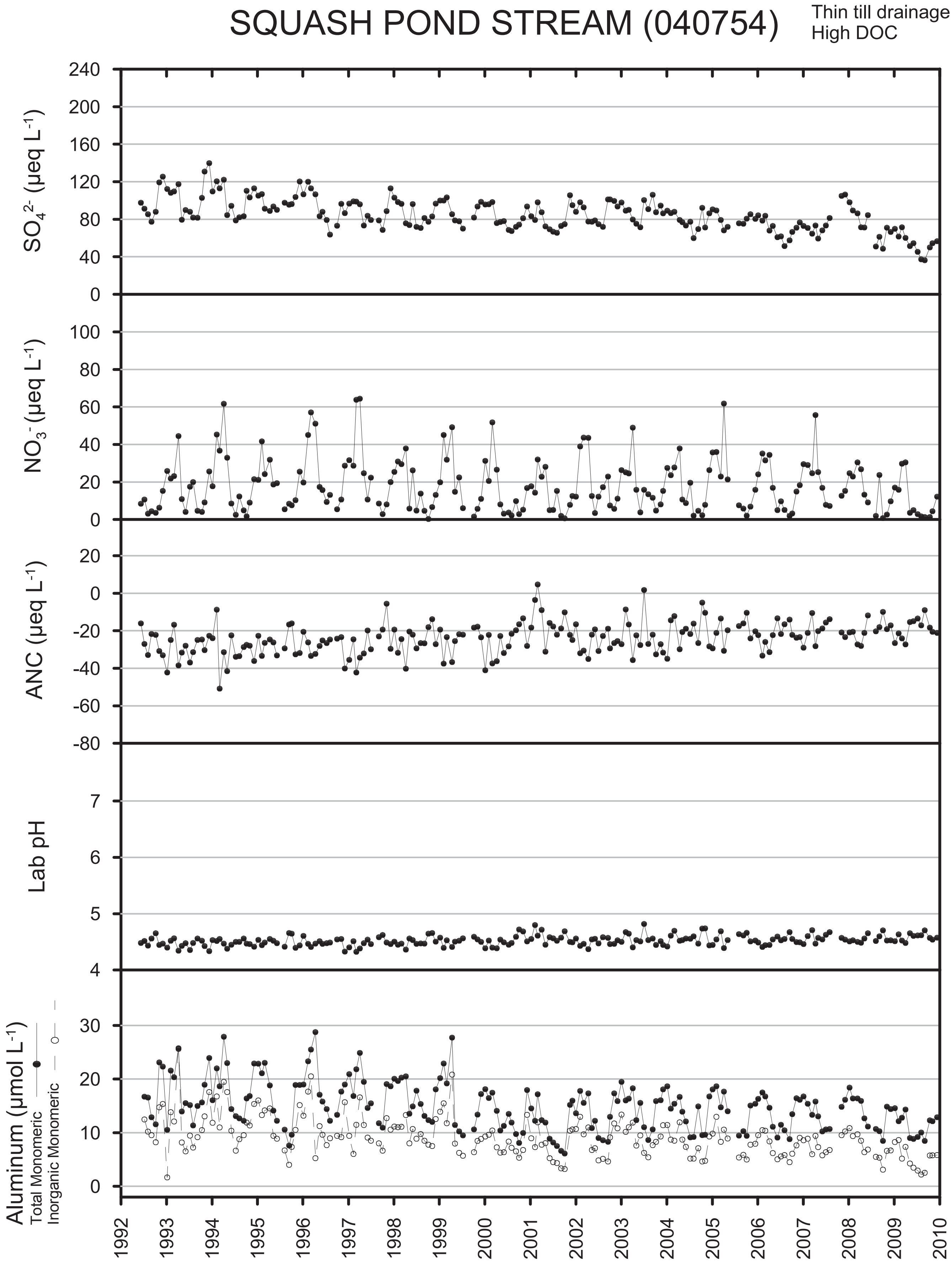
Table 1. Lake/Stream Chemistry (Station 1)

040754			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	79.53	139.91	103.44	36.34	71.40	54.07	µeq L^{-1}
NO_3^-	4.05	44.51	17.60	1.28	30.45	10.45	µeq L^{-1}
Cl^-	4.23	11.00	7.38	3.44	8.46	5.96	µeq L^{-1}
F^-	1.89	3.11	2.47	1.83	2.75	2.15	µeq L^{-1}
ANC	-42.17	-16.77	-29.41	-27.29	-8.91	-19.10	µeq L^{-1}
DIC	3.33	34.97	18.46	12.49	28.31	20.49	µmol L^{-1} -C
DOC	422.61	727.82	567.34	589.04	900.18	712.90	µmol L^{-1} -C
SiO_2	26.30	95.20	61.63	23.27	92.54	56.74	µmol L^{-1}
Ca^{2+}	31.44	56.89	46.37	25.83	35.43	30.12	µeq L^{-1}
Mg^{2+}	12.34	17.28	15.09	8.21	12.34	10.20	µeq L^{-1}
Na^+	12.18	21.75	16.42	12.67	19.57	15.46	µeq L^{-1}
K^+	3.84	8.70	6.61	3.05	6.91	4.80	µeq L^{-1}
NH_4^+	-0.50	8.59	3.03	-0.63	4.60	0.92	µeq L^{-1}
AL_TD	13.71	29.32	21.12	16.27	24.98	20.36	µmol L^{-1}
AL_TM	10.53	25.74	17.30	8.47	14.57	11.38	µmol L^{-1}
AL_OM	0.11	8.97	6.06	3.48	7.83	6.20	µmol L^{-1}
AL_IM	1.67	25.63	11.24	2.18	8.64	5.18	µmol L^{-1}
LABPH	4.33	4.56	4.44	4.48	4.70	4.58	
AIREQPH	4.36	4.59	4.46	4.47	4.70	4.58	
TRUECOLOR	40	80	54	60	120	88	Pt Co

Table 2. Lake Characteristics

Parameter	Value
Elevation	653 m
Maximum depth	5.8 m
Mean depth	1.4 m
Volume	4.5×10^4 m^3
Surface area	3.3 ha
Watershed area	125.1 ha
Watershed ratio	0.03
Hydraulic retention time (year)	0.05
Watershed	Oswegatchie/Black
County, Town	Herkimer, Webb
USGS Quadrangle	Eagle Bay
Land use classification	Private - Rural Use and Fulton Chain Wild Forest

Figure 3. Chemistry Time Series / Station 1



Land use/cover: In 1986, the ALS described the watershed as: 50% deciduous-coniferous mixed forest; 40% deciduous forest; and 10% scrub/sapling (ALSC 1987). Total wetland area is 10.7 ha and comprises 8.5% of the watershed. The lake is surrounded by a scrub shrub wetland fringe. The predominant wetland cover types are emergent marsh (3.1%), forested needle-leaf evergreen (3%), and broad leaf evergreen scrub/shrub (2.4%). A wetland fringe occurs around Silver Dollar Pond, portions of Pocket Pond, along the western inlet of Squash Pond (Roy, K. M. et al. 1996).

Squash Pond is in mixed ownership. Nearly all the pond and watershed lies in the Fulton Chain Wild Forest. The remainder is classified as Rural Use under the Adirondack Park Agency Land Use and Development Plan Map. There is no development in the watershed.

Watershed disturbance: The 1916 fire protection source data show 96.5% of the watershed as green timber with no slash. The watershed was affected by the November 1950 storm that damaged 32% of the area with 50 to 100% blow down. The July 1995 microburst storm caused 0 to 30% change in crowns in 93% of the watershed and 30 to 60% change in crowns in 7% of the watershed (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1986 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns,D.A., McHale,M.R., Driscoll,C.T., and Roy,K.M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Cumming,B.F., Davey,K.A., Smol,J.P., and Birks,H.J.B. 1994. When did acid-sensitive Adirondack lakes (New York, USA) begin to acidify and are they still acidifying? Canadian Journal of Fisheries and Aquatic Sciences 51: 1550-1568.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Driscoll,C.T., Yatsko,C.P., and Unangst,F.J. 1987. Longitudinal and temporal trends in the water chemistry of the North Branch of the Moose River. Biogeochemistry 3: 37-61.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

Newton,R.M., Weintraub,J., and April,R. 1987. The relationship between surface water chemistry and geology in the North Branch of the Moose River. Biogeochemistry 3: 21-35.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of atmospheric deposition of sulfur, nitrogen, and mercury on Adirondack ecosystems. New York State Energy Research and Development Authority No. Final 04-03.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schaefer,D.A. and Driscoll,C.T. 1993. Identifying sources of snowmelt acidification with a watershed mixing model. Water, Air, and Soil Pollution 67: 345-365.

Schofield,C.L. and Driscoll,C.T. 1987. Fish species distribution in relation to water quality gradients in the North Branch of the Moose River Basin. Biogeochemistry 3: 63-85.

Smol,J.P., Cumming,B.F., Dixit,A.S., and Dixit,S.S. 1998. Tracking recovery patterns in acidified lakes: A paleolimnological perspective. Restoration Ecology 6: 318-326.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

This page intentionally left blank.

Constable Pond & Constable Pond Stream 040777

Lat. 43° 49' 50'' N Long. 074° 48' 27'' W

Lake: Constable Pond lies in the Oswegatchie-Black watershed at 580 m. The 20.6 ha pond receives drainage from three lake sub-watersheds: Pigeon Lake (040779); Chub Lake (040778); and an Unnamed Pond (045328). A beaver dam exists on the outlet. The outlet stream flows through an old beaver meadow/wetland complex called Constable Creek, which receives drainage from two additional sub-watersheds: Mays Pond (040775) and an Unnamed Pond (040775A) ultimately flowing into the South Bay of Big Moose Lake (Figure 1). Constable Pond reaches a maximum depth of 4.0 m (Figure 2).

Constable Pond is classified as a thin till chain drainage lake, with low dissolved organic carbon considered sensitive to acidification. Constable Pond Stream (Station 1) is one of 17 original ALTM sites, monitored monthly since June 1982. Station 1 is located approximately 2700 m downstream from the lake outlet just above where Constable Creek flows through a culvert under Higby Road. The ALTM began collecting a monthly sample at Constable Pond (Station 2) in July 1993. Snow cores have been collected monthly in the watershed (Figure 1) since January 1999.

Lake chemistry: Constable Pond was sampled during the ALS on 31 Jul 1984 finding: Lab pH 4.94, ANC -9.0 µeq L^{-1}, SO_4^{2-} 142.41 µeq L^{-1}, NO_3^- 0.16 µeq L^{-1}, Ca^{2+} 77.85 µeq L^{-1}, Mg^{2+} 24.69 µeq L^{-1}, DOC 3.5 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent water chemistry at Constable Pond Stream (Station 1). Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 10 Aug 1984, the ALS aquatic plant survey identified: Eriocaulon spp. and Nymphaea *spp*. Emergent vegetation covered 25% of the lake surface. On 12 Jun 1984, a dip-net survey identified the following Insecta: Odonata Corduliidae and Libellulidae; and Hemiptera Corixidae. On 31 Jul 1984, the lake was isothermal (ALSC 1985).

During the NYSDEC Biota project, the lake had an average chlorophyll a value of 2.97 µg L^{1-}, and an average total phosphorus value of 8.0 µg L^{1-} in July 1984. The phytoplankton community was dominated by a Chrysophcea unidentified spherical cell #2. Collotheca mutabilis was the dominant rotifer and Diaptomus minutus was the dominant crustacean

Figure 1. Catchment

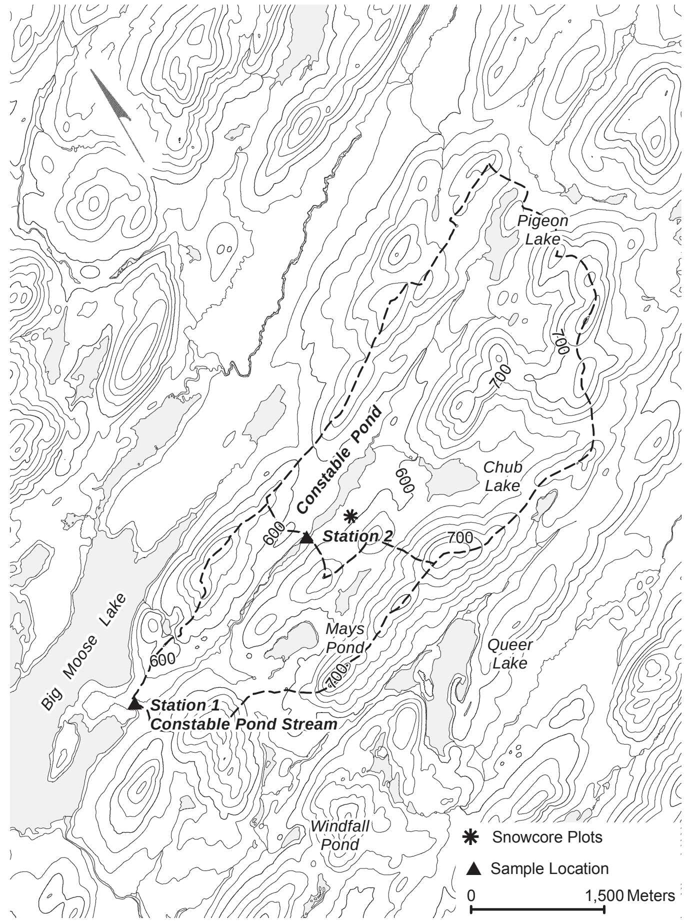
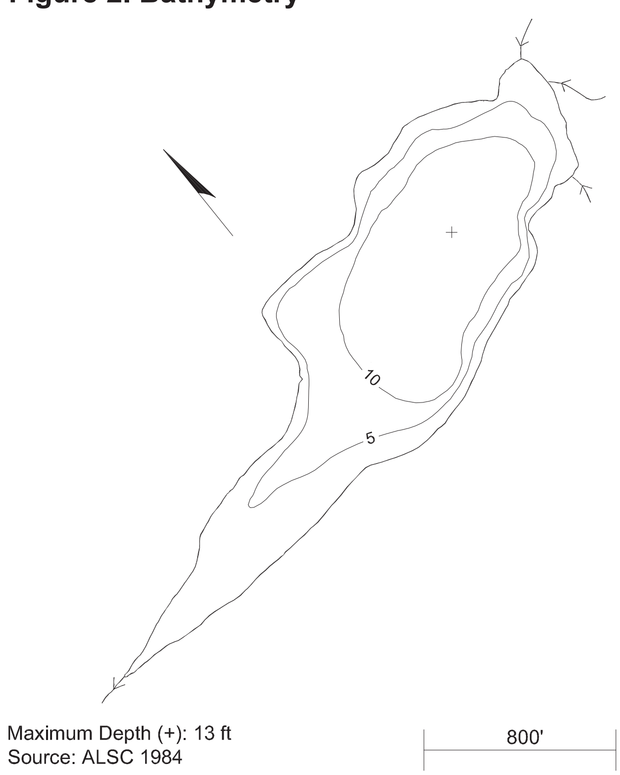


Figure 2. Bathymetry



zooplankton (Sutherland, J. W. 1989). In August 1975, NYSDOH found total phosphorus was 14.9 mg m^{-3} and chlorophyll a was 3.17 µg L^{-1} (Wood, L. W. 1978). In 2003, the AEAP reported the average value of chlorophyll a was 1.79 µg L^{-1} (Momen, B. et al. 2006).

Fisheries: Earliest records show brook trout were stocked in 1932 and 1934 and annually from 1949-1975 (ALSC 1985). No stocking has been recorded since then. During the NBMR study in 1982 - 1983, brown bullhead, yellow perch, and brook trout were captured (Schofield, C. L. and Driscoll, C. T. 1987). The ALTM has surveyed the lake. Refer to Table 3 for recent netting history.

Intensive studies: NYSDOH conducted a limnological survey of Constable Pond in August 1975 (Wood, L. W. 78). Constable Pond Stream was studied during the RILWAS and NBMR in the early 1980s (Newton, R. M. et al. 1987; Driscoll, C. T. et al. 1987; Schofield, C. L. and Driscoll, C. T. 87; Driscoll, C. T. and Newton, R. M. 1985). Constable Pond was surveyed in 1984 as part of the NYSDEC Biota Project (Sutherland, J. W. 1989). During the 1986 and 1987, Schaefer and Driscoll (1993) evaluated snowmelt acidification in Constable Pond Stream. Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Landscape characteristics and disturbance history have been evaluated within this watershed (Sullivan, T. J. et al. 1999). This lake has been studied as part of the AEAP (Momen, B. et al. 2006) and was one of 20 Adirondack lakes evaluated for regional trends in chrysophyte-inferred lake water pH (Cumming, B. F. et al. 1994; Smol, J. P. et al. 1998). Constable Pond was studied as part of the Adirondack/ Catskill comparison study from 1992 - 2001 (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005). During 1999 and 2000, mass-balance studies at three ALTM lakes (Grass, Constable and G) included the establishing of snow core plots in these watersheds (Figure 1). Grass Pond and Constable Pond were

Table 1. Lake/Stream Chemistry (Station 1)

040777			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	103.68	159.06	130.16	53.36	93.77	72.07	µeq L^{-1}
NO_3^-	3.84	46.77	18.91	0.31	30.11	8.08	µeq L^{-1}
Cl^-	6.49	13.82	8.81	4.62	9.51	6.39	µeq L^{-1}
F^-	3.74	5.37	4.29	2.67	3.65	3.21	µeq L^{-1}
ANC	-26.46	33.00	1.33	-2.06	32.64	12.08	µeq L^{-1}
DIC	22.48	87.42	46.48	25.81	70.77	44.07	µmol L^{-1} -C
DOC	318.95	555.90	396.50	394.80	570.27	483.35	µmol L^{-1} -C
SiO_2	53.92	105.52	76.57	27.29	92.37	59.86	µmol L^{-1}
Ca^{2+}	62.88	122.26	90.07	52.44	77.85	61.97	µeq L^{-1}
Mg^{2+}	20.57	34.56	26.95	14.81	23.11	17.83	µeq L^{-1}
Na^+	15.66	33.93	24.11	16.96	26.13	21.08	µeq L^{-1}
K^+	6.65	10.23	8.21	4.35	8.18	5.67	µeq L^{-1}
NH_4^+	0.22	4.60	1.97	-0.75	3.22	0.57	µeq L^{-1}
AL_TD	5.97	21.76	14.57	8.82	16.94	11.33	µmol L^{-1}
AL_TM	2.69	18.83	11.08	3.07	8.82	5.83	µmol L^{-1}
AL_OM	0.70	7.89	3.88	2.35	4.82	3.49	µmol L^{-1}
AL_IM	0.74	13.96	7.21	0.50	4.00	2.34	µmol L^{-1}
LABPH	4.51	6.12	4.94	4.81	6.13	5.21	
AIREQPH	4.54	6.54	4.96	4.83	6.34	5.21	
TRUECOLOR	20	40	28	35	80	53	Pt Co
SCONDUCT	18.95	31.40	24.84	13.79	21.29	16.58	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	580 m
Maximum depth	4.0
Mean depth	2.1 m
Volume	43.5 x 10^4 m^3
Surface area	20.6 ha
Watershed area	937.4 ha
Watershed ratio	0.02
Hydraulic retention time (year)	0.06
Watershed	Oswegatchie/Black
County, Town	Herkimer, Long Lake
USGS Quadrangle	Eagle Bay
Land use classification	Pigeon Lake Wilderness

Figure 3. Chemistry Time Series

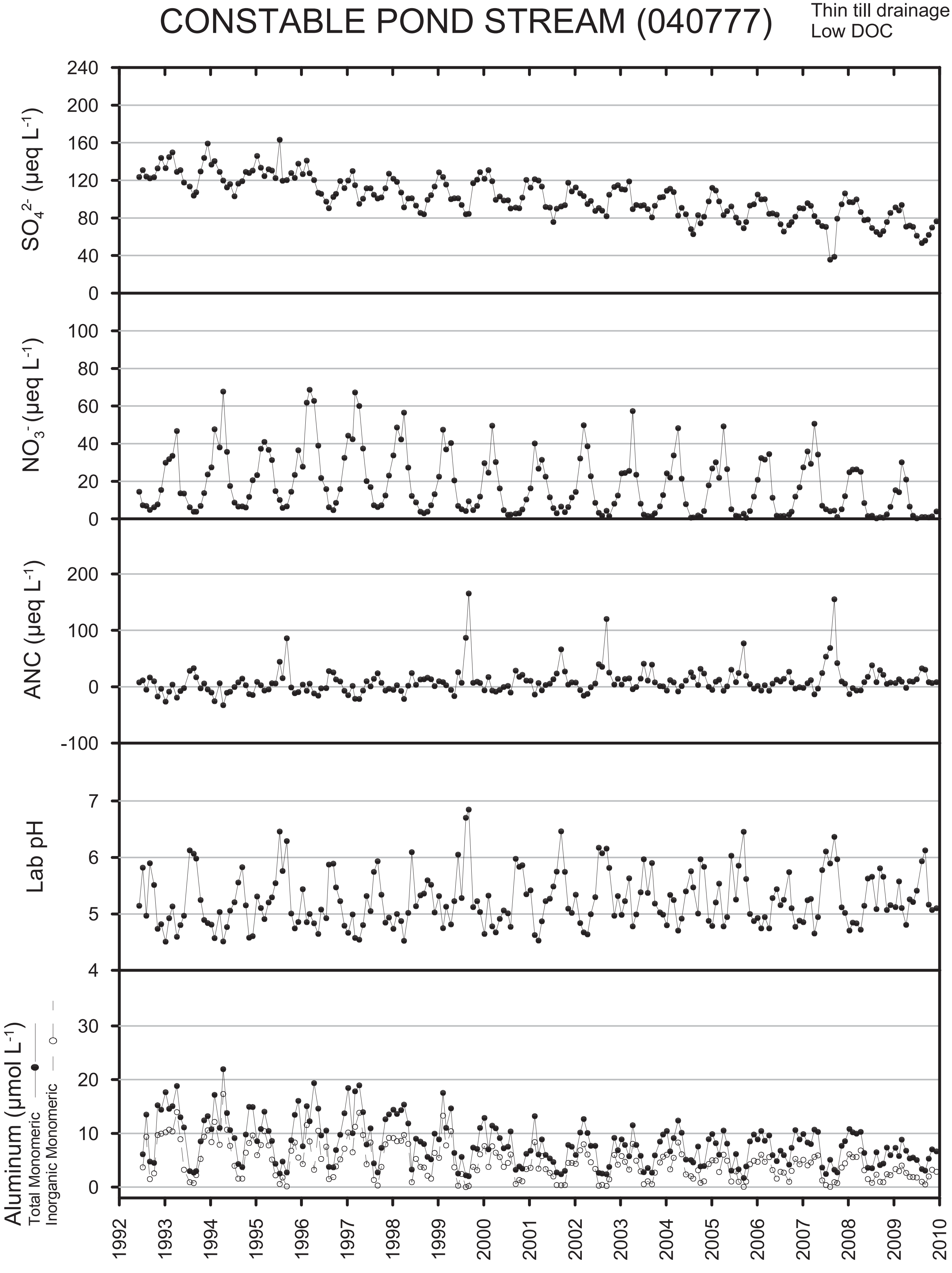


Table 3. Netting History

Date		Number	Length	Length	Weight	Total
			Min	Max		
Month-Year	Species	Measured	(mm)	(mm)	Grams	Number
May-99	Brook trout	27	177	343	3622	28
May-99	Brown bullhead	8	123	241	1091	8
May-99	Pumpkinseed	9	125	184	445	9
May-99	Yellow perch	16	131	157	574	16
June-84	Brown bullhead	2	195	210	340	2

studied intensively for nitrogen dynamics in 1999-2000 (Ito, M. et al. 2006). Fisheries recovery since the NBMR survey was evaluated for this water in 2000 (Raynal, D. J. et al. 2004). The lake is characterized as an example of an acid-sensitive watershed using the biogeochemical model PnET-BGC (Chen, L. and Driscoll, C. T. 2004; Chen, L. et al. 2004). Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: Ito and others conducted a study of surficial geology and soils in the Constable Pond and Grass Pond (040706) watersheds. In 1985, five soils pits, field observations, and aerial photographs were used to map areas of thick till deposits within the Constable Pond watershed (Ito, M. et al. 2006). The NBMR study sampled this watershed for soils, mineralogy, and chemistry of surficial materials (Newton, R. M. et al. 1987). A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 6 km northeast at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 22 km southwest at Nick's Lake.

Watershed: Approximately 63% of the Constable Pond Stream watershed lies on inter-layered metasedimentary rock, granitic gneiss, having medium to high ANC. This area includes Chub Lake, Mays Pond and the Unnamed Pond in between. The remaining 37% of the watershed that contains Pigeon Lake and Constable Pond is over biotite and/or hornblende granite gneiss having low-to-no ANC (Roy, K. M. et al. 1997). The watershed is primarily (84%) overlain by till while 11.3% of the watershed has exposed bedrock. The remaining 4.3% is outwash sand and gravel and appears just above the outlet on the western tip of the watershed. The immediate area around Constable Pond and the majority of the low lying areas draining into it are basal till. An area of hydric soils occurs just north of the lake outlet and along the outlet stream extending to and including the outlet stream from Mays Pond. Rock outcrop and shallow soils predominate in areas above 600 m along the southern end of the watershed (APA 2001). The highest elevation in the watershed is found between Chub Lake and Pigeon Lake at 752 m. The watershed has a maximum relief of 172 m. In 1984, the ALS found the shoal water substrate comprised of 70% rubble and 30% muck/silt (ALSC 1985).

Land cover/use: In 1984, deciduous forest covered 60% of the Constable Pond watershed, deciduous-conifer mixed forest 20%, coniferous forest 10%, and open space 10%. The immediate shoreline was comprised of 30% open grass, 20% wetland, 20% shrub-sapling, 10% deciduous forest, 10% coniferous forest and 10% sand-gravel beach (ALSC 1985). Total wetland area is 88.4 ha comprising 9.4% of the watershed (Roy, K. M. et al. 1996). The predominant wetland cover type is forested needle-leaf evergreen (57.2 ha) and scrub/shrub broad-leaf deciduous (23.4 ha). Wetlands dominate the main inlet and outlet of Constable Pond.

Constable Pond and its watershed occur within the Pigeon Lakes Wilderness Area. The ALTM sampling Station 1 is on private land. There is a foot trail that runs parallel to the south shore of the outlet and along the southern shoreline of the pond.

Watershed disturbance: The 1916 fire protection source data show 96.3% of the Constable Pond watershed as green timber with no slash. The forest age source data show 100% of the watershed as old growth, with no evidence of logging. The November 1950 storm caused 50 to 100% blowdown in 36.4% of the watershed. The July 1995 microburst storm caused forest damage with 72.2% of the watershed showing 0 to 30% change, 21.6% showing 30 to 60% change, and 6.2% of the watershed had 60-100% tree crown damage (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook NY.Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns,D.A., McHale,M.R., Driscoll,C.T., and Roy,K.M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: Comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Chen,L. and Driscoll,C.T. 2004. Modeling the response of soil and surface waters in the Adirondack and Catskill regions of New York to changes in atmospheric deposition and historical land disturbance. Atmospheric Environment 38: 4099-4109.

Chen,L., Driscoll,C.T., Gbondo-Tugbawa,S.S., Mitchell,M.J., and Murdoch,P.S. 2004. The application of an integrated biogeochemical model (PnET-BGC) to five forested watersheds in the Adirondack and Catskill regions of New York. Hydrological Processes 18: 2631-2650.

Cumming,B.F., Davey,K.A., Smol,J.P., and Birks,H.J.B. 1994. When did acid-sensitive Adirondack lakes (New York, USA) begin to acidify and are they still acidifying? Canadian Journal of Fisheries and Aquatic Sciences 51: 1550-1568.

Dixit,S.S., Cumming,B.F., Birks,H.J.B., Smol,J.P., Kingston,J.C., Uutala,A.J., Charles,D.F., and Camburn,K.E. 1993. Diatom assemblages from Adirondack lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Driscoll,C.T., Yatsko,C.P., and Unangst,F.J. 1987. Longitudinal and temporal trends in the water chemistry of the North Branch of the Moose River. Biogeochemistry 3: 37-61.

Ito,M., Mitchell,M.J., Driscoll,C.T., Newton,R.M., Johnson,C.E., and Roy,K.M. 2006. Controls on surface water chemistry in two lake watersheds in the Adirondack region of New York: Differences in nitrogen solute sources and sinks. Hydrological Processes 21: 1249-1264.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

Newton,R.M., Weintraub,J., and April,R. 1987. The relationship between surface water chemistry and geology in the North Branch of the Moose River. Biogeochemistry 3: 21-35.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of atmospheric deposition of sulfur, nitrogen, and mercury on Adirondack ecosystems. New York State Energy Research and Development Authority No. Final 04-03.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schaefer,D.A. and Driscoll,C.T. 1993. Identifying sources of snowmelt acidification with a watershed mixing model. Water, Air, and Soil Pollution 67: 345-365.

Schofield,C.L. and Driscoll,C.T. 1987. Fish species distribution in relation to water quality gradients in the North Branch of the Moose River Basin. Biogeochemistry 3: 63-85.

Smol,J.P., Cumming,B.F., Dixit,A.S., and Dixit,S.S. 1998. Tracking recovery patterns in acidified lakes: A paleolimnological perspective. Restoration Ecology 6: 318-326.

Sullivan,T.J., Charles,D.F., Bernert,J.A., McMartin,B., Vaché,K.B., and Zehr,J. 1999. Relationship between landscape characteristics, history, and lakewater acidification in the Adirondack Mountains, New York. Water, Air, and Soil Pollution 112: 407-427.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Sutherland, J. W. 1989. Field Surveys of the Biota and Selected Water Chemistry Parameters in 50 Adirondack Mountain Lakes. New York State Department of Environmental Conservation No. Final Report, Albany, NY.

Wood, L. W. 1978. Limnology of remote lakes in the Adirondack region of New York State with emphasis on acidification problems. New York State Department of Health, Albany, NY.

This page intentionally left blank.

Limekiln Lake 040826

Lat. 43° 42’ 48’’ N   Long. 074° 48’ 47’’ W

Lake: Limekiln Lake lies in the Oswegatchie-Black watershed at 575 m. Fawn Lake (040827) drains into the lake from the east. A large wetland on the southeastern shore is another major tributary (Figure 1). A small concrete dam constructed on the outlet in 1972 is used to elevate the water level during the summer. Approximately 500 feet downstream, a fish barrier dam was built in 1961 prior to reclamation (NYSDEC 2008). The outlet becomes Limekiln Creek and flows into the South Branch of Moose River. Limekiln Lake has a number of bays and small islands, and reaches a maximum depth of 22 m (Figure 2).

Limekiln Lake is a medium till chain drainage lake, with low dissolved organic carbon. The lake is considered to be moderately sensitive to acidification. The ALTM program began monitoring the lake in June 1992.

Lake chemistry: Limekiln Lake was sampled during the ALS survey on 22 Jul 1985 finding: Lab pH 6.06, ANC 8.9 µeq L^{-1}, SO_4^{2-} 119.72 µeq L^{-1}, NO_3^- 4.37 µeq L^{-1}, Ca^{2+} 111.78 µeq L^{-1}, Mg^{2+} 30.45 µeq L^{-1}, DOC 2.7 mg L^{-1} -C (ALSC 1986). Table 1 summarizes recent water sample chemistry taken at the outlet. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 14 Oct 1985, the ALS reported no emergent aquatic plants, and the following submergent plants were found: Eriocaulon spp. and Utricularia spp. The dip-net sampling found: Insecta: Odonata Coenagriidae and Ephemeroptera Leptophlebiidae; Crustacea Amphipoda Unspecified; and Hirudinea Unspecified (ALSC 86). The ALS found the lake thermally stratified between 12 and 14 m on 22 Jul 1985 (ALSC 1986). Bukavecas and Shaw (1998) found phosphorus as the limiting nutrient and a chlorophyll a average of 0.69 µg L^{-1} during 1990 and 1991. The AEAP reported the average value of chlorophyll a as 1.90 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Figure 1. Catchment

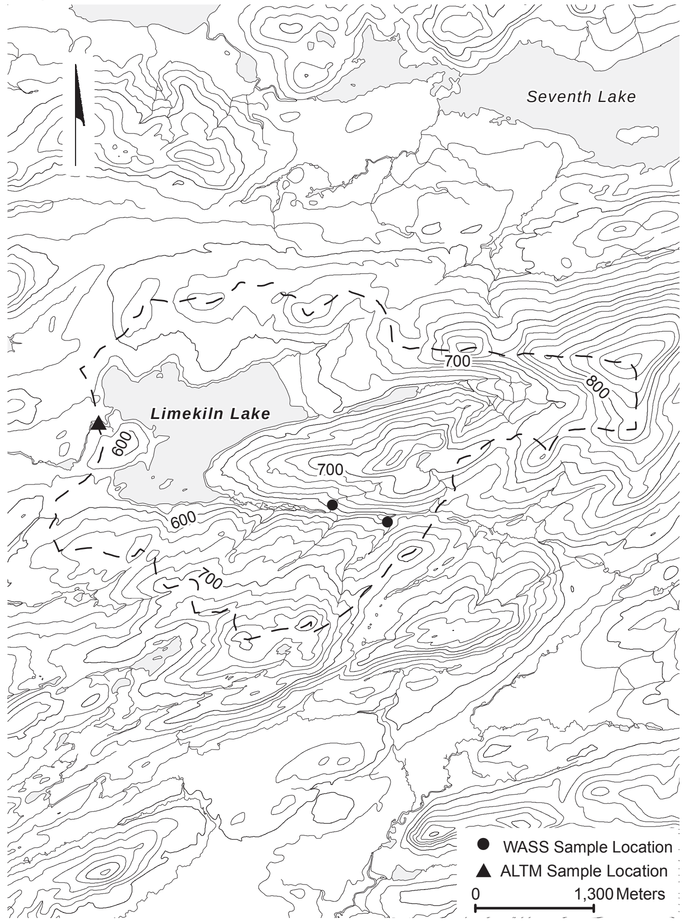
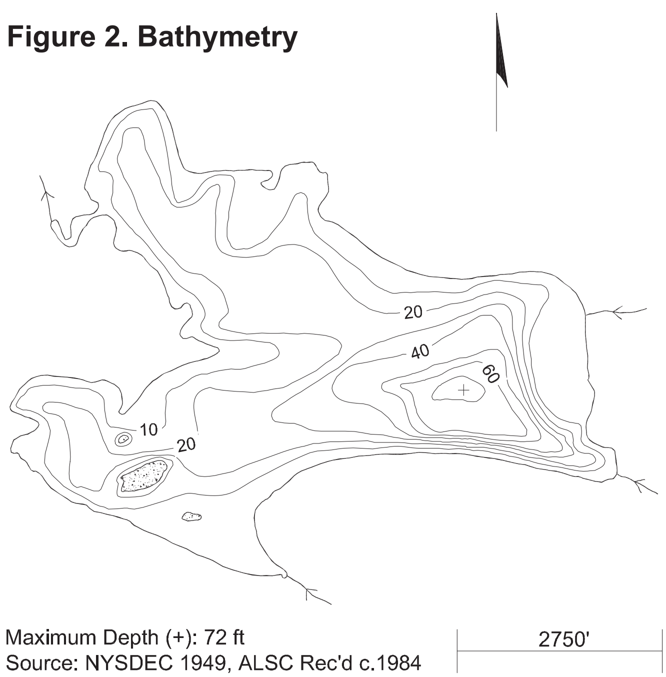


Figure 2. Bathymetry



Maximum Depth (+): 72 ft
Source: NYSDEC 1949, ALSC Rec'd c.1984

Fisheries: Early records show brook trout stocking began in 1888. Stocking from 1888-1985 have included a mix of species (ALSC 1986). The ALTM found a mix of species in recent nettings. Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: A phytoplankton and zooplankton experiment was conducted in 1990 (Bukaveckas, P. and Shaw, W. 1998). Limekiln Lake was studied by the Mercury Response Project to evaluate mercury in fish. It was sampled on 1 Oct 1992 and resurveyed on 7 Sep 2006 (Dittman, J. A. and Driscoll, C. T. 2009). The lake has been studied by the AEAP since 1994 (Momen, B. et al. 2006). Common loons were surveyed for mercury content in 1998-2000 (Schoch, N. and Evers, D. C. 2002) and in 2003 - 2004 (Schoch, N. et al. 2004). Limekiln Lake was sampled by the Statewide Monitoring of Mercury Project in 2004 (Simonin, H. et al. 2008). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed. Two WASS streams studied during 2003-2005 (Lawrence et al. 2008) are located in this watershed (Figure 1).

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 9 km northwest at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 14 km west at Nick's Lake.

Watershed: The Limekiln Lake watershed lies on interlayered metasedimentary rock and granitic gneiss with medium to high ANC (Roy, K. M. et al. 1997). Till overlays 72.0% of the watershed while approximately 23% of the watershed has exposed bedrock, the remaining 4.7% is kame deposits. Soils data show 48% of the watershed as basal till primarily in the south, while shallow to bedrock and rock outcrop appear in the east (37%) above 600 m. A small area of hydric soils (1%) appears on the western shoreline of the lake and by the outlet. The highest elevation in the watershed is on Seventh Lake Mountain at 888 m. The maximum relief is 313 m. In 1985, the ALS found the shoal water substrate composed of 85% sand and gravel, 13% bedrock, boulder and rubble, and 2% muck/silt (ALSC 1986).

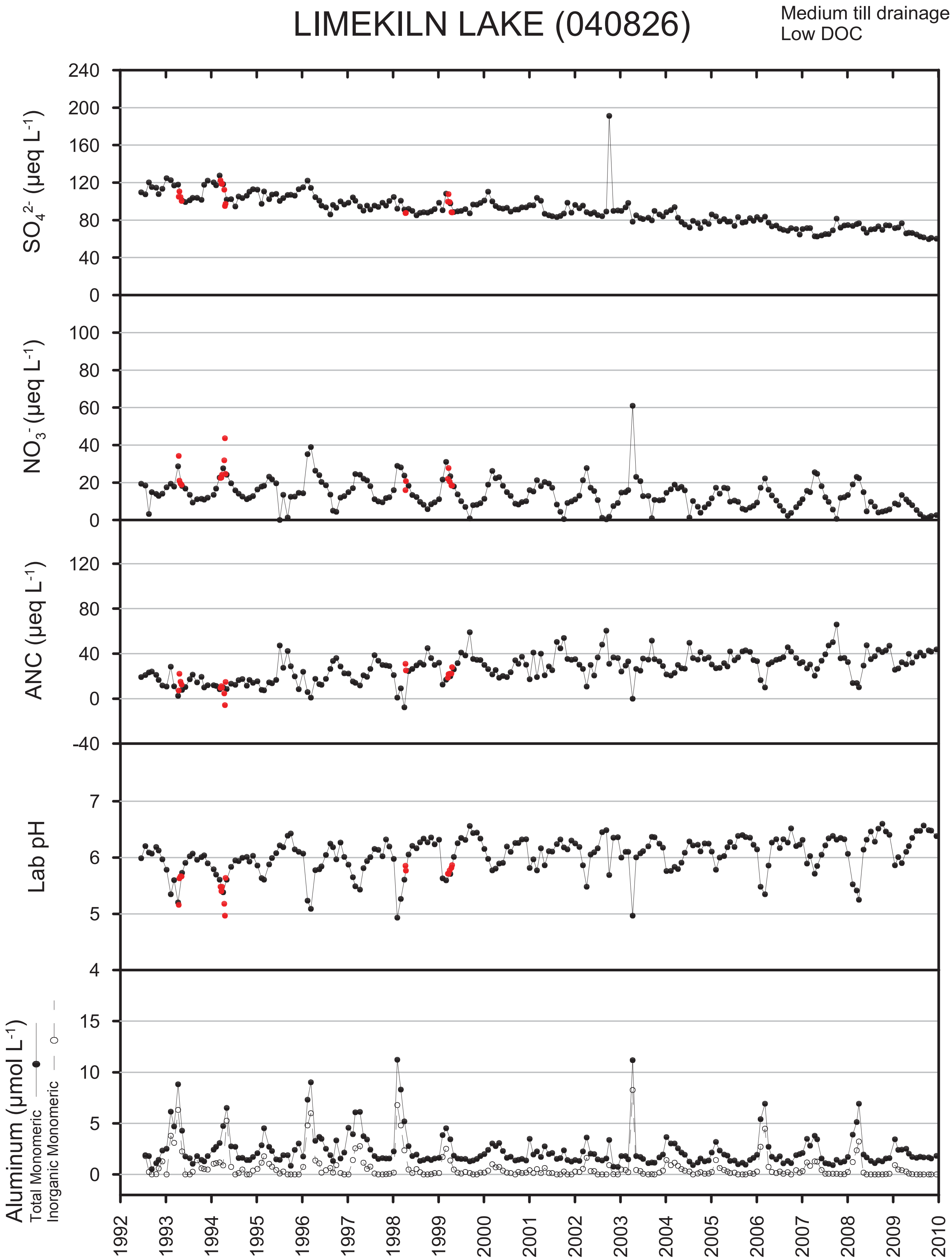
Table 1. Lake Chemistry

040826			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	99.31	124.71	111.06	59.68	76.69	65.71	µeq L^{-1}
NO_3^-	9.39	28.67	15.53	1.48	13.39	6.24	µeq L^{-1}
Cl^-	18.90	25.39	21.98	16.62	19.52	18.73	µeq L^{-1}
F^-	2.26	3.21	2.73	2.33	3.33	2.67	µeq L^{-1}
ANC	2.58	28.37	13.78	25.72	43.79	36.05	µeq L^{-1}
DIC	28.31	95.74	51.69	44.96	94.08	66.52	µmol L^{-1} -C
DOC	167.76	285.82	224.69	245.85	324.95	275.69	µmol L^{-1} -C
SiO_2	28.46	61.75	42.54	32.37	54.42	43.32	µmol L^{-1}
Ca^{2+}	69.37	113.78	97.69	74.85	86.33	82.87	µeq L^{-1}
Mg^{2+}	26.33	31.27	29.08	21.39	24.71	23.42	µeq L^{-1}
Na^+	26.97	32.62	30.09	23.49	31.75	29.15	µeq L^{-1}
K^+	5.63	7.16	6.48	4.09	5.88	4.79	µeq L^{-1}
NH_4^+	-0.61	1.83	0.89	-0.35	2.22	0.43	µeq L^{-1}
AL_TD	1.11	10.04	4.35	0.71	6.67	3.06	µmol L^{-1}
AL_TM	1.03	8.83	3.10	1.57	3.45	2.06	µmol L^{-1}
AL_OM	0.42	11.04	2.30	1.67	2.52	1.92	µmol L^{-1}
AL_IM	0.00	6.32	1.56	0.00	0.93	0.19	µmol L^{-1}
LABPH	5.20	6.07	5.70	5.86	6.57	6.20	
AIREQPH	5.27	6.31	5.83	6.28	6.72	6.55	
TRUECOLOR	5	20	12	15	25	21	Pt Co
SCONDUCT	20.23	23.76	21.63	16.32	19.05	17.26	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	575 m
Maximum depth	21.9
Mean depth	6.1 m
Volume	1147.6 x 10^4 m^3
Surface area	186.9 ha
Watershed area	1409.7 ha
Watershed ratio	0.13
Hydraulic retention time (year)	1.07
Watershed	Oswegatchie/Black
County, Town	Herkimer, Ohio
USGS Quadrangle	Old Forge
Land use classification	Moose River Plains Wild Forest

Figure 3. Chemistry Time Series



Land cover/ use: In 1985, the forest cover within the watershed was: 90% deciduous forest; 7% deciduous-coniferous mixed forest; and the remaining 3% coniferous forest (ALSC 1986). Wetland area was 58.1 ha and comprised 4.1% of the watershed. The predominant wetland cover type is forested needle-leaf evergreen (ALSC 2003).

The eastern shore of Limekiln Lake is classified as Rural Use and is privately owned and developed with numerous houses and camps. There is a NYSDEC campground along the northern shore, in an Intensive Use area, that offers a sandy beach and a paved boat launch. The remaining shoreline falls within the Moose River Plains Wild Forest (NYSDEC 2006).

Watershed disturbance: The 1916 fire protection source data show 70% of the watershed as logged for softwood only and 30% logged for both softwood and hardwood. The watershed was significantly disturbed by the November 1950 storm with 33% of the watershed suffering severe (50-100%) blowdown damage and 31%

Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Splake	5000	74
1982	Splake	3790	96
1983	Splake	4210	411
1984	Splake	5000	422
1985	Splake	5000	409
1986	Splake	3500	290
1987	Splake	5280	307
1987	Brook trout	13790	38
1988	Splake	5000	355
1989	Splake	5000	383
1990	Splake	8700	520
1991	Splake	5000	284
1992	Splake	3250	194
1992	Brown trout	13000	873
1993	Splake	4240	110
1993	Brown trout	8500	443
1994	Brown trout	8500	143
1995	Splake	1300	147
1995	Brown trout	8500	77
1996	Splake	1880	1033
1996	Brown trout	8500	556
1997	Brown trout	9000	1214
1997	Splake	2000	995
1998	Brown trout	4040	762
1998	Splake	3400	1318
1999	Splake	2000	345
2000	Splake	2000	305
2001	Splake	2000	151
2002	Splake	2000	244
2003	Splake	2000	256
2004	Splake	2000	233
2005	Splake	1620	152
2006	Splake	1730	205

Table 4. Netting History

Date Month-Year	Species	Number Measured	Min Length	Max Length	Weight Grams	Total Number
June-04	Splake	68	204	428	13170	69
June-04	Golden shiner	27	108	166	621	100
June-04	White sucker	2	395	450	2540	2
June-04	Brown bullhead	25	165	300	6443	59
June-04	Banded killifish	23	75	102	-	93
June-04	Rock bass	26	110	188	1489	86
June-04	Pumpkinseed	25	78	155	703	91
June-04	Yellow perch	20	125	229	943	20
October-85	Splake	26	203	286	2681	49
October-85	Golden shiner	24	137	180	1095	33
October-85	White sucker	26	207	414	13110	28
October-85	Brown bullhead	25	196	274	3800	241
October-85	Rock bass	26	76	217	1513	34
October-85	Pumpkinseed	16	112	151	670	19
October-85	Yellow perch	28	149	212	1400	86

moderately (25-50%) disturbed. The July 1995 microburst storm source data show 40% of the watershed with low (0-30% change in crowns) damage (ALSC 03). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1986. Adirondack Lakes Survey 1985 Field Studies Report Volumes 6-10. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Bukaveckas,P. and Shaw,W. 1998. Phytoplankton responses to nutrient and grazer manipulations among northeastern lakes of varying pH. Canadian Journal of Fisheries and Aquatic Sciences 55: 958-966.

Dittman,J.A. and Driscoll,C.T. 2009. Factors influencing changes in mercury concentrations in lake water and yellow perch (*Perca flavescens*) in Adirondack lakes. Biogeochemistry 93: 179-196

Lawrence, G. B., Baldigo, B. P., Roy, K. M., Simonin, H. A., Bode, R. W., Passy, S. I., and Capone, S. B. 2008. Results from the 2003-2005 Western Adirondack Stream Survey. 08-22. New York State Energy Research and Development Authority, Albany, NY.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

New York State Department of Environmental Conservation (NYSDEC) 2006. Moose River Plains Wild Forest Proposed Final Unit Management Plan. New York State Department of Environmental Conservation, Ray Brook, NY.

New York State Department of Environmental Conservation (NYSDEC) 2008. Moose River Plains Wild Forest Unit Management Plan (Draft – personal communication). New York State Department of Environmental Conservation, Ray Brook, NY.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schoch, N., Evers, D., Simonin, H., Glennon, Michale, and Adams, David 2004. Long-Term Monitoring and Assessment of Mercury Based on Integrated Sampling Efforts Using the Common Loon, Prey Fish, Water, and Sediment. Wildlife Conservation Society, New York, NY.

Schoch, N. and Evers, D. C. 2002. Monitoring Mercury in Common Loons: New York Field Report, 1998-2000. BioDiversity Research Institute No. BRI 2001-01. BioDiversity Research Institute, Falmouth, ME.

Simonin, H., Loukmas, J., Skinner, L., and Roy, K. 2008. Strategic Monitoring of Mercury in New York State Fish: Final Report 08-11. New York State Energy Research and Development Authority No. Report 08-11.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Squaw Lake 040850

Lat. 43° 38’ 10’’ N   Long. 074° 44’ 20’’ W

Lake: Squaw Lake lies in the Oswegatchie-Black watershed at 646 m. This 36.4 ha lake has three inlets and drains north into Beaver Lake 2 km downstream (Figure 1). During the 1984 survey of Squaw Lake, an active beaver dam was present at the outlet (ALSC 1985). The lake has a number of islands and reaches a maximum depth of 6.7 m (Figure 2).

Squaw Lake is classified as a thin till chain drainage lake, with low dissolved organic carbon considered sensitive to acidification. The ALTM program began monitoring this lake in June 1992. This lake is accessed by helicopter.

Lake chemistry: Squaw Lake was sampled during the ALS on 13 Aug 1984 finding: Lab pH 6.05, ANC 13.8 µeq L^{-1}, SO_4^{2-} 122.01 µeq L^{-1}, NO_3^- 1.62 µeq L^{-1}, Ca^{2+} 92.82 µeq L^{-1}, Mg^{2+} 36.21 µeq L^{-1}, DOC 2.9 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 18 Sep 1984, the ALS found emergent vegetation occupied 1% of the lake surface. Species identified included Sphagnum spp., Carex spp. and Eriocaulon spp. A dip net survey on 20 Sep 1984 found the following Insecta: Odonata Libellulidae and Aeshnidae; Hemiptera Notonectidae and Gerridae; Diptera Unspecified; Coleoptera Dytiscidae; and Trichoptera Phryganeidae. Also found were Crustacea Amphipoda Unspecified and Decapoda Astacidae; Oligochae Unspecified and Hirudinea Unspecified. The ALS found the lake isothermal on 13 Aug 1984 (ALSC 1985).

In 1984, the NYSDEC Biota Project found summer average values for: chlorophyll a of 2.6 µg L^{-1}; total phosphorus of 13.0 µg L^{-1}, and a Secchi depth of 3.5 m. A thermocline was observed at 5.0 m in July. The phytoplankton community was dominated by Unknown spherical chrysophyte cells and Schroederia setigera in May, and Merismopedia tenuissima in July and October. Keratella taurocephala was the dominant rotifer and Diaptomus minutus was the dominant crustacean zooplankton during all three months (Sutherland, J. W. 1989).

Figure 1. Catchment

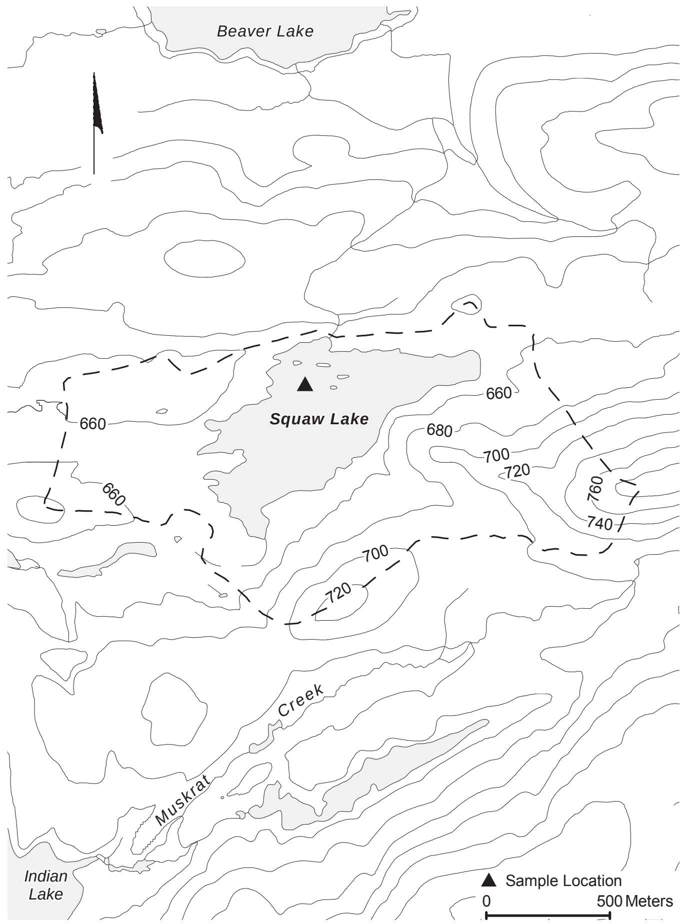
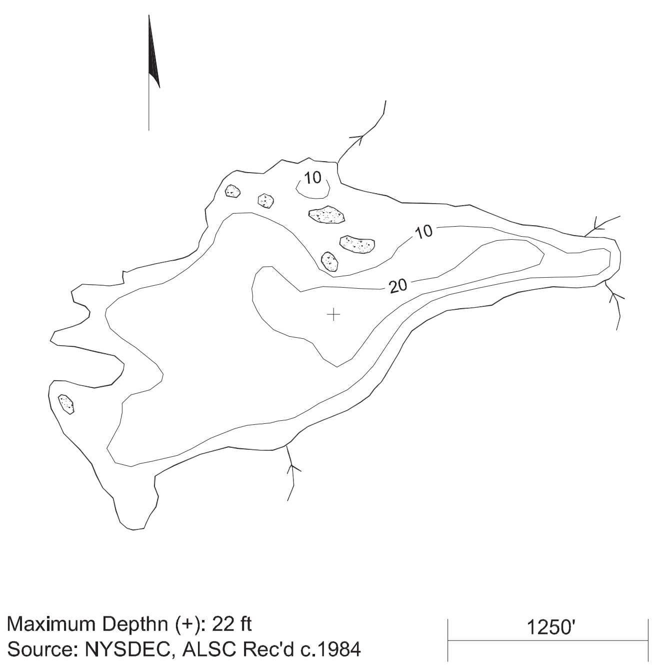


Figure 2. Bathymetry



In August 1975, NYSDOH found total phosphorus at 4.7 mg m^{-3} and total chlorophyll a at 7.90 µg L^{-1} (Wood, L. W. 1978). The AEAP reported the average value of chlorophyll a at 2.86 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: Early records indicate lake trout were stocked in 1899 and that brook trout were stocked annually from 1942-1984 (ALSC 85). Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: NYSDOH conducted a limnological survey of Squaw Lake in August 1975 (Wood, L. W. 78). The lake was surveyed by the Biota Project between 1982 and 1984 (Sutherland, J. W. 89). The AEAP (Momen, B. et al. 2006) has studied aquatic biota in this lake as has the Adirondack Cooperative Loon Project (Schoch, N. et al. 2004). This watershed has been analyzed using the integrated biogeochemical (PnET-BGC) model (Zhai, J. 2006). Squaw Lake was sampled by EPA's EMAP in 1991 and 1997. Since 1999, the lake is sampled annually by the ALSC as part of the TIME project (Stoddard, J. L. et al. 2003). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 19 km northwest at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 21 km west at Nick's Lake.

Watershed: The Squaw Lake watershed lies on interlayered metasedimentary rock and granitic gneiss considered to have medium to high ANC (Roy, K. M. et al. 1997). Till overlies 99.9% of the watershed and exposed bedrock accounts for the remaining surface area (ALSC 2003). Bedrock outcrop and shallow (<0.5m) soils predominate at elevations above 700 m and cover approximately 20% of the watershed. The rest of the watershed is basal till (APA 2001). The watershed has a maximum elevation of 795 m on the south ridge. The maximum relief is 149 m. In 1984, the ALS described the shoal water substrate as 15% bedrock/boulder, 45% rubble/gravel and 40% muck/silt/organic (ALSC 1985).

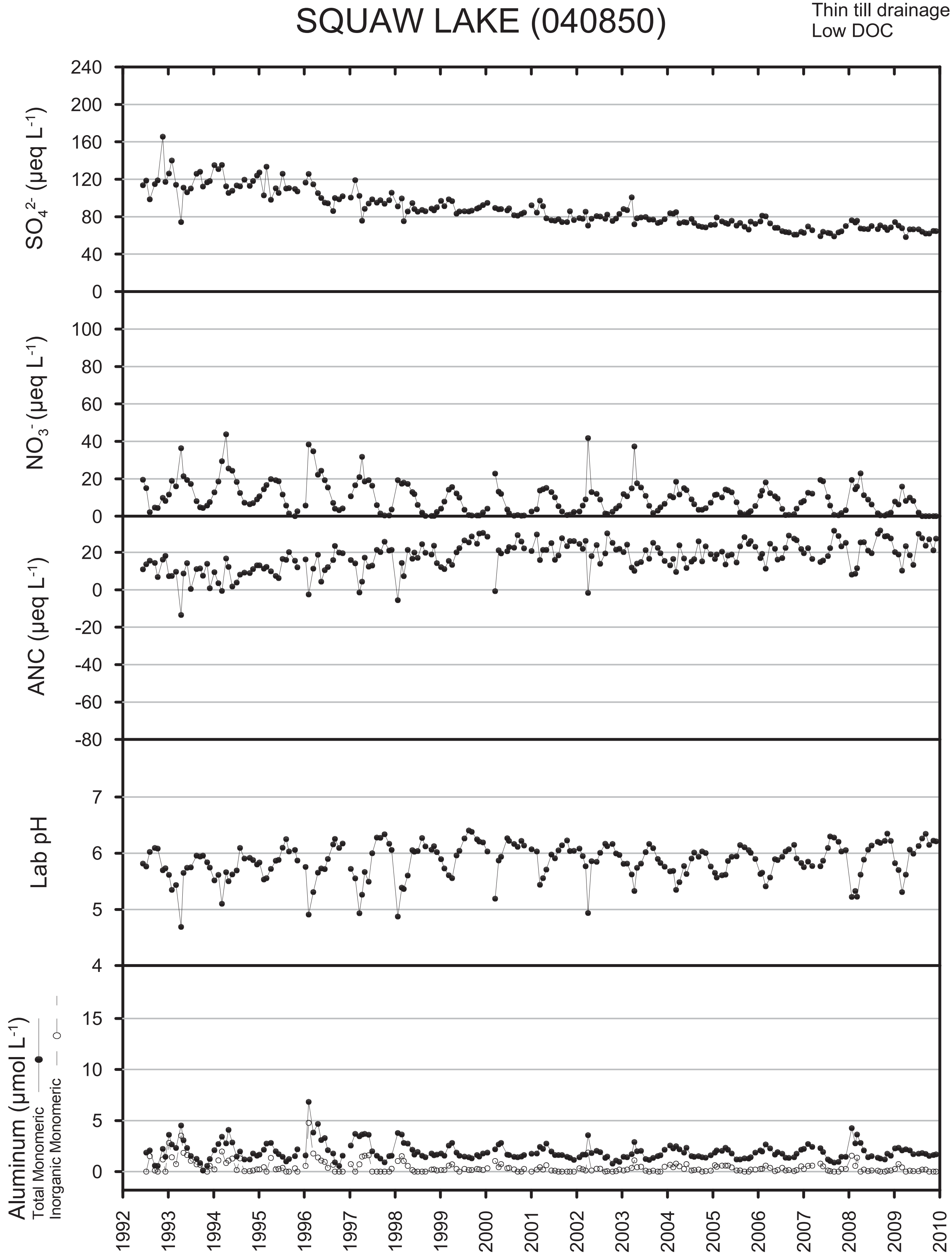
Table 1. Lake Chemistry

040850			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	74.12	140.12	115.20	58.39	74.11	65.67	µeq L^{-1}
NO_3^-	4.39	36.29	14.28	0.00	15.81	4.85	µeq L^{-1}
Cl^-	6.77	9.87	8.37	5.72	7.25	6.45	µeq L^{-1}
F^-	1.84	4.32	2.28	1.68	2.65	2.14	µeq L^{-1}
ANC	-13.45	14.27	6.55	10.15	29.87	21.71	µeq L^{-1}
DIC	10.82	99.07	43.85	33.24	149.03	61.88	µmol L^{-1} -C
DOC	185.08	300.64	226.02	213.88	293.23	251.32	µmol L^{-1} -C
SiO_2	3.99	37.95	21.51	9.13	35.62	22.85	µmol L^{-1}
Ca^{2+}	65.37	125.76	95.11	56.39	72.36	64.68	µeq L^{-1}
Mg^{2+}	20.57	39.50	34.15	23.04	29.62	26.34	µeq L^{-1}
Na^+	11.31	18.70	14.90	13.48	17.83	15.18	µeq L^{-1}
K^+	4.09	7.42	5.35	3.58	4.59	4.14	µeq L^{-1}
NH_4^+	0.11	4.99	2.14	-0.76	4.38	0.59	µeq L^{-1}
AL_TD	0.30	5.30	2.71	0.17	3.41	1.69	µmol L^{-1}
AL_TM	0.13	4.52	2.01	1.53	2.33	1.90	µmol L^{-1}
AL_OM	-0.13	1.56	0.75	1.54	2.33	1.78	µmol L^{-1}
AL_IM	0.00	3.52	1.26	0.00	0.74	0.16	µmol L^{-1}
LABPH	4.69	5.96	5.44	5.31	6.34	5.87	
AIREQPH	4.77	6.13	5.57	5.58	6.44	6.17	
TRUECOLOR	5	20	11	15	25	22	Pt Co
SCONDUCT	18.75	23.66	20.22	13.34	15.67	14.20	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	646 m
Maximum depth	6.7 m
Mean depth	3.4 m
Volume	124.9 x 10^4 m^3
Surface area	36.4 ha
Watershed area	182.7 ha
Watershed ratio	0.20
Hydraulic retention time (year)	0.77
Watershed	Oswegatchie/Black
County, Town	Hamilton, Morehouse
USGS Quadrangle	Wakely Mtn.
Land use classification	Moose River Plains Wild Forest

Figure 3. Chemistry Time Series



Land cover/use: In 1984, deciduous forest covered 80% of the watershed and coniferous forest 20%. The immediate shoreline was described as primarily coniferous forest 55%, deciduous forest 35%, shrub/saplings 5% and boulder/rock ledge 5% (ALSC 1985). Total wetland area was 33.9 ha and comprised 11.6% of the watershed. The predominant wetland vegetation types are forested needle-leaf evergreen (22 ha) and scrub/shrub broad leaf deciduous (10.3 ha) and found primarily in the western area of the watershed (Roy, K. M. et al. 1996). The lake is located within the Moose River Plains Wild Forest. A trail leads to the pond and a number of primitive campsites.

Watershed disturbance: The 1916 fire protection source data show 100% of the watershed as green timber with no slash. In November 1950, the watershed was disturbed by a storm that caused 50 to 100% blowdown in 44 % of the watershed. A July 1995 microburst storm damaged 100% of the watershed with a 0 to 30% change in forest crown (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	2625	32
1981	Brook trout	3780	57
1982	Brook trout	4200	33
1983	Brook trout	4200	29
1984	Brook trout	3108	32
1985	Brook trout	4620	68
1986	Brook trout	4200	49
1987	Brook trout	4200	39
1988	Brook trout	4200	36
1989	Brook trout	4620	30
1990	Brook trout	4580	21
1991	Brook trout	4200	52
1992	Brook trout	4200	45
1993	Brook trout	4200	66
1994	Brook trout	3320	42
1995	Brook trout	3910	81
1996	Brook trout	4200	175
1997	Brook trout	4410	296
1998	Brook trout	4410	126
1999	Brook trout	4200	54
2000	Brook trout	4200	54
2001	Brook trout	3740	63
2002	Brook trout	4200	99
2003	Brook trout	4200	99
2004	Brook trout	3000	71
2005	Brook trout	3000	71
2006	Brook trout	3300	60

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
October-94	Brook trout	15	115	465	6030	15
October-94	Blacknose dace	2	90	95	16	2
October-94	Creek chub	3	103	172	100	3
October-94	White sucker	50	90	283	3152	87
September-84	Brook trout	11	204	415	5250	11
September-84	White sucker	4	160	311	467	63
September-84	Creek chub	2	-	-	145	2

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

NYS DEC. Icing Zones. 1998. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. Final Report to EPA, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. U.S. Environmental Protection Agency Final Report to EPA, Ray Brook, NY.

Schoch, N., Evers, D., Simonin, H., Glennon, Michale, and Adams, D. 2004. Long-term monitoring and assessment of mercury based on integrated sampling efforts using the common loon, prey fish, water, and sediment. New York State Energy Research and Development Authority, Albany, NY.

Stoddard, J. L., Kahl, J. S., Deviney, F. A., DeWalle, D. R., Driscoll, C. T., Herlihy, A. T., Kellogg, J. H., Murdoch, P. S., Webb, J. R., and Webster, K. E. 2003. Response of surface water chemistry to the clean air act amendments of 1990. United States Environmental Protection Agency No. EPA620/R-03/001.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Sutherland, J. W. 1989. Field Surveys of the Biota and Selected Water Chemistry Parameters in 50 Adirondack Mountain Lakes. New York State Department of Environmental Conservation No. Final Report. New York State Department of Environmental Consevation, Albany, NY.

Wood, L. W. 1978. Limnology of remote lakes in the Adirondack region of New York State with emphasis on acidification problems. New York State Department of Health, Albany, NY.

Zhai,J. Regional application of PnET-BGC to lake-watersheds of the Adirondacks, NY to investigate past and future response to acidic deposition. Master of Science in Environmental Engineering thesis, Syracuse University.

Indian Lake 040852

Lat. 43° 37' 24" N Long. 074° 45' 44" W

Lake: Indian Lake lies in the Oswegatchie-Black watershed at 654 m. The 32 ha lake has four inlets, two of which are associated with a wetland at the southwest corner of the lake. The main inlet drains from the east and contains a stream sampled during the Western Adirondack Stream Survey (WASS) in 2003-2005 (Figure 1). In 1984, beaver dams were noted at two of the inlets (ALSC 1985). The source of the major inlet on the eastern shore of the lake drains from Muskrat Pond (040853). The lake has a maximum depth of 10.7 m (Figure 2).

Indian Lake is classified as a thin till chain drainage lake, with low dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. This lake is accessed by helicopter.

Lake chemistry: Indian Lake was sampled during the ALS on 07 Aug 1984 finding: Lab pH 4.88 ANC -6.0 µeq L^{-1}, SO_4^{2-} 117.63 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 69.37 µeq L^{-1}, Mg^{2+} 23.04 µeq L^{-1}, DOC 4.3 mg L^{-1}-C (ALSC 1985). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 17 Sep 1984, the ALS found submergent vegetation covered 5% of the lake bottom and floating vegetation occupied 10% of the lake surface. Plant species identified included: Sphagnum spp., Sparganium spp., Potamogeton spp., Eriocaulon spp., Nuphar spp. and Utricularia spp. A dip net survey on 18 Sep 1984 found the following Insecta: Odonata Libellulidae and Coenagriidae; Hemiptera Notonectidae and Corixidae; Coleoptera Dytiscidae; and Trichoptera Polycentropodidae. Also found were Demospong Haplosclerina spongillidae; and Crustacea Amphipoda Unspecified; and Decapoda Astacidae (ALSC 1985). On 08 Aug 1984, the ALS found the lake stratified between 2 and 4 m (ALSC 1985).

The NYSDEC Biota Project sampled the lake on 09 Jul 1984 and found a chlorophyll a value of 2.38 µg L^{-1}, a total phosphorus value of 11µg L^{-1}, and a Secchi depth of 3.5 m. In May, July, and October of 1984, the phytoplankton community was dominated by Unknown spherical chrysophyte cells, Merismopedia tenuissima, and Unknown elliptical flagellate #1,

Figure 1. Catchment

Figure 2. Bathymetry

Maximum Depth (+): 35 ft
Source: NYSDEC, ALSC Rec'd c.1984

respectively. Karatella taurocephala was the dominant rotifer during all three months and Diaptomus spp., Diaptomus minutus, and Bosmina longirostris were the dominant crustacean zooplankton, respectively (Sutherland, J. W. 1989).

In August 1975, NYSDOH found total phosphorus at 14.4 mg m^{-3} and chlorophyll a at 1.56 µg L^{-1} (Wood, L. W. 1978). The AEAP reported the average summer value of chlorophyll a in 2003 as 1.70 µg L^{-1} (Momen, B. et al. 2006).

Fisheries: Brook trout were stocked annually from 1942-1982. Lake trout were stocked in 1947 and in 1982. Atlantic salmon were stocked in 1981 (ALSC 1985). Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: NYSDOH conducted a limnological survey of Indian Lake in August 1975 (Wood, L. W. 1978). Indian Lake was surveyed by the Biota Project during 1984 (Sutherland, J. W. 1989). The integrated biogeochemical (PnET-BGC) model has been applied to this lake (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005; Zhai, J. 2006). Indian Lake was sampled as part of EPA's EMAP in 1991, 1994, and 1997. Since 1999, the lake is sampled annually as part of the TIME project (Stoddard, J. L. et al. 2003). It is an AEAP study lake (Momen, B. et al. 2006). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed. One of the headwater streams of Indian Lake (Figure 1.) was evaluated during the Western Adirondack Stream Survey (WASS) in 2003-2005 (Lawrence, G. B. et al. 2008).

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 20 km north at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 19 km west at Nick's Lake.

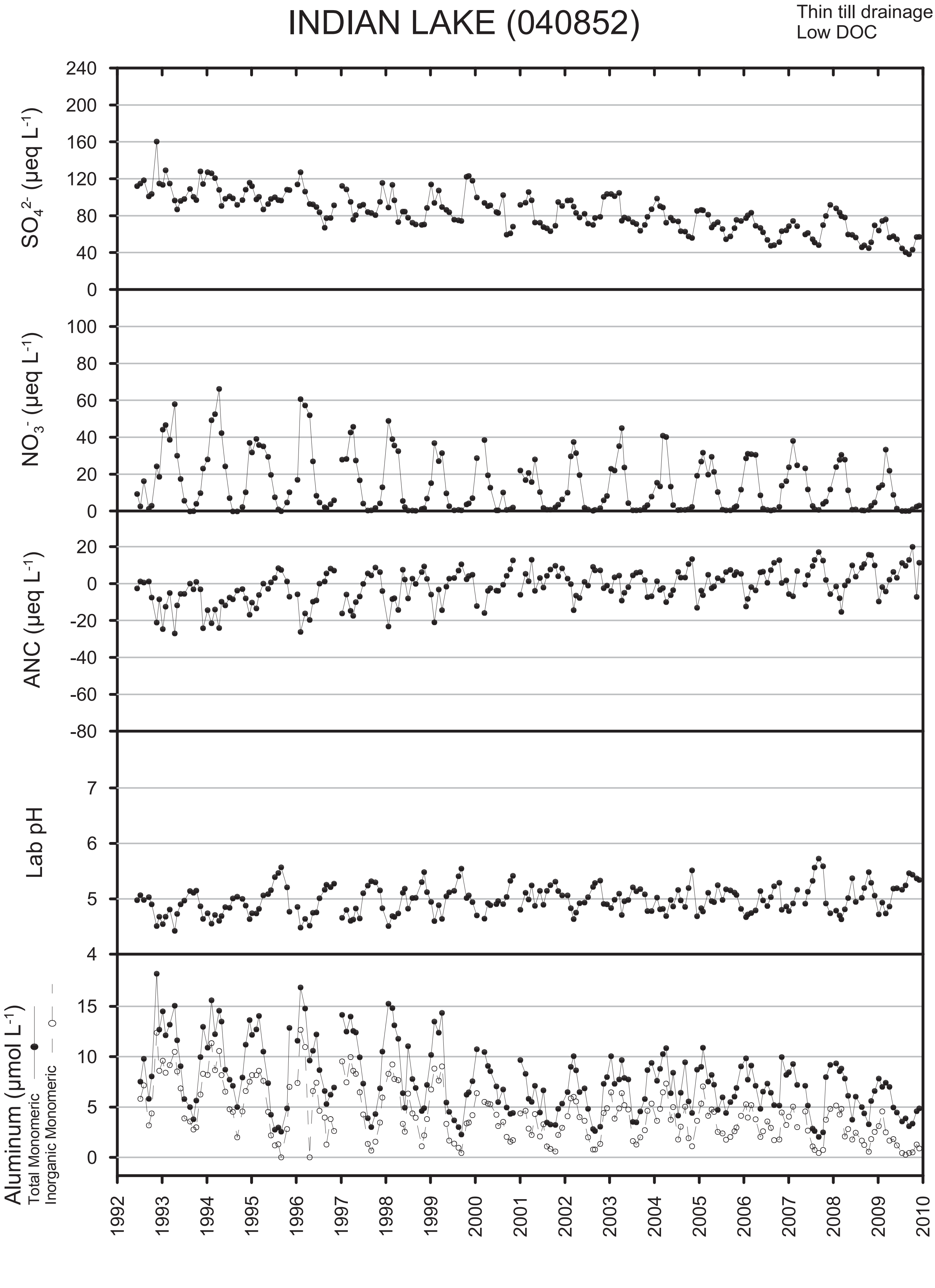
Table 1. Lake Chemistry

040852			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	86.82	129.29	106.95	38.05	75.99	55.23	µeq L^{-1}
NO_3^-	-0.16	57.88	23.04	0.00	33.24	8.19	µeq L^{-1}
Cl^-	5.08	10.72	7.24	3.50	8.74	5.91	µeq L^{-1}
F^-	1.95	3.11	2.27	1.54	2.19	1.87	µeq L^{-1}
ANC	-27.08	0.91	-10.16	-9.76	19.93	4.43	µeq L^{-1}
DIC	15.82	213.97	56.54	39.96	137.37	69.31	µmol L^{-1} -C
DOC	249.68	508.86	362.42	371.24	595.53	504.86	µmol L^{-1} -C
SiO_2	4.16	95.36	49.22	15.15	86.21	49.81	µmol L^{-1}
Ca^{2+}	60.38	104.30	74.60	39.42	60.88	46.90	µeq L^{-1}
Mg^{2+}	18.93	32.92	25.72	16.36	24.69	18.96	µeq L^{-1}
Na^+	12.61	20.88	15.95	13.05	19.14	16.00	µeq L^{-1}
K^+	2.81	6.39	4.43	1.79	5.63	3.73	µeq L^{-1}
NH_4^+	-0.33	4.49	1.46	-0.63	1.98	0.57	µeq L^{-1}
AL_TD	6.45	19.83	12.93	7.13	14.16	9.83	µmol L^{-1}
AL_TM	3.78	15.05	9.89	3.10	7.82	5.17	µmol L^{-1}
AL_OM	1.00	4.89	3.15	2.45	5.34	3.61	µmol L^{-1}
AL_IM	2.78	10.48	6.73	0.26	4.56	1.55	µmol L^{-1}
LABPH	4.42	5.15	4.77	4.72	5.46	5.06	
AIREQPH	4.45	5.13	4.76	4.74	5.63	5.09	
TRUECOLOR	15	40	26	45	70	58	Pt Co
SCONDUCT	16.68	30.62	23.39	10.97	23.25	14.92	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	654 m
Maximum depth	10.7 m
Mean depth	3 m
Volume	98.1 x 10^4 m^3
Surface area	33.2 ha
Watershed area	1121.4 ha
Watershed ratio	0.03
Hydraulic retention time (year)	0.10
Watershed	Oswegatchie/Black
County, Town	Hamilton, Morehouse
USGS Quadrangle	Honnedaga Lake
Land use classification	West Canada Lake Wilderness and Moose River Plains Wild Forest

Figure 3. Chemistry Time Series



Watershed: The Indian Lake watershed lies on interlayered metasedimentary rock and granitic gneiss considered to have medium to high ANC (Roy, K. M. et al. 1997). Till overlays 68.4% of the watershed while 31.6% is exposed bedrock (ALSC 2003). Bedrock outcrop and shallow (<0.5 m) soils predominate at elevations between 700 and 800 meters throughout the watershed, while basal till makes up the remainder (APA 2001). The watershed rises to a maximum elevation of approximately 880 m. The watershed has a maximum relief of 226 m. In 1984, the ALS found the shoal water substrate comprised of 59% organic, 39% muck/silt and 2% boulder/bedrock (ALSC 1985).

Land cover/use: In 1984, deciduous forest covered 90% of the watershed and the remaining 10% was coniferous forest (ALSC 1985). Wetland area totaled 144.3 ha comprising 12.9% of the watershed (Roy, K. M. et al. 1996). The predominant wetland types are forested needle-leaf evergreen (4.6%) and scrub/shrub broad leaf deciduous (5.7%) (ALSC 2003). Indian Lake is in the Moose River Plains Wild Forest. There is a trail to the pond and a number of primitive camp sites along the shore.

Watershed disturbance: The 1916 fire protection source data reveal 100% of the watershed as green timber with no slash. In November 1950, a storm caused 50 to 100% blowdown in 10.8 % of the watershed and 25 to 50% blowdown in 27.4 % of the watershed. The watershed was undisturbed by the July 1995 microburst storm and the ice storm of January 1998 (ALSC 2003; NYSDEC 1998).

Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	3570	43
1981	Brook trout	3420	51
1981	Atlantic salmon	11900	108
1982	Lake trout	3500	144
1982	Brook trout	3800	30
1983	Brook trout	3800	23
1985	Brook trout	4180	30
1988	Atlantic salmon	6700	152

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
October-94	Central mudminnow	12	80	103	92	12
September-84	No fish caught					

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns, D. A., McHale, M. R., Driscoll, C. T., and Roy, K. M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Lawrence, G. B., Baldigo, B. P., Roy, K. M., Simonin, H. A., Bode, R. W., Passy, S. I., and Capone, S. B. 2008. Results from the 2003-2005 Western Adirondack Stream Survey. New York State Energy Research and Development Authority No. 08-22.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen, B., Lawrence, G. B., Nierzwicki-Bauer, S. A., Sutherland, J. W., Eichler, L. W., Harrison, J. P., and Boylen, C. W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on wetlands and lakes in the Adirondack Park of New York State: A catalog of existing and new GIS data layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A demonstration-level GIS characterization of subcatchments of the Oswegatchie/Black River watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Stoddard, J. L., Kahl, J. S., Deviney, F. A., DeWalle, D. R., Driscoll, C. T., Herlihy, A. T., Kellogg, J. H., Murdoch, P. S., Webb, J. R., and Webster, K. E. 2003. Response of Surface Water Chemistry to the Clean Air Act Amendments of 1990. United States Environmental Protection Agency No. EPA620/R-03/001.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T. J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Sutherland, J. W. 1989. Field Surveys of the Biota and Selected Water Chemistry Parameters in 50 Adirondack Mountain Lakes. New York State Department of Environmental Conservation Final Report, Albany, NY.

Wood, L. W. 1978. Limnology of remote lakes in the Adirondack region of New York State with emphasis on acidification problems. New York State Department of Health, Albany, NY.

Zhai, J. Regional application of PnET-BGC to lake-watersheds of the Adirondacks, NY to investigate past and future response to acidic deposition. Master of Science in Environmental Engineering thesis, Syracuse University.

Brook Trout Lake 040874

Lat. 43° 36' 00'' N   Long. 074° 39' 45'' W

Lake: Brook Trout Lake lies in the Oswegatchie-Black watershed near the Mohawk River watershed divide at 724 m. It is one of the highest elevation lakes in the ALTM program. This 28.7 ha headwater lake lies in a relatively steep watershed with no perennial inlets. The outlet flows southwest into the Indian River (Figure 1). In 1984, an inactive beaver dam was present at the outlet (ALSC 1985). The lake reaches a maximum depth of 23.2 m (Figure 2).

Brook Trout Lake is classified as a thin till chain drainage lake, with low dissolved organic carbon and considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. This lake is accessed by helicopter. Note, the ALS traditionally used the variant spelling of this lake, "Brook Trout Lake", and that convention is continued here. The current spelling favored by the Geographic Names Information Service (GNIS) is "Brooktrout Lake" and appears on recent USGS maps and publications.

Lake chemistry: Brook Trout Lake was sampled during the ALS on 20 Aug 1984 finding: Lab pH 5.13, ANC -15.6 µeq L^{-1}, SO_4^{2-} 107.85 µeq L^{-1}, NO_3^- 2.1 µeq L^{-1}, Ca^{2+} 71.36 µeq L^{-1}, Mg^{2+} 24.69 µeq L^{-1}, DOC: 0.7 mg L^{-1}-C (ALSC 85). Table 1 summarizes recent water sample chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: An ALS dip net survey on 28 Jun 1984 identified the following Insecta: Odonata Libellulidae; Coleoptera Gyrinidae. Also found was Crustacea Decapoda Astacidae. On 14 Aug 1984, the lake was thermally stratified between 7 and 8 m. No macrophyte data were available (ALSC 1985). In August 1975, NYSDOH found total phosphorus at 4.7 mg m^{-3} and total chlorophyll a was 0.67 µg L^{-1} (Wood, L. W. 1978). In 2003, the AEAP reported the average value of chlorophyll a was 9.63 µg L^{-1} (Momen, B. et al. 2006).

In July 1984, the NYSDEC Biota Project found: chlorophyll a 2.1 µg L^{-1}, total phosphorus 6 µg L^{-1}, and a Secchi depth of 8.0 m. The phytoplankton

Figure 1. Catchment

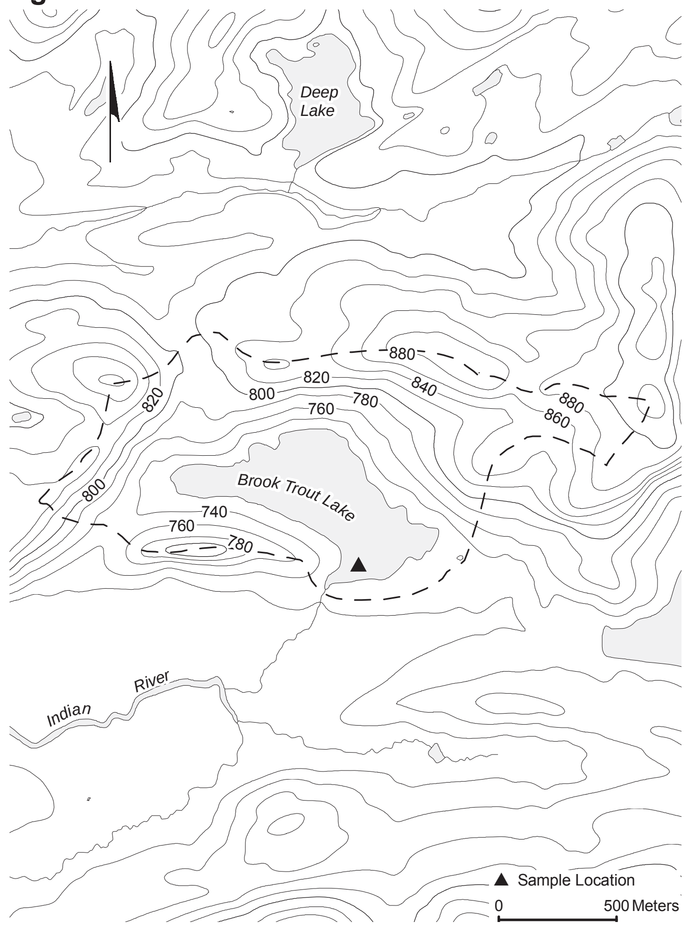
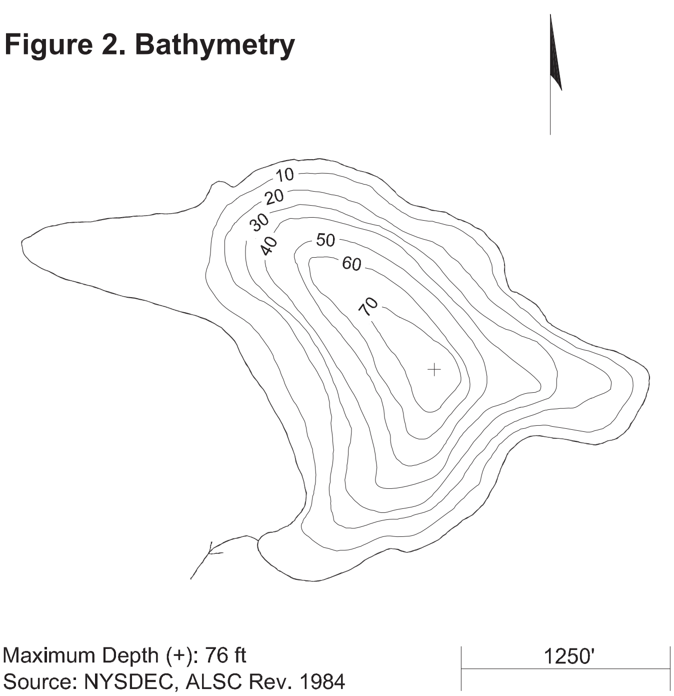


Figure 2. Bathymetry



Maximum Depth (+): 76 ft
Source: NYSDEC, ALSC Rev. 1984

community was composed of 10 species, dominated by Chrysophceae spherical cell #2. Bosmina longirostris was the dominant of three crustacean zooplankton species. Karatella taurocephala was the dominant of three rotifer species (Sutherland, J. W. 1989).

Fisheries: Brook trout were stocked annually from 1956 to 1971. The lake was surveyed for fish on 29 Jun 1984 (ALSC 1985) and 25 Jun 2002. No fish were captured in either survey. In 2005, NYSDEC undertook an experimental stocking of heritage strain brook trout (Sutherland, J. W. 2005). Refer to Table 3 for recent fish stocking history.

Intensive studies: NYSDOH conducted a limnological survey of Brook Trout Lake in August 1975 (Wood, L. W. 1978). Brook Trout Lake was surveyed in 1984 as part of the NYS DEC Biota Project (Sutherland, J. W. 1989). The lake is part of the AEAP (Momen, B. et al. 2006) with additional biological studies associated with brook trout recovery. McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 26 km northwest at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 20 km southeast at Piseco Lake.

Watershed: The watershed lies on inter-layered metasedimentary rock and granitic gneiss with medium to high ANC (Roy, K. M. et al. 1997). Till comprises 83.3% of the watershed while the remaining 16.7% is exposed bedrock. General soils source data reveal bedrock outcrops in the steep sloped areas (approximately 50% of the watershed) with the remaining area as shallow (<0.5 m) to bedrock soils. The area near the outlet is basal till (APA 2001). The watershed rises sharply on three sides to a maximum elevation of 890 m on the north ridge. The maximum relief is 166 m. In 1984, the ALS described the shoal water substrate as 40% bedrock and boulder and 60% mud/silt and organic (ALSC 1985).

Table 1. Lake Chemistry

040874			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	102.43	127.00	112.19	56.20	85.89	63.33	µeq L^{-1}
NO_3^-	9.48	41.61	16.08	0.00	22.23	5.69	µeq L^{-1}
Cl^-	7.05	9.31	8.13	5.46	9.29	6.34	µeq L^{-1}
F^-	2.05	2.89	2.39	1.45	2.16	1.92	µeq L^{-1}
ANC	-27.17	0.47	-5.76	-6.04	21.56	7.44	µeq L^{-1}
DIC	11.66	75.76	36.22	18.32	92.41	52.24	µmol L^{-1} -C
DOC	12.57	256.76	124.79	204.73	277.16	242.62	µmol L^{-1} -C
SiO_2	55.75	69.73	64.85	38.77	59.75	48.08	µmol L^{-1}
Ca^{2+}	51.40	81.34	64.37	23.45	46.98	43.52	µeq L^{-1}
Mg^{2+}	16.46	27.16	22.90	9.05	19.42	17.09	µeq L^{-1}
Na^+	14.79	20.44	17.33	13.05	20.88	16.82	µeq L^{-1}
K^+	4.09	6.39	5.01	2.05	4.60	4.07	µeq L^{-1}
NH_4^+	0.22	2.77	2.02	-0.22	6.93	2.20	µeq L^{-1}
AL_TD	4.34	28.65	10.53	2.32	12.38	5.40	µmol L^{-1}
AL_TM	4.19	18.64	8.74	1.93	6.71	3.09	µmol L^{-1}
AL_OM	0.16	10.30	2.02	1.70	3.04	2.09	µmol L^{-1}
AL_IM	0.00	15.84	6.82	0.00	3.67	1.02	µmol L^{-1}
LABPH	4.43	5.36	4.98	4.79	5.91	5.30	
AIREQPH	4.49	5.32	4.98	4.77	6.24	5.32	
TRUECOLOR	0	15	9	15	30	22	Pt Co
SCONDUCT	17.47	30.27	20.47	11.56	21.13	13.69	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	724 m
Maximum depth	23.2 m
Mean depth	8.4 m
Volume	242.0 x 10^4 m^3
Surface area	28.7 ha
Watershed area	165.7 ha
Watershed ratio	0.17
Hydraulic rentention time (year)	1.64
Watershed	Oswegatchie/Black
County, Town	Hamilton, Morehouse
USGS Quadrangle	West Canada Lakes
Land use classification	West Canada Lake Wilderness

Figure 3. Chemistry Time Series

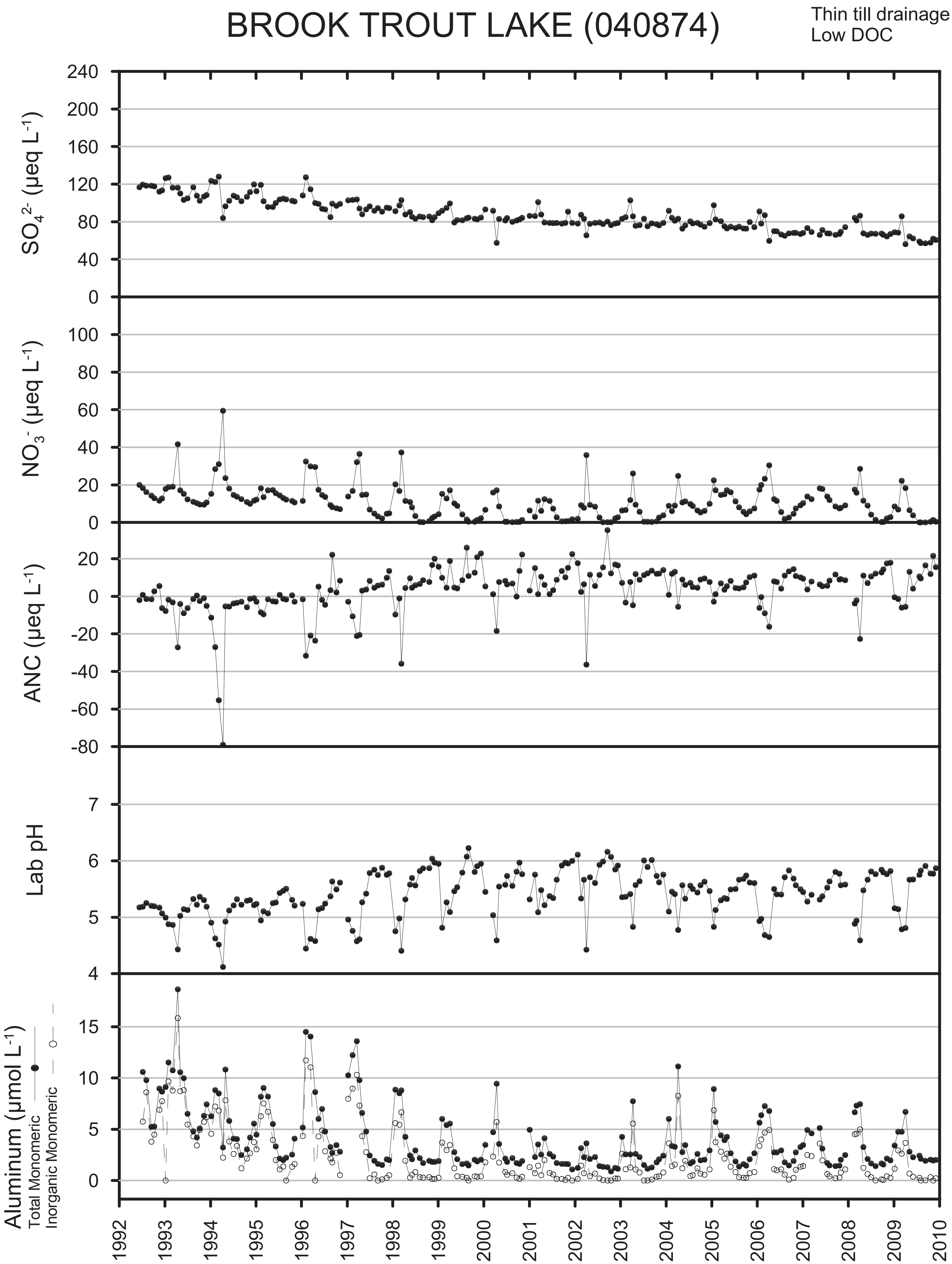


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
2005	Brook trout	2000	25
2006	Brook trout	900	11

Land cover/use: In 1984, deciduous forest covered 80% of the watershed, and deciduous-coniferous mixed forest covered the remainder. The immediate shoreline was dominated by coniferous forest interspersed with 5% deciduous-coniferous mixed forest (ALSC 1985). Total wetland area comprises 0.7 ha or 0.4% of the watershed. The predominant wetland type is forested needle-leaf evergreen found in two small isolated pockets in the upper reaches of the western portion of the watershed (Roy, K. M. et al. 1996). The watershed lies entirely within the West Canada Lakes Wilderness area.

Watershed disturbance: The 1916 fire protection source data shows 83.4% of the watershed as green timber with no slash. The source data did not reveal any disturbance from the November 1950 blowdown, July 1995 microburst, or the January 1998 ice storms (ALSC 2003; NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar Nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen, B., Lawrence, G. B., Nierzwicki-Bauer, S. A., Sutherland, J. W., Eichler, L. W., Harrison, J. P., and Boylen, C. W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T. J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Sutherland, J. W. 1989. Field Surveys of the Biota and Selected Water Chemistry Parameters in 50 Adirondack Mountain Lakes. New York State Department of Environmental Conservation Final Report, Albany, NY.

Sutherland, J. W. Brooktrout Lake Fish Stocking Proposal. 2005. Bolton Landing, NY, Darrin Fresh Water Institute, Bolton Landing, NY.

Wood, L. W. 1978. Limnology of remote lakes in the Adirondack region of New York State with emphasis on acidification problems. New York State Department of Health, Albany, NY.

This page intentionally left blank.

Lost Pond 040887

Lat. 43° 38’ 48’’ N Long. 074° 33’ 30’’ W

Lake: Lost Pond lies in the Oswegatchie-Black River watershed near the Upper Hudson watershed divide at 717 m. This 4.4 ha headwater lake has no channelized tributaries (Figure 1) but inflows are evident from the shoreline fringe wetland and the wetland complex on the south-eastern shoreline (APA 2001). In 1984, a beaver dam was present at the outlet (ALSC 1985). The outlet forms a tributary to Otter Brook. The lake reaches a maximum depth of 1.2 m (Figure 2).

Lost Pond is classified as a thin till drainage lake, with high dissolved organic carbon and is considered sensitive to acidification. The ALTM program began monitoring the pond in June 1992. This lake is accessed by helicopter.

Lake chemistry: Lost Pond was sampled during the ALS on 24 Aug 1984 finding: Lab pH 5.13, ANC 4.0 µeq L^{-1}, SO_4^{-2} 82.03 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 61.38 µeq L^{-1}, Mg^{2+} 24.69 µeq L^{-1}, DOC 9.7 mg L^{-1} -C (ALSC 1985). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 12 Sep 1984, ALS found submergent vegetation occupied 40% of the lake bottom. Emergent and floating vegetation occupied 10% and 5% of the lake surface, respectively. Species identified included: Sphagnum spp., Sparganium spp., Potamogeton spp., Nuphar spp., Brasenia spp., and Utricularia spp. A dip net survey on that date found the following Insecta: Odonata Libellulidae, Hemiptera Notonectidae and Gerridae, and Coleoptera Gyrinidae. On 24 Aug 1984, ALS found the lake isothermal (ALSC 1985).

In August 1975, NYSDOH found total phosphorus was 16.6 mg m^{-3} and total chlorophyll a was 3.62 µg L^{-1} (Wood, L. W. 1978).

Fisheries: Brook trout were stocked annually from 1956 to 1969 (ALSC 1985). Refer to Table 3 for recent netting history.

Intensive studies: DOH conducted a limnological survey of Lost Pond in August 1975 (Wood, L. W. 1978). Lost Pond was one of 36 ALTM lakes evaluated by Momen and Zehr (1998) during 1994 examining lake-water chemistry and terrestrial characteristics with the existing watershed

Figure 1. Catchment

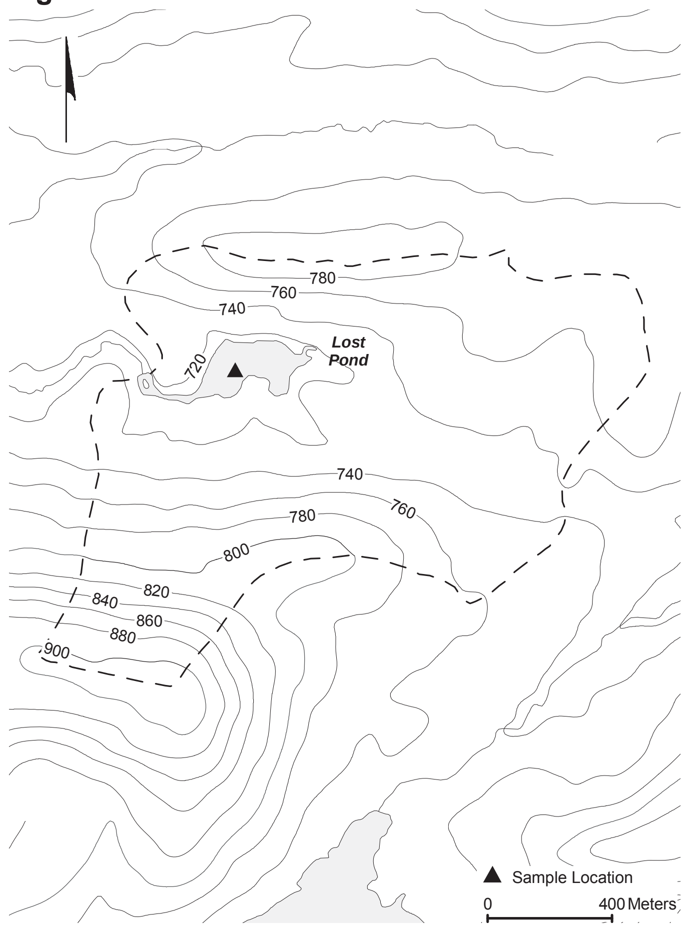
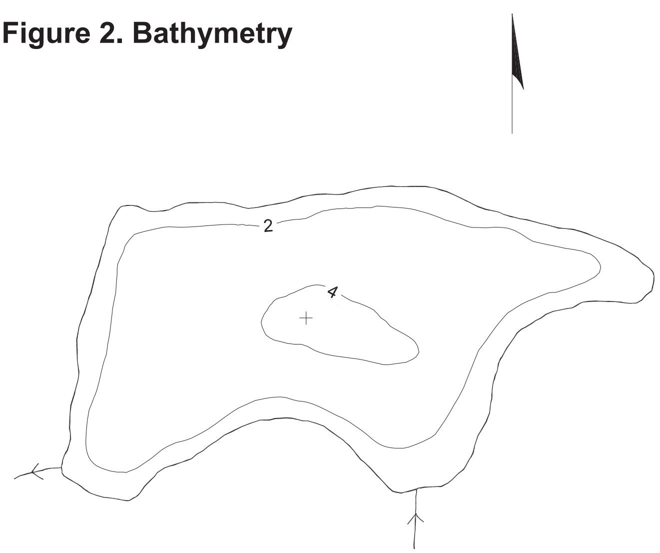


Figure 2. Bathymetry



Maximum Depth (+): 4 ft
Source: NYSDEC, ALSC Rev. 1984

classifications (Momen, B. and Zehr, J. P. 1998). Ito and others (2005) evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 – 2000 (Ito, M. et al. 2006).

Deposition: The nearest NADP deposition monitoring site is 28 km northwest at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 22 km south at Piseco Lake.

Watershed: Lost Pond lies on interlayered metasedimentary rock and granitic gneiss with medium to high ANC (Roy, K. M. et al. 1997). Till overlays 85.7% of the watershed, while exposed bedrock makes up the remainder, and is found at elevations above 800 m. Basal till is found on the immediate shoreline, while shallow soils and rock outcrop are found around the lake at elevations between 750 and 800 meters (APA 2001). The maximum elevation is 913 m. The maximum relief is 196 m. In 1984, the ALS found the shoal water substrate to be 50% organic and 50% muck/silt (ALSC 1985).

Land cover/use: In 1984, the ALS found deciduous-coniferous mixed forest covered 70% of the watershed (ALSC 1985). Total wetland area is 21.9 ha and comprises 12.6% of the watershed. Wetlands border the lake and the inlet drainage area. The predominant wetland type is forested needle-leaf evergreen (6.1%) and scrub/shrub broad leaf deciduous (6.5%) (ALSC 2003). The watershed is located entirely within the West Canada Lakes Wilderness Area.

Watershed disturbance: The 1916 fire protection source data reveal 87.4% of the watershed as green timber with no slash. The remaining area, at the upper reaches of the watershed, is shown as logged for softwood only, with considerable slash. The November 1950 blowdown and July 1995 microburst storm source data show no recorded disturbances (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

Table 1. Lake Chemistry

040887			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	78.28	118.67	92.84	48.81	85.86	65.60	μeq L^{-1}
NO_3^-	1.15	92.25	38.26	0.00	33.25	9.63	μeq L^{-1}
Cl^-	4.51	15.51	8.70	1.88	7.64	5.72	μeq L^{-1}
F^-	1.05	3.00	2.42	2.09	3.12	2.43	μeq L^{-1}
ANC	-33.87	37.31	-2.34	-19.40	19.53	0.90	μeq L^{-1}
DIC	24.14	322.20	113.92	44.50	239.78	91.86	μmol L^{-1} -C
DOC	280.49	844.80	525.28	336.60	757.46	523.99	μmol L^{-1} -C
SiO_2	35.78	168.09	86.70	35.78	111.84	72.97	μmol L^{-1}
Ca^{2+}	52.90	104.30	80.39	41.92	58.39	47.58	μeq L^{-1}
Mg^{2+}	21.39	39.50	30.04	15.63	23.86	19.19	μeq L^{-1}
Na^+	13.92	37.41	23.56	16.53	26.76	21.44	μeq L^{-1}
K^+	1.79	10.74	5.99	0.35	4.09	2.46	μeq L^{-1}
NH_4^+	-0.06	25.00	5.99	-0.59	5.04	0.94	μeq L^{-1}
AL_TD	8.82	21.98	13.62	8.07	13.05	11.45	μmol L^{-1}
AL_TM	3.60	17.64	10.63	4.11	8.75	6.65	μmol L^{-1}
AL_OM	2.96	11.19	4.86	3.09	5.72	4.15	μmol L^{-1}
AL_IM	0.52	13.01	5.78	1.02	4.72	2.50	μmol L^{-1}
LABPH	4.42	6.10	4.81	4.71	5.58	4.95	
AIREQPH	4.39	6.43	4.83	4.69	5.69	4.99	
TRUECOLOR	30	80	46	30	80.00	52	Pt Co
SCONDUCT	16.40	37.14	26.05	13.04	21.33	16.66	μS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	717 m
Maximum depth	1.2 m
Mean depth	0.7 m
Volume	3.2×10^4 m^3
Surface area	4.4 ha
Watershed area	173.8 ha
Watershed ratio	0.03
Hydraulic retention time (year)	0.03
Watershed	Oswegatchie/ Black
County, Town	Hamilton, Arietta
USGS Quadrangle	Wakely Mtn.
Land use classification	West Canada Lake Wilderness

Figure 3. Chemistry Time Series

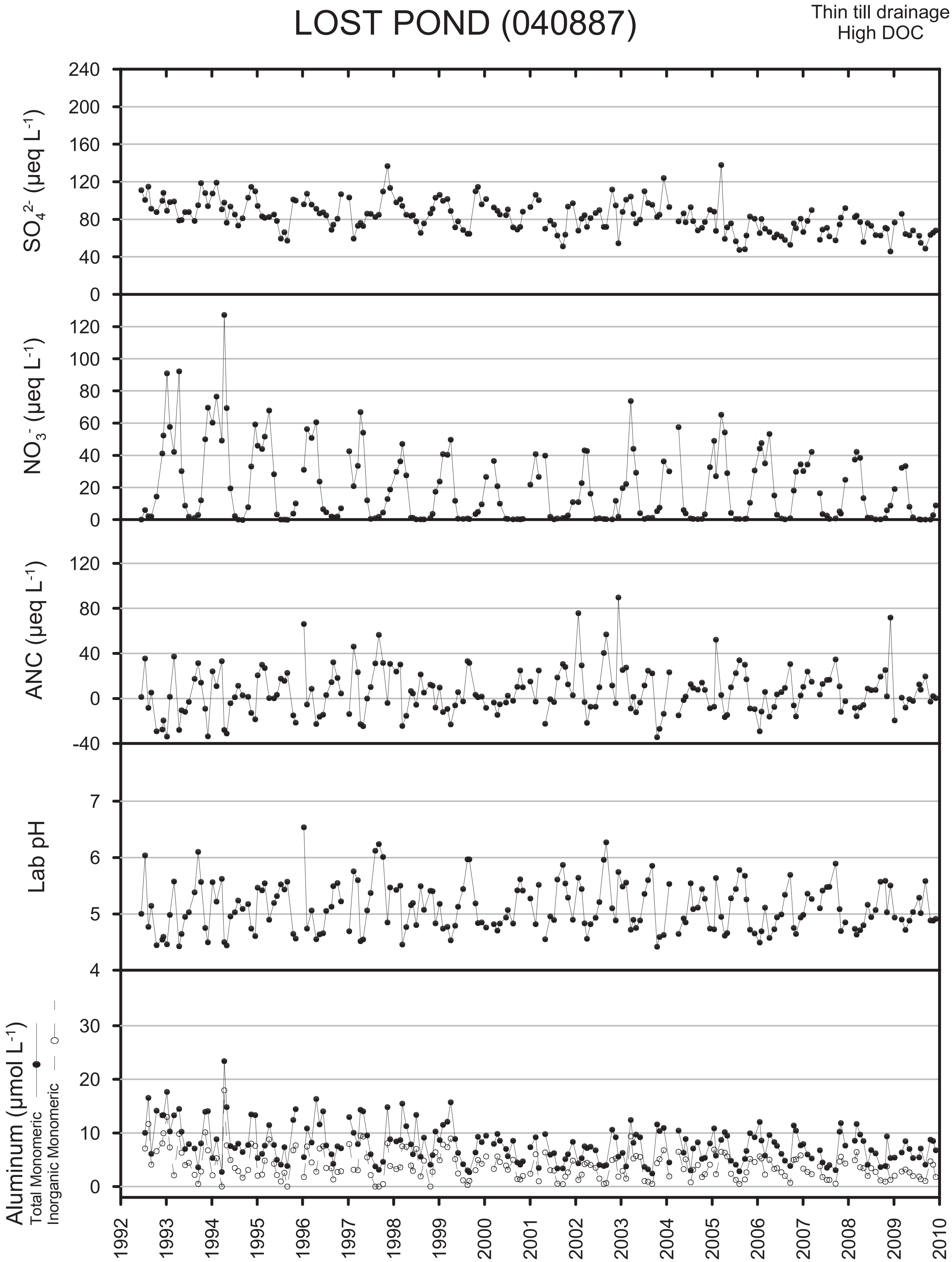


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-94	Brook trout	9	183	340	2382	9
September-84	Brook trout	17	105	250	1934	17

References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Ito, M., Mitchell, M. J., Driscoll, C. T., and Roy, K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

Momen, B. and Zehr, J. P. 1998. Watershed classification by discriminant analyses of lakewater-chemistry and terrestrial characteristics. Ecological Applications 8: 497-507.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Wood, L. W. 1978. Limnology of remote lakes in the Adirondack region of New York State with emphasis on acidification problems. New York State Department of Health, Albany, NY.

Barnes Lake 040905

Lat. 43° 33’ 52’’ N Long. 075° 13’ 36’’ W

Lake: Barnes Lake lies in the Oswegatchie-Black watershed at 395 m. It is the only ALTM water located outside of the Adirondack Park. The 2.9 ha lake receives no channelized direct drainage from its small watershed. Most of its inputs are considered to be from direct deposition. The lake has no outlet (Figure 1). Barnes Lake reaches a maximum depth 10.1 m (Figure 2).

Barnes Lake is classified as a mounded seepage lake with relatively high dissolved organic carbon. The lake is considered sensitive to acidification.

Lake chemistry: On 23 Jul 1985 the ALS found: Lab pH 4.67, ANC -25.0 µeq L^{-1}, SO_4^{-2} 59.75 µeq L^{-1}, NO_3^- LTD, Ca^{2+} 26.95 µeq L^{-1}, Mg^{2+} 10.70 µeq L^{-1} DOC 8.9 mg L^{-1}-C. Barnes Lake is not included in the ALTM overall water chemistry trend analyses due to its liming history. Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

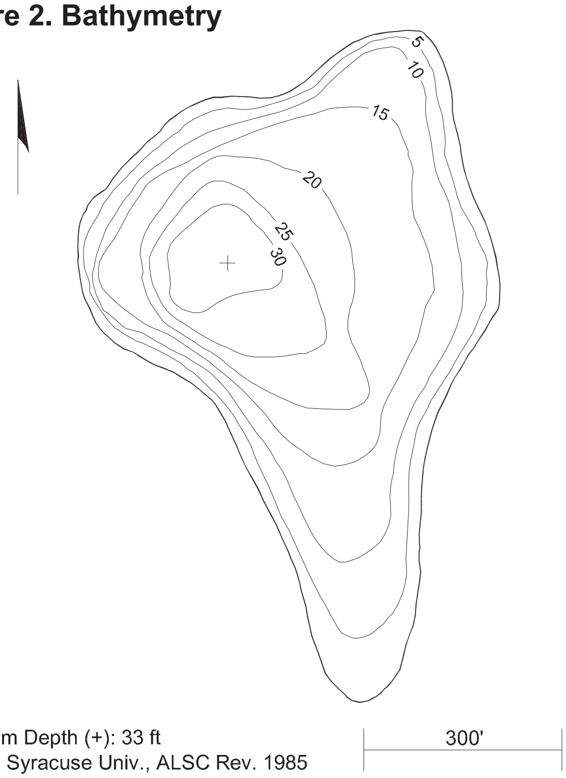
Aquatic biota: On 05 Sep 1985, ALS found submergent vegetation occupied 10% of the lake bottom. Emergent and floating vegetation occupied 10% of the lake surface. Aquatic plant species identified were Nuphar spp. and Dulichium spp. A dip net survey on that date found the following Insecta: Odonata Libellulidae, Lestidae, and Coenagriidae; Hemiptera Unspecified, Corixidae, Notonectidae, and Nepidae; Megaloptera Sialidae; Trichoptera Phryganeidae; Coleoptera Dytiscidae, Gryinidae, and Chrysomelidae; Diptera Culicidae and Chironomidae. Also found were Oligochae Unspecified. On 23 Jul 1985, the ALS found the lake stratified between 4 and 6 m (ALSC 1986).

Fisheries: Barnes Lake has no recent (since 1971) history of stocking. The lake was limed in 1987. ALSC fish surveys occurred on 06 Sep 1985 and 29 Oct 2002. No fish were caught in either netting effort (ALSC 1986).

Intensive studies: A 1931 survey of Barnes Lake reported the lake as a sterile bog water (NYSDEC 1932). Barnes Lake was studied under RILWAS in 1985 (Driscoll and Newton 1985). Charles and others (1990) found evidence of recent acidification in Barnes Lake. The historic diatom inferred pre-industrial (1850s) and recent (1985) pH values were

Figure 1. Catchment

Figure 2. Bathymetry



Maximum Depth (+): 33 ft
Source: Syracuse Univ., ALSC Rev. 1985

estimated at 5.2 and 4.7 respectively. The Barnes Lake profile was very similar to that of Little Echo Pond (020126) another small acidified high DOC lake. Diatoms stratigraphy and both lakes contained many fewer total taxa, with many taxa commonly associated with bog environments (e.g. several Eunotia and Pinnularia species). The short form of Asterionella ralfsii var. Americana increased up to 58% in the surface of recent sediments at Barnes Lake. The lake was limed in 1987 (ALSC 2003).

Deposition: The nearest NADP deposition monitoring site is 39 km northeast at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 24 km northeast at Nicks Lake.

Watershed: Barnes Lake is underlain by deep quaternary deposits of bedrock and is overlain by deep deposits of glacial outwash (ALSC 1986). The watershed is generally characterized as a predominately northern hardwood stand with second growth forest. Barnes Lake is a perched mounded seepage water, the 400 meter elevation generally represents its watershed boundary. In 1985, the shoal water substrate of the lake was described as 60% mud silt and organic with the remaining 40% as sand (ALSC 1986).

Land use/cover: In 1985, the ALS described the watershed as: 60% deciduous-conifer mixed forest with 5% coniferous forest and 35% wetland shrub/sapling mix. The immediate shoreline consisted of 55% deciduous-conifer mixed forest and 25% wetland shrub/sapling mix. There are a few pockets of bog mat habitat occur around the shoreline and a wetland is associated with a small portion of the southern shore of the lake (ALSC 1986). Approximately ten percent of the watershed is developed. A gated private gravel road leads to a few seasonal camps along the southern shoreline, one of which has a sand-gravel beach. The lake and its watershed are on private land just outside the Adirondack Park.

Watershed disturbance: Logging and agricultural practices took place in the early mid-1900s in the vicinity of the lake (Charles, D. F. et al. 1990). There is no coverage for this watershed area pertaining to the 1916 fire map, the November 1950 blowdown or the July 1995 microburst storms (APA 2001). This watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

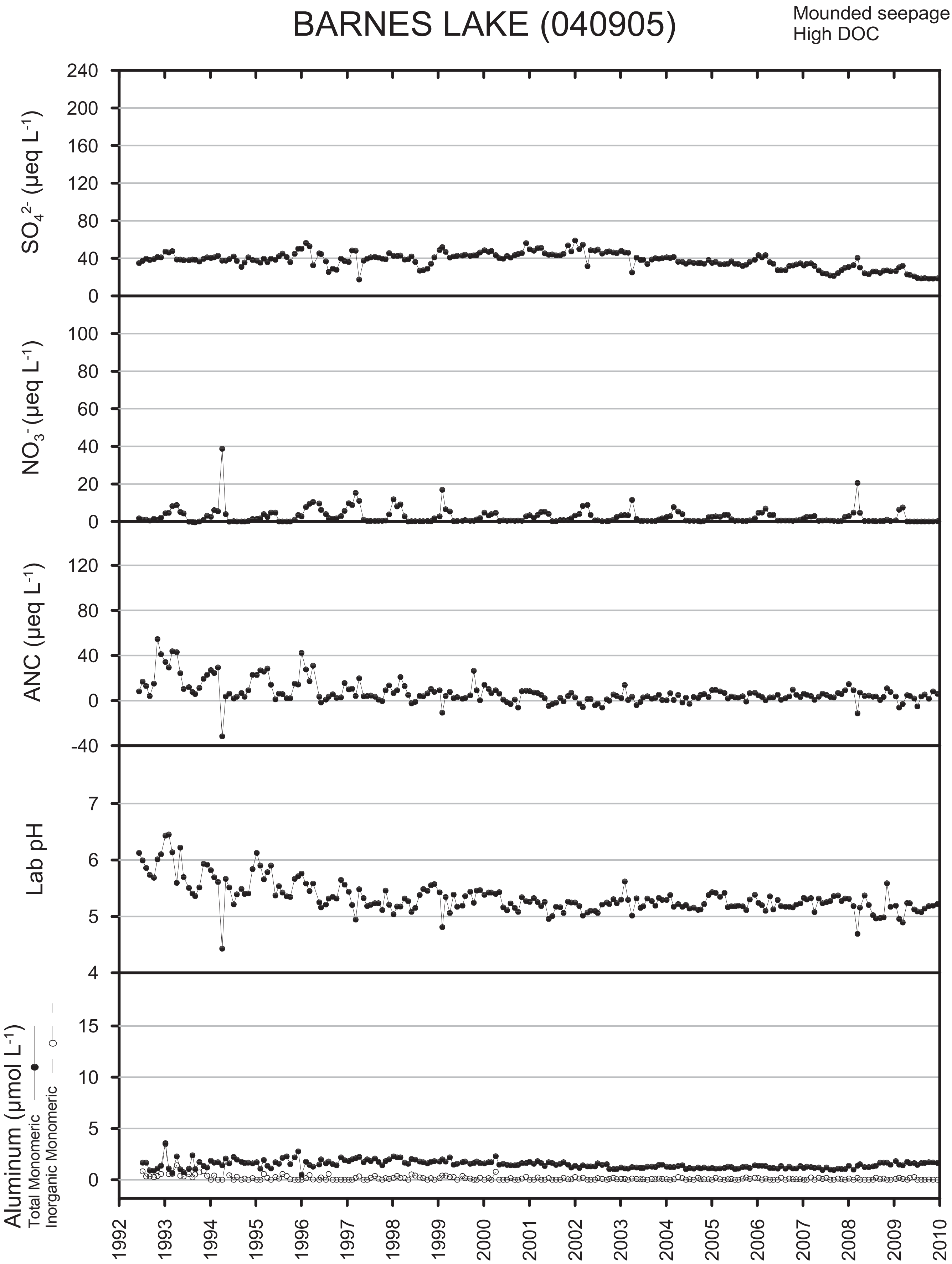
Table 1. Lake Chemistry

040905			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	36.64	47.68	40.74	18.29	32.04	22.27	µeq L^{-1}
NO_3^-	-0.40	8.71	3.22	0.00	7.45	1.21	µeq L^{-1}
Cl^-	5.08	13.26	7.52	4.83	9.74	5.89	µeq L^{-1}
F^-	0.63	1.05	0.78	0.57	0.89	0.68	µeq L^{-1}
ANC	5.92	43.81	22.02	-6.21	8.28	2.14	µeq L^{-1}
DIC	11.66	283.90	79.44	-0.83	109.07	38.27	µmol L^{-1} -C
DOC	303.47	563.98	450.55	457.66	946.63	689.27	µmol L^{-1} -C
SiO_2	-2.83	8.49	1.87	0.32	5.99	3.88	µmol L^{-1}
Ca^{2+}	49.40	87.33	63.96	23.45	29.94	26.44	µeq L^{-1}
Mg^{2+}	9.87	12.34	10.70	6.58	8.00	7.10	µeq L^{-1}
Na^+	2.61	8.70	4.46	3.32	5.65	3.76	µeq L^{-1}
K^+	6.14	11.77	8.21	4.35	5.63	5.19	µeq L^{-1}
NH_4^+	-0.78	20.46	8.97	-0.65	2.27	0.20	µeq L^{-1}
AL_TD	0.33	5.34	1.17	0.23	0.96	0.57	µmol L^{-1}
AL_TM	0.66	3.56	1.51	1.41	1.82	1.62	µmol L^{-1}
AL_OM	0.07	2.13	0.68	1.30	2.01	1.62	µmol L^{-1}
AL_IM	0.24	3.48	0.84	0.00	0.26	0.07	µmol L^{-1}
LABPH	5.36	6.45	5.71	4.89	5.24	5.11	
AIREQPH	5.41	6.65	5.97	4.97	5.38	5.17	
TRUECOLOR	25	35	30	25	40	30	Pt Co
SCONDUCT	9.75	15.46	12.00	7.17	11.09	8.07	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	395 m
Maximum depth	10.1 m
Mean depth	4.5 m
Volume	13.1 x 10^4 m^3
Surface area	2.9 ha
Watershed area	6.5 ha
Watershed ratio	0.45
Hydraulic retention time (year)	NA
Watershed	Oswegatchie/Black
County, Town	Lewis, Lyonsdale
USGS Quadrangle	McKeever
Land use classification	Private - outside Adirondack Park

Figure 3. Chemistry Time Series



References

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 1986. Adirondack Lakes Survey 1985 Field Studies Report Volumes 6-10. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Charles, D. F., Binford, M. W., Furlong, E. T., Hites, R. A., Mitchell, M. J., Norton, S. A., Oldfield, F., Paterson, M. J., Smol, J. P., Uutala, A. J., White, J. R., Whitehead, D. R. and Wiese, R. J., Paleoecological investigation of recent lake acidification in the Adirondack Mountains, N.Y. Journal of Paleolimnology 3:195-241, 1990.

Driscoll, C. T., and Newton, R. M. Chemical characteristics of Adirondack Lakes. Environmental Science & Technology 19 (11):1018-1024, 1985.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

State of New York Conservation Department (NYSDEC) 1932. A biological survey of the Oswegatchie and Black River systems. New York: Burland Printing Company, Inc., Bronx, NY.

South Lake 041004

Lat. 43° 30' 35'' N Long. 074° 52' 35'' W

Lake: South Lake lies in the Oswegatchie-Black watershed at 615 m. Several tributaries flow into this 197.4 ha reservoir (Figure 1). The lake was formed by two dams built on the South Branch of the Black River in the mid -1800s. The primary outlet is a concrete control structure located on the main outlet in the southeast end of the lake. A secondary outlet is a low, non-controllable concrete structure approximately 0.5 km west of the main outlet. The outlet flows southeast and joins the south branch of the Black River. Lake levels are currently managed by the New York State Thruway Authority. The lake has a maximum depth of 18.3 m (Figure 2).

South Lake is classified as a thin till chain drainage lake with low dissolved organic carbon and is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. The lake is accessed by helicopter.

Lake chemistry: South Lake was not sampled during the ALS, but was sampled as part of the ELS (1A3-065) on 16 Oct 1984, which found: Field pH 5.22, ANC 2.9 µeq L^{-1}, SO_4^{2-} 113.5 µeq L^{-1}, NO_3^- 15.1 µeq L^{-1}, Ca^{2+} 72.6 µeq L^{-1}, Mg^{2+} 25.3 µeq L^{-1}, DOC 1.67 mg L^{-1} (Kanciruk, P. et al. 1986). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: In 2003, the AEAP reported the average value of chlorophyll a was 1.11 µg L^{-1} (Momen, B. et al. 2006).

Fisheries: NYS DEC has stocked the lake annually with brook trout and other species since 1995. Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Figure 1. Catchment

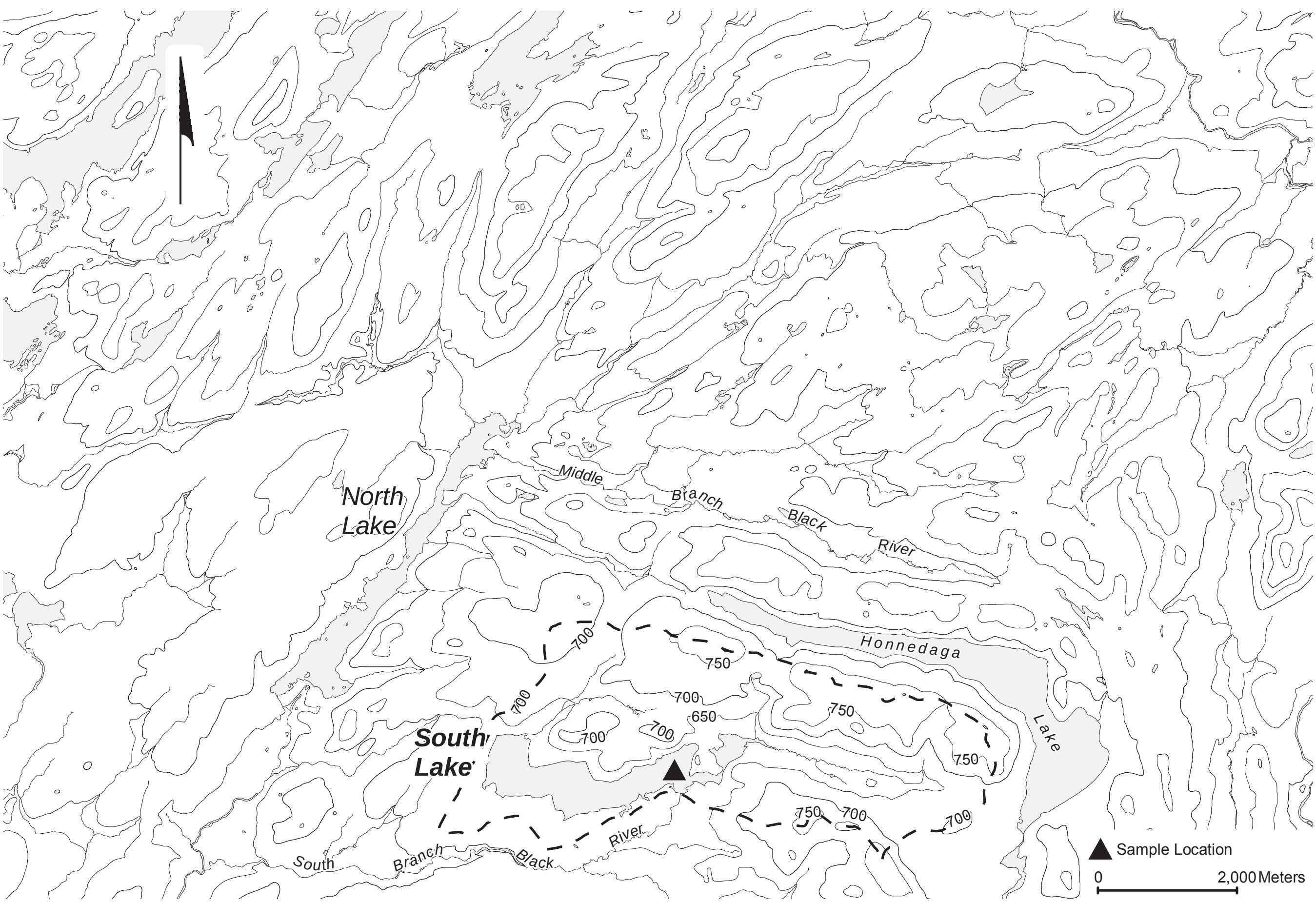
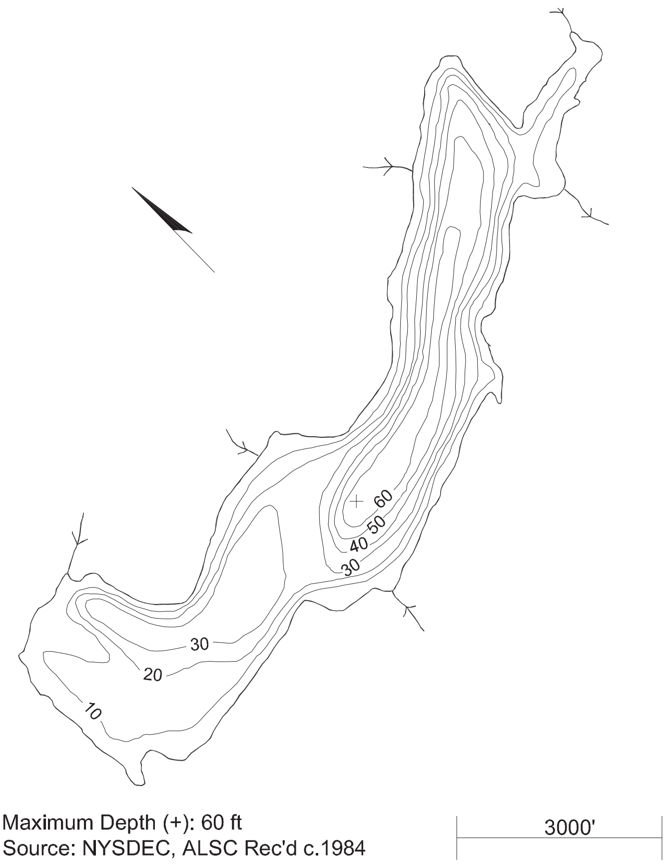


Figure 2. Bathymetry



Maximum Depth (+): 60 ft
Source: NYSDEC, ALSC Rec'd c.1984

Intensive studies: Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Landscape characteristics and disturbance history have been evaluated within this watershed (Sullivan, T. J. et al. 1999). The AEAP has studied aquatic biota at this site (Momen, B. et al. 2006). South Lake was one of 20 Adirondack lakes evaluated for regional trends in chrysophyte-inferred lake water pH changes (Cumming, B. F. et al. 1994; Smol, J. P. et al. 1998). This watershed has been analyzed using the integrated biogeochemical (PnET-BGC) model (Zhai, J. 2006). Common loons were surveyed for mercury content in 1998-2000 (Schoch, N. and Evers, D. C. 2002) and in 2003-2004 (Schoch, N. et al. 2004). The lake was part of EPA's EMAP in 1992, 1994, 1995, and 1997. Since 1999, the lake is sampled each year by the ALSC as part of the TIME project (Stoddard, J. L. et al. 2003). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Table 1. Lake Chemistry

041004			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	59.34	111.80	94.85	51.10	72.56	60.77	µeq L^{-1}
NO_3^-	17.02	42.56	27.31	4.67	53.51	16.39	µeq L^{-1}
Cl^-	5.36	8.74	7.50	4.71	8.05	6.26	µeq L^{-1}
F^-	1.58	4.21	2.76	2.12	2.87	2.52	µeq L^{-1}
ANC	-27.12	15.57	-7.42	-15.83	28.81	11.21	µeq L^{-1}
DIC	11.66	110.73	50.79	21.31	110.73	56.13	µmol L^{-1} -C
DOC	127.46	452.83	212.34	201.98	421.86	260.84	µmol L^{-1} -C
SiO_2	34.28	66.41	56.06	42.33	78.22	54.49	µmol L^{-1}
Ca^{2+}	30.44	79.35	66.08	36.43	71.86	55.57	µeq L^{-1}
Mg^{2+}	11.52	25.51	22.77	13.17	21.39	19.13	µeq L^{-1}
Na^+	10.44	22.62	18.45	14.79	21.65	19.65	µeq L^{-1}
K^+	2.81	7.16	5.22	3.33	5.12	4.09	µeq L^{-1}
NH_4^+	-0.06	14.58	3.39	-0.89	2.42	0.81	µeq L^{-1}
AL_TD	4.26	18.79	9.40	2.08	17.57	6.43	µmol L^{-1}
AL_TM	2.56	16.05	7.42	1.47	10.82	3.93	µmol L^{-1}
AL_OM	0.48	5.00	1.86	1.61	4.97	2.48	µmol L^{-1}
AL_IM	2.08	11.04	5.56	0.00	5.86	1.49	µmol L^{-1}
LABPH	4.53	5.41	4.91	4.59	6.25	5.26	
AIREQPH	4.46	5.40	4.91	4.59	6.40	5.26	
TRUECOLOR	0	35	13	20	35	25	Pt Co
SCONDUCT	17.34	29.56	20.81	13.01	25.38	15.41	µS cm^{-1}

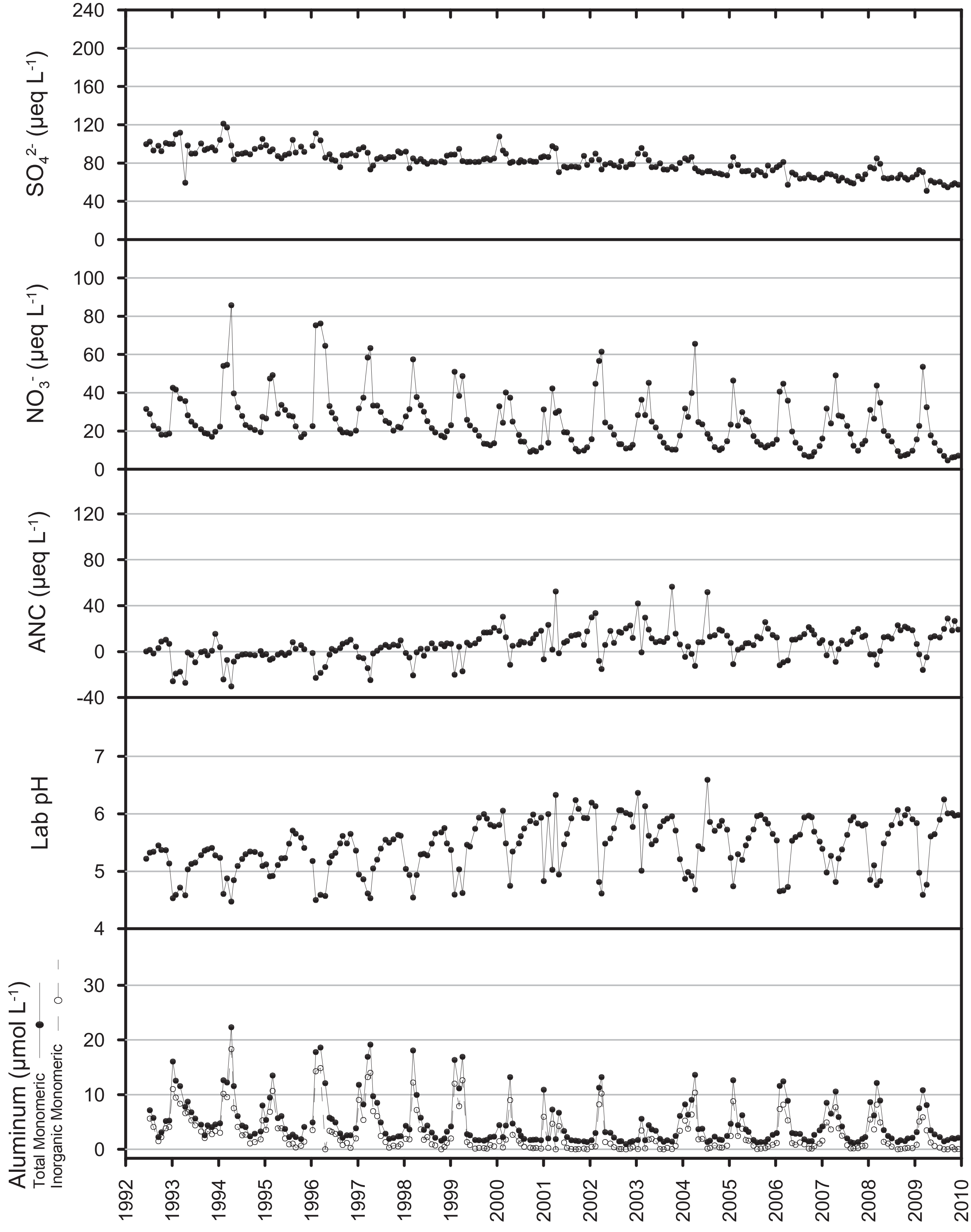
Table 2. Lake Characteristics

Parameter	Value
Elevation	615 m
Maximum depth	18.3 m
Mean depth	8.3 m
Volume	1630.2×10^4 m^3
Surface area	197.4 ha
Watershed area	1662.2 ha
Watershed ratio	0.12
Hydraulic retention time (year)	1.30
Watershed	Oswegatchie/Black
County, Town	Herkimer, Ohio
USGS Quadrangle	Honnedaga Lake
Land use classification	Black River Wild Forest

Figure 3. Chemistry Time Series

SOUTH LAKE (041004)

Thin till drainage
Low DOC



Deposition: The nearest NADP deposition monitoring site is 31 km north at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 21 km northwest at Nick's Lake.

Watershed: The watershed lies on biotite and/or hornblende granitic gneiss with low to no ANC (Roy, K. M. et al. 1997). Till overlays 77.7% of the watershed, while bedrock makes up the remainder primarily to the east. Bedrock outcrop and shallow (<0.5 m) soils occur over 12% of the watershed and generally appear at elevations above 650 m and along the north shore of the Lake. Basal till predominates in the rest of the watershed (71%) except for two wetland areas along the western shore and the northwestern inlet where hydric soils occur (APA 2001). The highest elevation in the watershed is 802 m. The maximum relief is 187 m.

Land cover/use: Total wetland area is 119 ha comprising 7.1% of the watershed. The predominant wetland vegetation types are: forested needle-leaf evergreen (70 ha) and scrub/shrub broad leaf deciduous (23 ha). Wetlands are primarily distributed along surface drainage channels throughout the watershed (Roy, K. M. et al. 1996).

Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1993	Brook trout	11760	60
1995	Lake trout	5000	-
1995	Brook trout	14240	-
1996	Brook trout	6700	356
1997	Rainbow trout	3400	-
1997	Lake trout	1200	-
1997	Walleye	13000	-
1997	Brook trout	3500	117
1997	Atlantic salmon	5000	313
1998	Rainbow trout	3230	-
1998	Lake trout	5060	-
1998	Walleye	13000	-
1998	Brook trout	35910	1364
1999	Lake trout	1200	-
1999	Rainbow trout	5400	-
1999	Walleye	13000	-
1999	Brook trout	6000	-
1999	Atlantic salmon	6000	-
2000	Rainbow trout	3400	-
2000	Lake trout	1200	-
2000	Walleye	13000	-
2000	Brook trout	3500	-
2001	Walleye	6500	-
2001	Brook trout	3120	-
2002	Brook trout	5000	-
2003	Brook trout	6000	-
2004	Brook trout	10125	-
2005	Brook trout	6100	-
2006	Brook trout	3850	-

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-02	Atlantic salmon	1	466	466	1422	1
May-02	Brook trout	70	155	502	30835	70
May-02	Lake chub	5	105	116	62	5
May-02	N. redbelly dace	2	95	106	16	2
May-02	Blacknose dace	1	99	99	8	1
May-02	Creek chub	8	101	200	343	8
May-02	Brown bullhead	14	55	192	753	14

This watershed is a combination of public and private land ownership. The southern half (56%) of the watershed is Forest Preserve – Black River Wild Forest. A small area of private land in Rural Use contains a cluster of camps and houses on the northwestern shore. There are gravel roads around the perimeter of the northwestern bay. Approximately 4% of the shoreline is considered developed. The remaining portion of the watershed to the north is private ownership in Resource Management with little to no development (Roy, K. M. et al. 1997).

Watershed disturbance: The 1916 fire protection source data show 100% of the watershed as green timber with no slash. A storm in November 1950, caused 50 to 100% blowdown in 65.8% of the watershed and 25 to 50% blowdown in 34.2% of the watershed. The July 1995 microburst storm did not record any damage throughout the watershed (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Cumming, B. F., Davey, K. A., Smol, J. P., and Birks, H. J. B. 1994. When did acid-sensitive Adirondack lakes (New York, USA) begin to acidify, and are they still acidifying? Canadian Journal of Fisheries and Aquatic Sciences 51: 1550-1568.

Dixit, S. S., Cumming, B. F., Birks, H. J. B., Smol, J. P., Kingston, J. C., Uutala, A. J., Charles, D. F., and Camburn, K. E. 1993. Diatom assemblages from Adirondack lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Kanciruk, P., Eilers, J. M., McCord, R. A., Landers, D. H., Brakke, D. F., and Linthurst, R. A. 1986. Characteristics of Lakes in the Eastern United States: Volume III. Data Compendium of Site Characteristics and Chemical Variables. U.S. Environmental Protection Agency No. EPA/600/4-86/007c.

McNeil, B., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen, B., Lawrence, G. B., Nierzwicki-Bauer, S. A., Sutherland, J. W., Eichler, L. W., Harrison, J. P., and Boylen, C. W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schoch, N., Evers, D., Simonin, H., Glennon, Michale, and Adams, David 2004. Long-Term Monitoring and Assessment of Mercury Based on Integrated Sampling Efforts Using the Common Loon, Prey Fish, Water, and Sediment. BioDiversity Research Institute, Falmouth, ME.

Schoch, N. and Evers, D. C. 2002. Monitoring Mercury in Common Loons: New York Field Report, 1998-2000. BioDiversity Research Institute No. BRI 2001-01, Falmouth, ME.

Smol, J. P., Cumming, B. F., Dixit, A. S., and Dixit, S. S. 1998. Tracking recovery patterns in acidified lakes: A paleolimnological perspective. Restoration Ecology 6: 318-326.

Stoddard, J. L., Kahl, J. S., Deviney, F. A., DeWalle, D. R., Driscoll, C. T., Herlihy, A. T., Kellogg, J. H., Murdoch, P. S., Webb, J. R., and Webster, K. E. 2003. Response of Surface Water Chemistry to the Clean Air Act Amendments of 1990. United States Environmental Protection Agency No. EPA620/R-03/001.

Sullivan, T. J., Charles, D. F., Bernert, J. A., McMartin, B., Vaché, K. B., and Zehr, J. 1999. Relationship between landscape characteristics, history, and lakewater acidification in the Adirondack Mountains, New York. Water, Air, and Soil Pollution 112: 407-427.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T. J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Zhai, J. Regional application of PnET-BGC to lake-watersheds of the Adirondacks, NY to investigate past and future response to acidic deposition. Master of Science in Environmental Engineering thesis, Syracuse University.

North Lake 041007

Lat. 43° 31' 22'' N Long. 074° 56' 53'' W

Lake: North Lake lies in the Oswegatchie-Black watershed at 555 m. The 176.8 ha lake has a number of major inlets, two of which are the Middle and North Branches of the Black River (Figure 1). Twenty-six ponded sub-watersheds feed North Lake (Roy, K. M. et al. 1996). The North Lake Reservoir was reconstructed in 1870 as part of the Black River Canal (Boonville Black River Canal Museum 2005). The lake has two outlets. The main outlet has a concrete dam with a head height of approximately 10 m. Lake levels are currently managed by the New York State Thruway Authority. The lake is drawn down significantly every winter. North Lake reaches a maximum depth of 17.7 m near the southern end (Figure 2).

North Lake is classified as a thin till chain drainage lake, with low dissolved organic carbon and is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. This lake is accessed by helicopter.

Lake chemistry: North Lake was sampled during the ALS on 08 Jul 1986 finding: Lab pH 5.06, ANC -1.9 µeq L^{-1}, SO_4^{2-} 109.72 µeq L^{-1}, NO_3^- 3.07 µeq L^{-1}, Ca^{2+} 79.35 µeq L^{-1}, Mg^{2+} 26.33 µeq L^{-1}, DOC 5.0 mg L^{-1} -C (ALSC 1987). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 15 Sep 1986, submergent vegetation covered 30% of the lake bottom and emergent plants covered 1% of the surface. Species identified were: Sphagnum spp., Sparganium spp., Potamogeton spp., Eriocaulon spp., Typha spp., Scirpus spp., Iris spp., and Utricularia spp. A dip net survey on the same date found Coleoptera Dytiscidae; Diptera Chironomidae; Decapoda Astacidae; Haplosclerina Spongillidae; and Oligochae Unspecified (ALSC 87). On 08 Jul 1986, the lake was thermally stratified between 4 and 6 m. In 2003, the AEAP reported the average value of chlorophyll a was 3.15 µg L^{-1} (Momen, B. et al. 2006).

Figure 1. Catchment

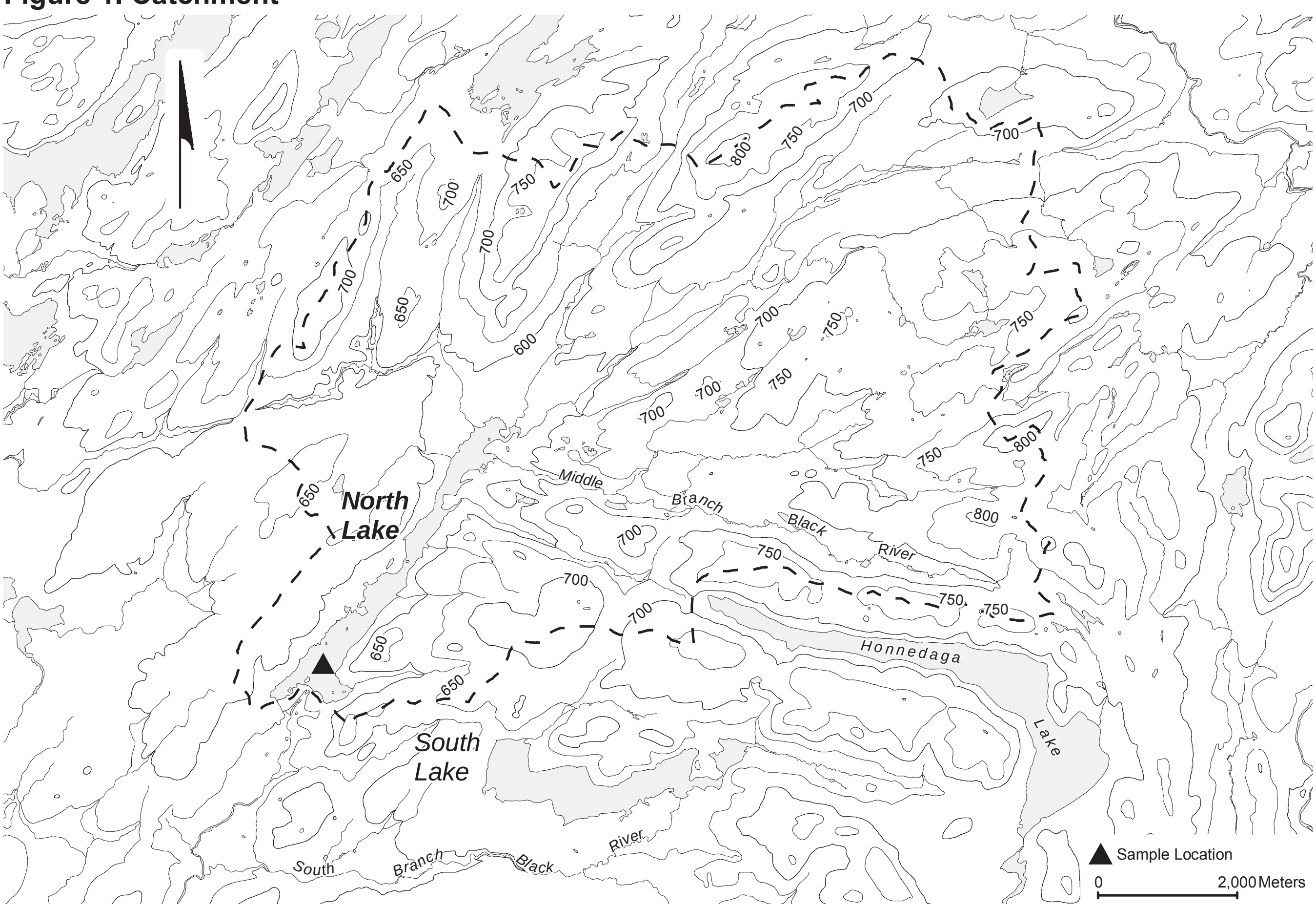


Figure 2. Bathymetry

Maximum Depth (+): 58 ft
Source: ALSC 1986

4000'

Fisheries: The earliest records indicate the lake was stocked with brook trout in 1893 and brown trout in 1899. North Lake was intermittently stocked between 1933 and 1980 with brook trout and rainbow trout (ALSC 1987). Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: North Lake has been modeled using the integrated biogeochemical (PnET-BGC) model (Zhai, J. 2006). North Lake was sampled by the Statewide Monitoring of Mercury Project in 2003 (Simonin, H. et al. 2008). Common loons were surveyed for mercury content in 1998-2000 (Schoch, N. and Evers, D. C. 2002) and in 2003-2004 (Schoch, N. et al. 2004). North Lake was part of EPA's Environmental Monitoring and Assessment Program (EMAP) in 1992, 1994, 1995, and 1997. Since 1999, the lake is sampled annually as part of the TIME project (Stoddard, J. L. et al. 2003). The lake is an AEAP water (Momen, B. et al. 2006). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

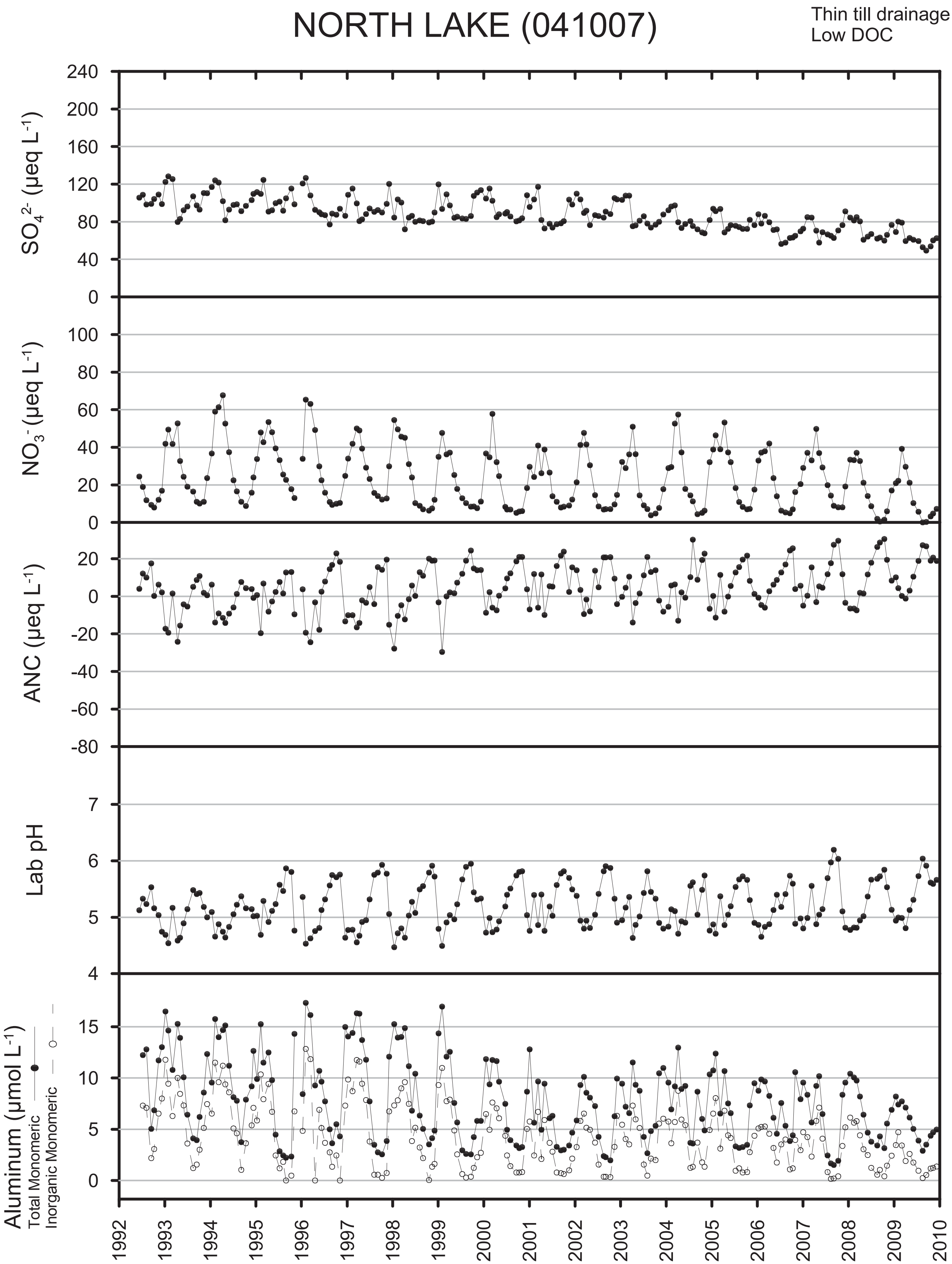
Table 1. Lake Chemistry

041007			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	79.74	128.25	103.79	49.38	80.30	62.47	µeq L^{-1}
NO_3^-	10.13	52.72	27.84	0.00	39.21	13.72	µeq L^{-1}
Cl^-	5.92	10.44	7.43	4.69	8.67	6.28	µeq L^{-1}
F^-	2.26	3.58	2.70	2.22	2.87	2.49	µeq L^{-1}
ANC	-24.20	10.73	-4.82	-1.27	27.13	13.13	µeq L^{-1}
DIC	12.49	91.58	43.64	22.89	68.27	49.83	µmol L^{-1} -C
DOC	248.77	440.92	372.71	365.41	585.92	455.81	µmol L^{-1} -C
SiO_2	51.26	105.35	76.49	54.59	93.87	72.73	µmol L^{-1}
Ca^{2+}	55.39	100.80	77.06	48.41	63.38	57.63	µeq L^{-1}
Mg^{2+}	19.75	33.74	27.29	18.10	26.33	21.80	µeq L^{-1}
Na^+	12.61	30.88	20.55	17.40	27.40	21.66	µeq L^{-1}
K^+	5.12	7.67	6.03	3.07	6.39	4.85	µeq L^{-1}
NH_4^+	0.28	4.32	1.54	-1.05	2.31	0.68	µeq L^{-1}
AL_TD	6.78	19.12	13.21	7.38	13.79	10.60	µmol L^{-1}
AL_TM	3.93	16.49	10.23	2.89	8.19	5.49	µmol L^{-1}
AL_OM	2.37	5.48	3.96	2.65	5.23	3.55	µmol L^{-1}
AL_IM	1.22	11.79	6.27	0.24	4.71	1.94	µmol L^{-1}
LABPH	4.54	5.48	4.89	4.80	6.04	5.23	
AIREQPH	4.53	5.55	4.91	4.84	6.10	5.24	
TRUECOLOR	20	40	33	40	90	56	Pt Co
SCONDUCT	17.91	30.40	22.86	13.21	21.84	16.17	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	555 m
Maximum depth	17.7 m
Mean depth	5.7 m
Volume	1010.7 x 10^4 m^3
Surface area	176.8 ha
Watershed area	7,700.8 ha
Watershed ratio	0.02
Hydraulic retention time (year)	0.15
Watershed	Oswegatchie/Black
County, Town	Herkimer, Ohio
USGS Quadrangle	Honnedaga Lake
Land use classification	Black River Wild Forest

Figure 3. Chemistry Time Series



Deposition: The nearest NADP deposition monitoring site is 31 km north at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 18 km north at Nick's Lake.

Watershed: Approximately 80% of the watershed lies on metasedimentary rock, migmatite, and granitic gneiss with medium to high ANC. The remainder of the watershed is underlain by biotite and other hornblende granite gneiss, with a small portion of leucograntic gneiss to the east, both of which have low-to-no ANC (Roy, K. M. et al. 1997). Till overlays 85.9% of the watershed, of which basal till is the predominate soil type. Bedrock outcrops and shallow (<0.5 m) soils appear between 650 and 700 meters and together account for about 30% of the watershed. Hydric soils appear along the broad stream valleys where the wetlands occur and cover about 8% of the watershed. Glacial outwash soils appear at the north shore along the southern half of North Lake and near its outlet (APA 2001). The watershed rises to a maximum of about 817 m at Ice Cave Mountain. The watershed has a maximum relief of 262 m. In 1986, the ALS found shoal water substrate comprised of 70% sand and gravel, 25% boulders and rubble, and 5% muck/silt (ALSC 1987).

Land cover/use: In 1986, the ALS characterized the watershed as 90% deciduous forest, 8% deciduous-coniferous mixed forest, 1% shrub/sapling and 1% developed. The immediate shoreline was bounded by 70% deciduous forest, 10% deciduous-coniferous mixed forest, 10% developed, 5% shrub-sapling vegetation, 3% boulder rock ledge, 1% open grass area, and 1% sand and gravel beach (ALSC 1987). Total wetland area consists of 1018 ha comprising 13.2 % of the watershed. The predominant wetland types are forested needle-leaved evergreen and scrub/shrub broad leaf deciduous. Wetlands are primarily distributed along surface drainage channels throughout the watershed (Roy, K. M. et al. 1996).

This watershed is a combination of public and private land ownership. The southern half (44%) of the watershed is Forest Preserve – Black River Wild Forest. Several primitive campsites are located along the southwestern shore of the lake. Other portions of the southern shoreline in private ownership are developed (6% of shoreline) in Low and Moderate Intensity and Rural Use classifications. The northern portion of the watershed in private ownership is in Resource Management with little to no development (Roy, K. M. et al. 1997).

Watershed disturbance: The 1916 fire protection source data reveal 96.1% of the watershed as green timber with no slash. The remaining portion, in the north, is indicated as logged for softwoods only. In November 1950, a storm caused 50 to 100% blowdown in 21.2% of the watershed and 25 to 50% blowdown in 68.2% of the watershed. The watershed was not impacted by the July 1995 microburst (ALSC 2003). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

Table 3. Stocking

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1990	Bass-Lg/Sm	300	600
1993	Brook trout	11760	60
1995	Brook trout	6000	-
1995	Tiger musky	2000	250
1998	Brook trout	700	171
1998	Tiger musky	400	36
1999	Splake	2000	810
2003	Brook trout	2500	30
2004	Brook trout	6625	390
2005	Brook trout	6100	606
2006	Brook trout	3000	6.25
2006	Tiger musky	1000	133

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-01	Brook trout	1	275	275	204	1
June-01	Golden shiner	5	106	173	143	5
June-01	White sucker	23	222	333	5175	170
June-01	Brown bullhead	24	135	175	909	24
June-01	Yellow perch	136	85	370	-	136
September-86	Brook trout	10	213	415	3300	10
September-86	Lake chub	25	95	177	1350	37
September-86	Golden shiner	31	80	186	929	40
September-86	Creek chub	25	92	195	951	37
September-86	White sucker	25	205	389	5800	342
September-86	Brown bullhead	25	108	302	1960	51

References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1985 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Boonville Black River Canal Museum. Boonville Black River Canal Museum. <http://blackrivercanalmuseum.com> 2005. (Accessed 4 December 2009).

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen, B., Lawrence, G. B., Nierzwicki-Bauer, S. A., Sutherland, J. W., Eichler, L. W., Harrison, J. P., and Boylen, C. W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Roy, K. M., Curran, R. P., Barge, J. W., Spada, D. M., Bogucki, D. J., Allen, E. B., and Kretser, W. A. 1996. Watershed Protection for Adirondack Wetlands: A Demonstration-Level GIS Characterization of Subcatchments of the Oswegatchie/Black River Watershed. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schoch, N., Evers, D., Simonin, H., Glennon, Michale, and Adams, David 2004. Long-Term Monitoring and Assessment of Mercury Based on Integrated Sampling Efforts Using the Common Loon, Prey Fish, Water, and Sediment. Report to the New York State Energy Research and Development Authority, Albany, NY.

Schoch, N. and Evers, D. C. 2002. Monitoring Mercury in Common Loons: New York Field Report, 1998-2000. BioDiversity Research Institute No. BRI 2001-01. BioDiversity Research Institute, Falmouth, ME.

Simonin, H., Loukmas, J., Skinner, L., and Roy, K. 2008. Strategic Monitoring of Mercury in New York State Fish: Final Report 08-11. New York State Energy Research and Development Authority No. Report 08-11.

Stoddard, J. L., Kahl, J. S., Deviney, F. A., DeWalle, D. R., Driscoll, C. T., Herlihy, A. T., Kellogg, J. H., Murdoch, P. S., Webb, J. R., and Webster, K. E. 2003. Response of Surface Water Chemistry to the Clean Air Act Amendments of 1990. United States Environmental Protection Agency No. EPA620/R-03/001.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T. J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Zhai, J. Regional application of PnET-BGC to lake-watersheds of the Adirondacks, NY to investigate past and future response to acidic deposition. Master of Science in Environmental Engineering thesis, Syracuse University.

Willis Lake 050215

Lat. 43° 22' 17'' N Long. 074° 14' 47'' W

Lake: Willis Lake lies in the Upper Hudson watershed at 400 m. The wide outlet flows approximately 300 m until it is channelized through a culvert under the causeway. The lake has no primary inlets (Figure 1). The lake has a maximum depth of 2.7 m (Figure 2).

Willis Lake is a medium till drainage lake, with low dissolved organic carbon. It is considered moderately sensitive to acidification. The ALTM program began monitoring (Station 1) in June 1992 (Figure 1).

Lake chemistry: Willis Lake was sampled during the ALS on 13 Aug 1987 finding: Lab pH 6.67, ANC 58.8 µeq L^{-1}, SO_4^{2-} 98.27 µeq L^{-1}, NO_3^- 0.16 µeq L^{-1}, Ca^{2+} 111.78 µeq L^{-1}, Mg^{2+} 34.56 µeq L^{-1}, DOC 4.8 mg L^{-1} -C (ALSC 1989). Table 1 summarizes recent water chemistry taken at the outlet. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 08 Sep 1987, the ALS found submergent vegetation occupied 30% of the lake bottom, while emergent and floating vegetation occupied 5% and 15%, respectively, of the surface. The following aquatic plant species were identified: Chara spp., Potamogeton spp., Sparganium spp., Carex spp., Fontinalis spp., Sagittaria spp., Dulichium spp., Eleocharis spp, Iris spp., Nuphar spp., Nymphaea spp., Brasenia spp., Hypericum spp., Utricularia spp., and Eriocaulon spp. Also identified was Poaceae. A dip-net survey on the same date found the following Insecta: Odonata Gomphidae, Libellulidae and Coenagriidae; and Hemiptera Mesoveliidae. Also found were: Crustacea Isopoda Unspecified and Amphipoda Unspecified; Gastropod Basommatophora Planorbidae; and Demospong Haplosclerina Spongillidae (ALSC 1989). The ALS found no evidence of a thermocline on 13 Aug 1987 (ALSC 1989). The AEAP reported an average value of chlorophyll a of 5.3 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: The earliest records indicate smallmouth bass were stocked three times during 1947 with no records of stocking since (ALSC 1989). Refer to Table 3 for recent netting history.

Figure 1. Catchment

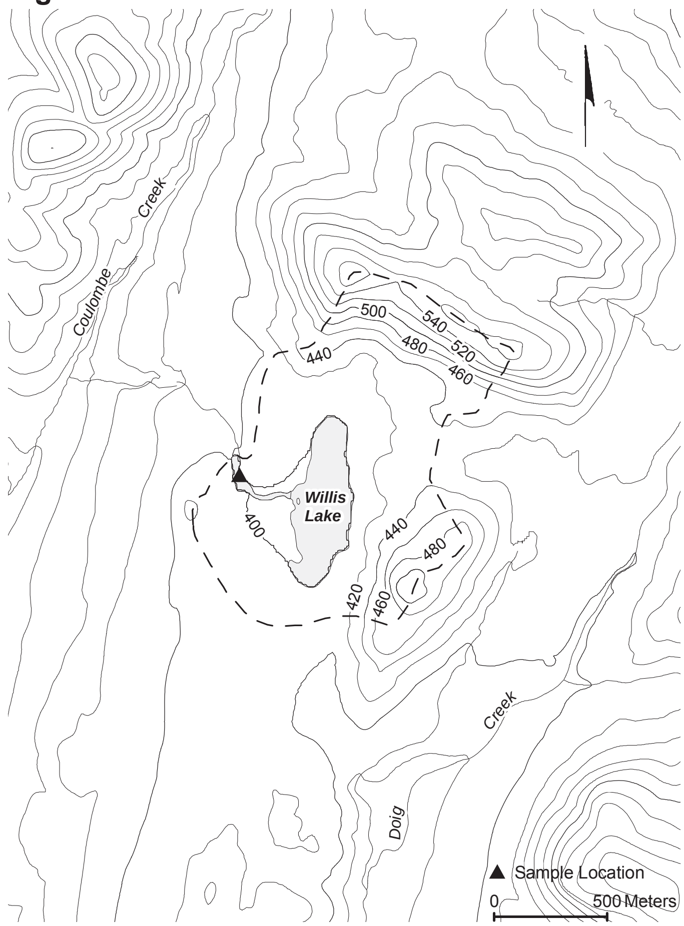
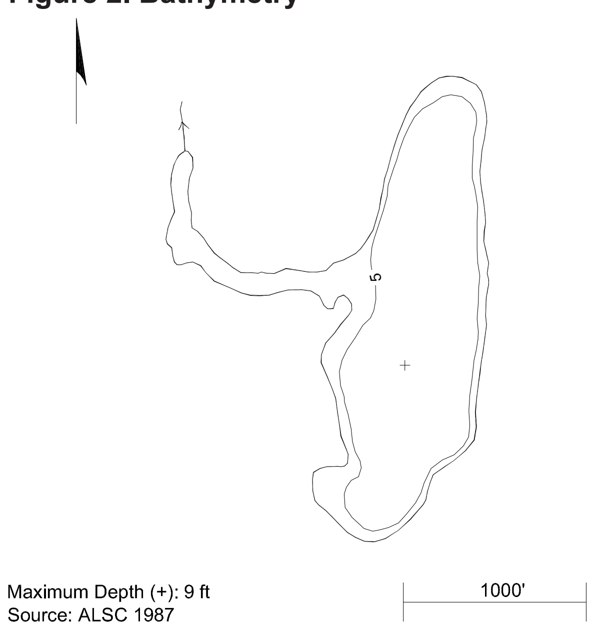


Figure 2. Bathymetry



Intensive Studies: Diatoms were evaluated for use as environmental indicators for the EMAP-Surface Water project in 1991 (Dixit, S. S. and Smol, J. P. 1994). Willis Lake was sampled by EMAP in 1991, 1992, and 1995. The lake has been studied by the AEAP since 1994 (Momen, B. et al. 2006). The Statewide Monitoring of Mercury Project surveyed the lake in 2003 (Simonin, H. et al. 2008). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 67 km north at Huntington Wildlife. The nearest NYSDEC wet deposition monitoring site is 24 km west at Piseco Lake.

Watershed: The Willis Lake watershed lies primarily (64%) on biotite and/or hornblende granite gneiss with low to no ANC. The northern portion of the watershed (36%) lies on interlayered metasedimentary rock and granitic gneiss with medium to high ANC (Roy, K. M. et al. 1997). Till overlies 85% of the watershed, while exposed bedrock makes up the remainder. Shallow to bedrock soils (<0.5 m) with bedrock outcrop predominate above 420 m elevations occurs in 58% of the watershed. The remaining portion on the western shore of the lake consists of basal till soils (APA 2001). The highest elevation in the watershed is Corrigan Hill at 571 m. The watershed has a maximum relief of 171 m. In 1987, the ALS described the shoal water substrate around the lake as 40% rubble, sand, gravel and 60% muck/silt/organic (ALSC 1989).

Land cover/use: In 1987, the watershed was characterized as: deciduous forest 15%; coniferous forest 15%; deciduous-coniferous mixed forest 20%; shrub/sapling 15%; wetland 20%; and developed land accounted for 15%. The immediate shoreline was characterized as: deciduous forest 50%; wetland 20%; deciduous-coniferous forest mix 10% and developed 20% (ALSC 1989). Wetland area totals 8.5 ha comprising 6.2% of the watershed. The predominant wetland types are scrub/shrub needle leaf evergreen and scrub/shrub broad-leaf evergreen (ALSC 2003). Wetlands exist along the northern and southern shorelines and dominate the entire shoreline of the outlet (ALSC

Table 1. Lake Chemistry

050215			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	65.58	133.25	91.04	39.42	76.34	58.21	µeq L^{-1}
NO_3^-	-0.27	7.40	1.30	0.00	7.71	1.19	µeq L^{-1}
Cl^-	13.82	27.36	19.74	17.99	71.32	33.55	µeq L^{-1}
F^-	1.58	2.11	1.81	1.77	2.35	2.03	µeq L^{-1}
ANC	23.55	91.00	59.28	27.93	103.53	66.44	µeq L^{-1}
DIC	14.99	519.52	211.19	153.19	444.59	253.16	µmol L^{-1}-C
DOC	292.73	1208.63	682.69	341.85	1145.49	614.71	µmol L^{-1}-C
SiO_2	20.97	89.37	53.48	22.63	85.55	49.22	µmol L^{-1}
Ca^{2+}	92.32	148.21	127.67	97.31	165.59	116.35	µeq L^{-1}
Mg^{2+}	30.45	48.55	38.54	28.80	48.17	34.17	µeq L^{-1}
Na^+	29.14	40.89	36.10	29.58	60.41	43.77	µeq L^{-1}
K^+	1.02	4.60	2.96	0.51	3.84	2.18	µeq L^{-1}
NH_4^+	-0.06	5.38	1.62	-0.61	3.27	0.74	µeq L^{-1}
AL_TD	1.78	5.34	2.91	1.47	2.82	2.25	µmol L^{-1}
AL_TM	1.00	3.70	2.33	1.84	2.56	2.18	µmol L^{-1}
AL_OM	1.11	3.68	1.98	1.48	2.56	2.17	µmol L^{-1}
AL_IM	0.00	1.85	0.48	0.00	0.59	0.09	µmol L^{-1}
LABPH	5.38	6.21	5.85	5.37	6.28	5.79	
AIREQPH	5.79	7.07	6.44	6.42	7.15	6.69	
TRUECOLOR	25	100	63	30	160	80	Pt Co
SCONDUCT	18.82	25.01	22.65	17.71	27.73	21.69	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	400 m
Maximum depth	2.7 m
Mean depth	1.6 m
Volume	22.9 x 10^4 m^3
Surface area	14.6 ha
Watershed area	136.4 ha
Watershed ratio	0.11
Hydraulic retention time (year)	0.22
Watershed	Upper Hudson
County, Town	Hamilton, Wells
USGS Quadrangle	Harrisburg

Figure 3. Chemistry Time Series

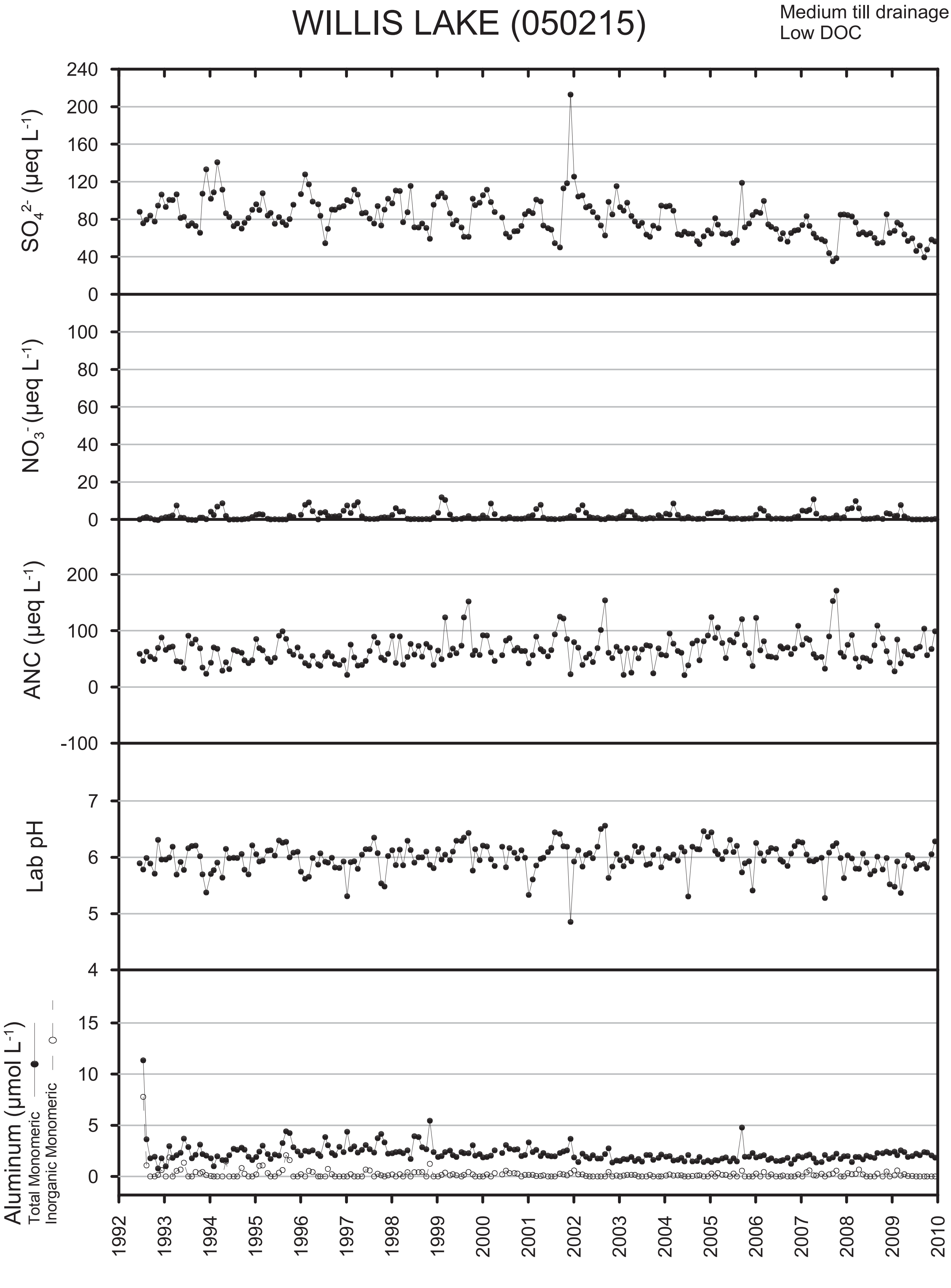


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
May-01	Chain pickerel	7	170	460	2554	7
May-01	Golden shiner	23	136	190	1052	68
May-01	Brown bullhead	8	215	363	4385	8
May-01	Pumpkinseed	20	120	230	3569	20
May-01	Smallmouth bass	3	310	455	-	3
May-01	Largemouth bass	1	390	390	1193	1
May-01	Yellow perch	20	145	312	1722	20
September-87	Golden shiner	25	85	205	449	60
September-87	Brown bullhead	3	301	355	1430	3
September-87	Pumpkinseed	16	58	225	1112	16
September-87	Largemouth bass	11	186	500	6070	11
September-87	Yellow perch	18	105	342	3489	18

1989). Most of Willis Lake and its watershed occur within the Wilcox Lake Wild Forest. Twenty percent of the shoreline, northwest of the outlet, is privately owned and classified as Resource Management land (NYSDEC 2006). There are approximately eight permanent homes within the area.

Watershed disturbance: The 1916 fire protection data shows 92% of the watershed as green timber with no slash and less than 1% as open grazing and farm land. A November 1950 storm damaged 100% of the watershed causing 25 to 50% blowdown (ALSC 2003). The watershed was not affected by the 1995 microburst or the January 1998 ice storms (ALSC 2003; NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1985 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Dixit, S. S. and Smol, J. P. 1994. Diatoms as indicators in the environmental monitoring and assessment program-surface waters (EMAP-SW). Environmental Monitoring and Assessment 31: 275-306.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen, B., Lawrence, G. B., Nierzwicki-Bauer, S. A., Sutherland, J. W., Eichler, L. W., Harrison, J. P., and Boylen, C. W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

New York State Department of Environmental Conservation (NYSDEC) 2006. Wilcox Lake Wild Forest Draft Unit Management Plan/ Draft Environmental Impact Statement. New York State Department of Environmental Conservation, Ray Brook, NY.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Simonin, H., Loukmas, J., Skinner, L., and Roy, K. 2008. Strategic Monitoring of Mercury in New York State Fish: Final Report 08-11. New York State Energy Research and Development Authority No. Report 08-11.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T. J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

This page intentionally left blank.

Jockeybush Lake   050259

Lat. 43° 18’ 08’’ N   Long. 074° 35’ 09’’ W

Lake: Jockeybush Lake lies in the Upper Hudson watershed at 599 m. This headwater lake has no perennial inlets (Figure 1). In 1987, an active beaver dam was present at the outlet (ALSC 1989). The outlet drains east into the West Branch of the Sacandaga River. Jockeybush Lake reaches a maximum depth of 11.3 m. (Figure 2).

Jockeybush Lake is classified as a thin till drainage lake, with low dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. The lake is accessed by helicopter.

Lake chemistry: Jockeybush Lake was sampled during the ALS on 04 Aug 1987 finding: Lab pH 5.34, ANC -1.1 µeq L^{-1}, SO_4^{2-} 113.47 µeq L^{-1}, NO_3^- 1.94 µeq L^{-1}, Ca^{2+} 63.38 µeq L^{-1}, Mg^{2+} 31.27 µeq L^{-1}, DOC 2.8 mg L^{-1}-C (ALSC 1989). Table 1 summarizes recent water chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 02 Sep 1987, the ALS found submergent vegetation covered 20% of the bottom and emergent vegetation covered 1% of the surface. ALS identified the following aquatic plants: Sphagnum spp.; Sparganium spp.; Nuphar spp.; Hypericum spp.; Utricularia spp.; Eriocaulon spp. and numerous Algae. A dip-net survey on the same date found the following Insecta: Odonata Coenagriidae and Aeshnidae; Coleoptera Dytiscidae and Hydrophilidae; Diptera Chironomidae; Hemiptera Notonectidae and Gerridae. Also found were Crustacea Amphipoda Unspecified and Demospong Haplosclerina Spongillidae (ALSC 1989). The ALS found evidence of a thermocline between 6 and 8 m on 04 Aug 1987 (ALSC 1989). The AEAP reported the average value of chlorophyll a as 0.8 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: NYSDEC has stocked this lake annually with brook trout since 1952 (ALSC 1989). The ALTM has netted the lake. Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: Jockeybush Lake has been studied by the AEAP since 1994 (Momen, B. et al 2006). It was one of 36 ALTM lakes evaluated by Momen and Zehr (1998) during 1994 examining lake-water chemistry and terrestrial characteristics

Figure 1. Catchment

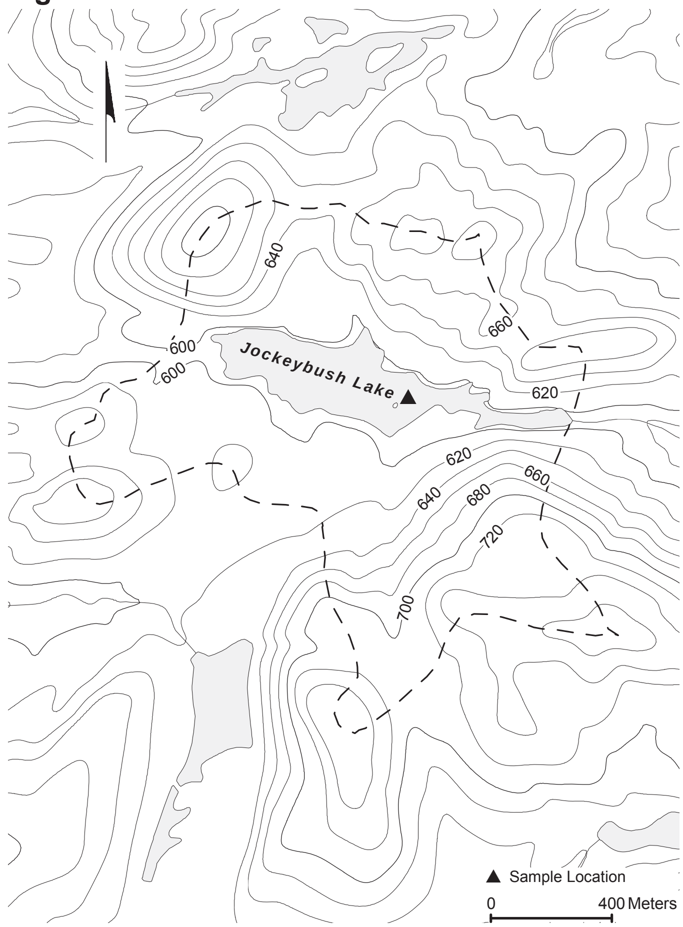
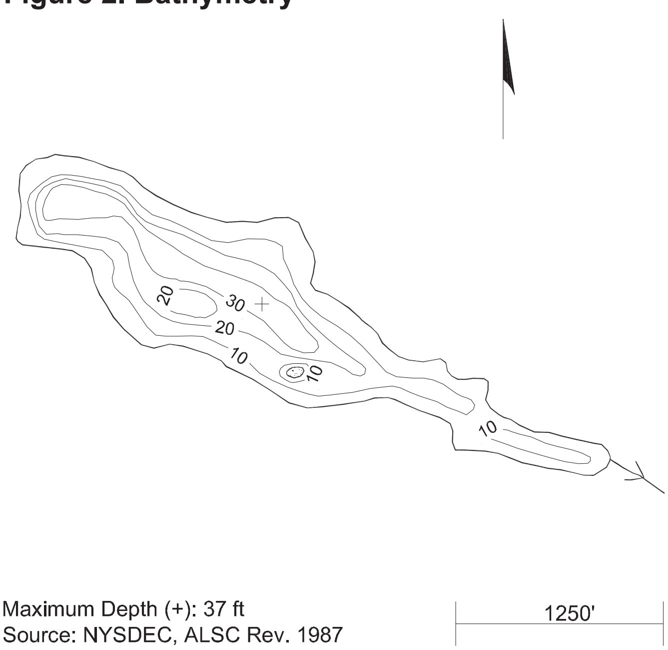


Figure 2. Bathymetry



Maximum Depth (+): 37 ft
Source: NYSDEC, ALSC Rev. 1987

with the existing watershed classifications (Momen, B. and Zehr, J. P. 1998). Ito et al. 2005 evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 – 2000 (Ito, M. et al. 2006). In 2003, this lake watershed was part of a 36 lake-watershed regional survey of foliar nitrogen gradients in the Adirondack Park (McNeil, Brenden E. et al. 2007).

Soils: A soil plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b) (Fig. 1).

Deposition: The nearest NADP deposition monitoring site is 58 km north at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 17 km north at Piseco Lake.

Watershed: Jockeybush Lake lies on charnockite, granitic and quartz syenite gneiss bedrock with low to no ANC (Roy, K. M. et al. 1997). The southern half of the watershed is dominated by biotite-quartz-plagioclase paragneiss, commonly with leucocratic bedrock. Till comprises 71% of the watershed, while the remainder is exposed bedrock (ALSC 2003). Shallow soils and rock outcrops predominate in areas between 640 and 700 meters in elevation. Basal till soils are located around most of the lake shoreline and throughout the remainder of the watershed except near the outlet and in the higher elevations above 640 m where rock outcrop predominates (APA 2001). To the southeast, the watershed rises to a maximum of 773 m**.** The maximum relief is 174 m. In 1987, the shoal water substrate is 75% sand and gravel, 5% boulder and 20% organic (ALSC 1989).

Land cover/use: In 1987, deciduous forest covered 75% of the watershed, while the remaining 20% was deciduous-coniferous mixed forest and 5% shrub/sapling. The immediate shoreline consists of 55% deciduous-coniferous mixed forest, 40% coniferous forest, 3% wetland and 2% boulder/rock ledge (ALSC 89). Total

Table 1. Lake Chemistry

050259			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	95.15	142.20	112.15	66.31	89.59	73.31	μeq L^{-1}
NO_3^-	2.82	54.84	16.76	0.00	42.07	9.69	μeq L^{-1}
Cl^-	6.21	19.74	9.54	6.13	10.95	7.49	μeq L^{-1}
F^-	0.89	2.47	1.79	1.00	1.78	1.56	μeq L^{-1}
ANC	-10.86	-0.74	-5.02	-2.25	24.72	11.37	μeq L^{-1}
DIC	8.33	183.16	65.36	22.48	134.87	60.26	μmol L^{-1} -C
DOC	132.54	336.35	201.47	188.66	256.76	210.53	μmol L^{-1} -C
SiO_2	27.63	65.74	45.69	39.78	63.08	50.23	μmol L^{-1}
Ca^{2+}	61.38	96.81	71.61	48.41	66.87	55.66	μeq L^{-1}
Mg^{2+}	23.04	30.45	26.13	18.93	25.51	22.02	μeq L^{-1}
Na^+	15.22	30.88	18.52	15.94	23.49	17.54	μeq L^{-1}
K^+	3.58	7.93	4.69	2.30	3.84	3.01	μeq L^{-1}
NH_4^+	-0.06	5.71	2.19	-0.34	2.88	0.86	μeq L^{-1}
AL_TD	4.00	20.09	9.39	2.67	13.86	5.86	μmol L^{-1}
AL_TM	3.07	16.63	8.01	1.61	14.38	3.62	μmol L^{-1}
AL_OM	0.76	6.60	1.91	1.63	3.11	2.10	μmol L^{-1}
AL_IM	2.05	13.71	6.10	0.00	11.60	1.53	μmol L^{-1}
LABPH	4.65	5.27	4.96	4.84	5.91	5.45	
AIREQPH	4.76	5.32	5.01	4.86	6.00	5.52	
TRUECOLOR	5	20	11	10	20	17	Pt Co
SCONDUCT	17.06	30.49	21.34	12.84	23.66	14.98	μS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	599 m
Maximum depth	11.3 m
Mean depth	4.5 m
Volume	78.6 x 10^4 m^3
Surface area	17.3 ha
Watershed area	160.0 ha
Watershed ratio	0.11
Hydraulic retention times (year)	0.55
Watershed	Upper Hudson
County, Town	Hamilton, Arietta
USGS Quadrangle	Piseco Lake
Land use classification	Ferris Lake Wild Forest

Figure 3. Chemistry Time Series

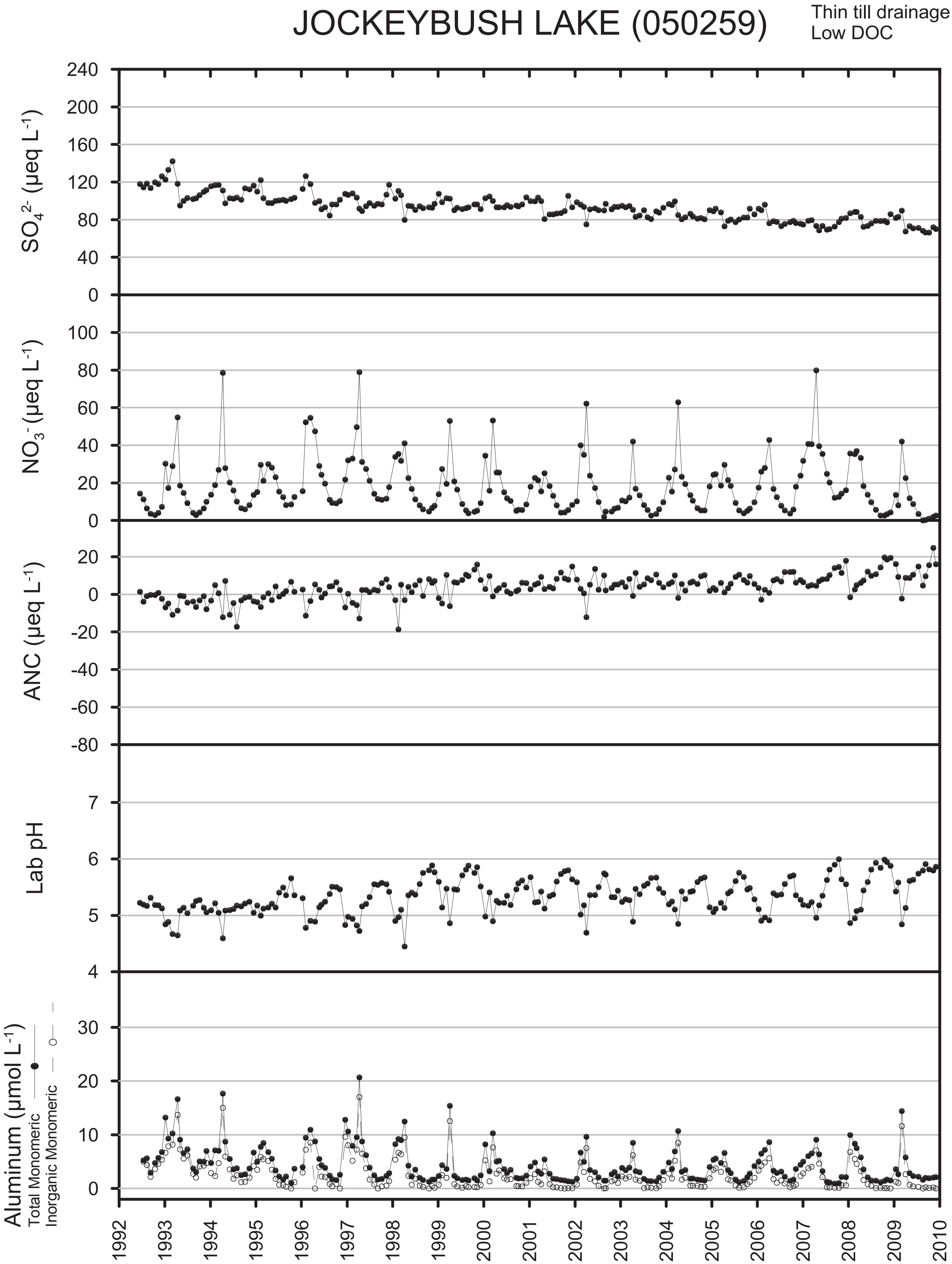


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	1680	19
1981	Brook trout	1260	36
1982	Brook trout	1400	8
1983	Brook trout	1400	10
1984	Brook trout	1036	10
1985	Brook trout	1540	16
1986	Brook trout	1400	13
1987	Brook trout	1400	10
1988	Brook trout	1400	12
1989	Brook trout	1540	10
1990	Brook trout	1530	17
1991	Brook trout	1400	16
1992	Brook trout	1400	13
1993	Brook trout	1400	20
1994	Brook trout	1100	14
1995	Brook trout	1300	27
1996	Brook trout	1400	61
1997	Brook trout	1470	49
1998	Brook trout	1470	42
1999	Brook trout	1400	18
2000	Brook trout	1400	18
2001	Brook trout	1250	21
2002	Brook trout	1400	22
2003	Brook trout	1400	22
2004	Brook trout	1400	29
2005	Brook trout	1400	29
2006	Brook trout	1540	25

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
July-96	Brook trout	19	212	423	-	19
September-87	Brook trout	40	86	389	11978	40

wetland area was 4.9 ha and comprised 3.1% of the watershed (ALSC 2003). The watershed lies entirely in the Ferris Lake Wild Forest. There is a foot trail along the outlet stream that leads to the lake and a primitive campsite near the shore.

Watershed disturbance: The 1916 fire protection map shows 88.8% of the watershed as virgin and second growth green timber with no slash. The watershed was not disturbed by the 1950, 1995, or 1998 storms (ALSC 2003; NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1985 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Ito, M., Mitchell, M. J., Driscoll, C. T., and Roy, K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen, B., Lawrence, G. B., Nierzwicki-Bauer, S. A., Sutherland, J. W., Eichler, L. W., Harrison, J. P., and Boylen, C. W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

Momen, B. and Zehr, J. P. 1998. Watershed classification by discriminant analyses of lakewater-chemistry and terrestrial characteristics. Ecological Applications 8: 497-507.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T. J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

This page intentionally left blank.

Clear Pond 050458

Lat. 43° 59' 38'' N Long. 073° 49' 40'' W

Lake: Clear Pond lies in the Upper Hudson River watershed at 584 m (Figure 1). There is one primary inlet in the northeast. The outlet flows west to join the outlet of Elk Lake approximately 650 m downstream. This headwater lake (ALSC 2003) reaches a maximum depth of 24.4 m (Figure 2).

Clear Pond is classified as a thick till drainage lake with low dissolved organic carbon. It is considered insensitive to acidification. This is one of the original ALS waters and has been monitored on a monthly basis since June 1982.

Lake chemistry: Clear Pond was sampled during the ALS on 04 Aug 1987 finding: Lab pH 6.48, ANC 110.5 µeq L^{-1}, SO_4^{2-} 112.43 µeq L^{-1}, NO_3^- 1.62 µeq L^{-1}, Ca^{2+} 157.19 µeq L^{-1}, Mg^{2+} 31.27 µeq L^{-1}, DOC 3.0 mg L^{-1} -C (ALSC 1989). Table 1 summarizes recent water sample chemistry taken at the outlet. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 20 Oct 1987, the ALS identified the following aquatic plants: Eriocaulon spp. and numerous algae. A dip-net survey on that date found the following Insecta: Odonata Libellulidae, Aeshnidae and Gomphidae; Ephemeroptera Heptageniidae, Ephemerellidae and Unspecified; Hemiptera Notonectidae. Also found were Crustacea: Amphipoda Unspecified and Decapoda Astacidae; and Demospong Haplosclerina Spongillidae. The ALS found the lake thermally stratified between 6 and 8 m on 04 Aug 1987 (ALSC 1989).

Fisheries: Clear Pond was intermittently stocked with Atlantic salmon from 1945 to 1954. There are no records of lake stocking since that time (ALSC 2003). The ALTM has netted several species in the lake. Refer to Table 3 for recent netting history.

Intensive studies: NYSDOH conducted a limnological survey of Clear Pond in August 1975 (Wood, L. W. 1978). Clear Pond was studied under RILWAS in 1985 (Driscoll, C. T. and Newton, R. M. 1985). Diatom stratigraphies were developed from sediment cores in the late 1980s (Charles, D. F. et al. 1990). Diatoms were evaluated for use as environmental indicators for the EMAP-Surface Water project in 1991 (Dixit, S. S. and Smol, J. P.

Figure 1. Catchment

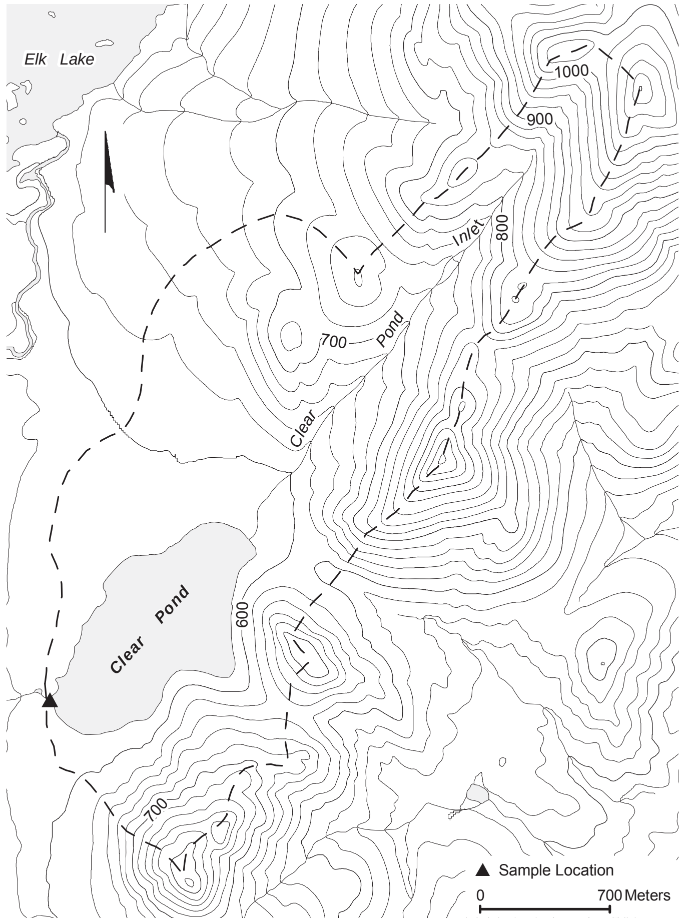


Figure 2. Bathymetry

Maximum Depth (+): 80 ft
Source: Cornell Univ. 1961, ALSC Rec'd c.1984

2000'

1994). Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Landscape characteristics and disturbance history have been evaluated within this watershed (Sullivan, T. J. et al. 1999). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed. Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995).

Deposition: The nearest NADP deposition monitoring site is 32 km west at Huntington Wildlife. The nearest NYSDEC wet deposition monitoring site is 42 km north at Whiteface Mountain.

Watershed: The Clear Pond watershed is underlain by anorthosite bedrock overlain by thin to moderate depths of till (Charles, D. F. et al.1990). Till comprises 89.9% of the watershed and 10.1% is exposed bedrock (ALSC 2003). Shallow (<0.5 m) soils and rock outcrops are found in the steep-sloped areas above 650 m throughout the watershed. A small area, below 600 m, along the north shore of the lake consists of hydric soils. Abalation till dominates the watershed in areas between 600 and 680 m, and is the primary soil type on the western and southern shore of the lake (APA 2001). The watershed is situated between the eastern watershed divide of Elk Lake and Sunrise Mountain. The watershed rises to a maximum elevation of 1103 m at Sunrise Mountain. The maximum relief is 519 m. In 1987, the ALS found the shoal water substrate comprised of 80% sand/gravel, 15% boulder/rubble and 5% organic (ALSC 1989).

Land cover/use: In 1987 the watershed was: 80% deciduous forest; 15% deciduous-conifer mixed forest; and 5% coniferous forest. The immediate shore line was 85% deciduous-conifer mixed forest, 5% coniferous forest, 5% deciduous and 5% shrub/sapling mix (ALSC 1989). Total wetland area was 15.3 ha and comprised 2.7% of the watershed. The predominant wetland type is forested needle-leaf evergreen with a total area of 13.6 ha (ALSC 2003).

Clear Pond and most of its watershed are located on private land classified as Resource Management. The remainder of the eastern watershed is in the Dix Mountain Wilderness. A paved road crosses the outlet, and a foot path intersects the southern portion of the watershed.

Table 1. Lake Chemistry

050458			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	94.73	127.83	107.67	62.86	91.25	72.33	µeq L^{-1}
NO_3^-	-0.16	16.95	3.80	0.00	12.79	3.66	µeq L^{-1}
Cl^-	7.05	10.15	8.06	5.55	8.82	6.62	µeq L^{-1}
F^-	0.32	0.74	0.44	0.58	0.78	0.67	µeq L^{-1}
ANC	72.87	124.86	108.63	74.78	113.80	102.91	µeq L^{-1}
DIC	104.90	203.98	154.16	96.58	170.67	128.87	µmol L^{-1} -C
DOC	231.37	331.44	263.16	247.44	359.88	300.66	µmol L^{-1} -C
SiO_2	82.72	123.66	96.28	86.71	113.51	99.66	µmol L^{-1}
Ca^{2+}	88.83	206.10	166.93	111.28	151.21	135.21	µeq L^{-1}
Mg^{2+}	28.80	38.68	32.09	19.75	31.27	26.37	µeq L^{-1}
Na^+	33.49	48.28	38.60	28.71	46.11	36.90	µeq L^{-1}
K^+	1.79	3.33	2.34	1.02	2.30	1.71	µeq L^{-1}
NH_4^+	-0.06	3.77	0.97	-0.74	1.66	0.30	µeq L^{-1}
AL_TD	0.74	3.37	1.63	1.99	3.11	2.64	µmol L^{-1}
AL_TM	0.59	4.00	1.18	1.45	2.08	1.81	µmol L^{-1}
AL_OM	-0.04	2.93	0.96	1.52	2.22	1.77	µmol L^{-1}
AL_IM	0.00	1.07	0.40	0.00	0.22	0.07	µmol L^{-1}
LABPH	6.48	7.18	6.84	6.36	7.20	6.75	
AIREQPH	6.82	7.29	7.12	7.02	7.35	7.13	
TRUECOLOR	5	20	13	20	25	23	Pt Co
SCONDUCT	24.61	29.77	26.47	18.76	26.69	22.17	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	584 m
Maximum depth	24.4 m
Mean depth	9.2 m
Volume	651.1 x 10^4 m^3
Surface area	70.4 ha
Watershed area	565.0 ha
Watershed ratio	0.12
Hydraulic retention time (year)	1.80
Watershed	Upper Hudson
County, Town	Essex, North Hudson
USGS Quadrangle	Schroon Lake
Land use classification	Private land - Resource Management

Figure 3. Chemistry Time Series

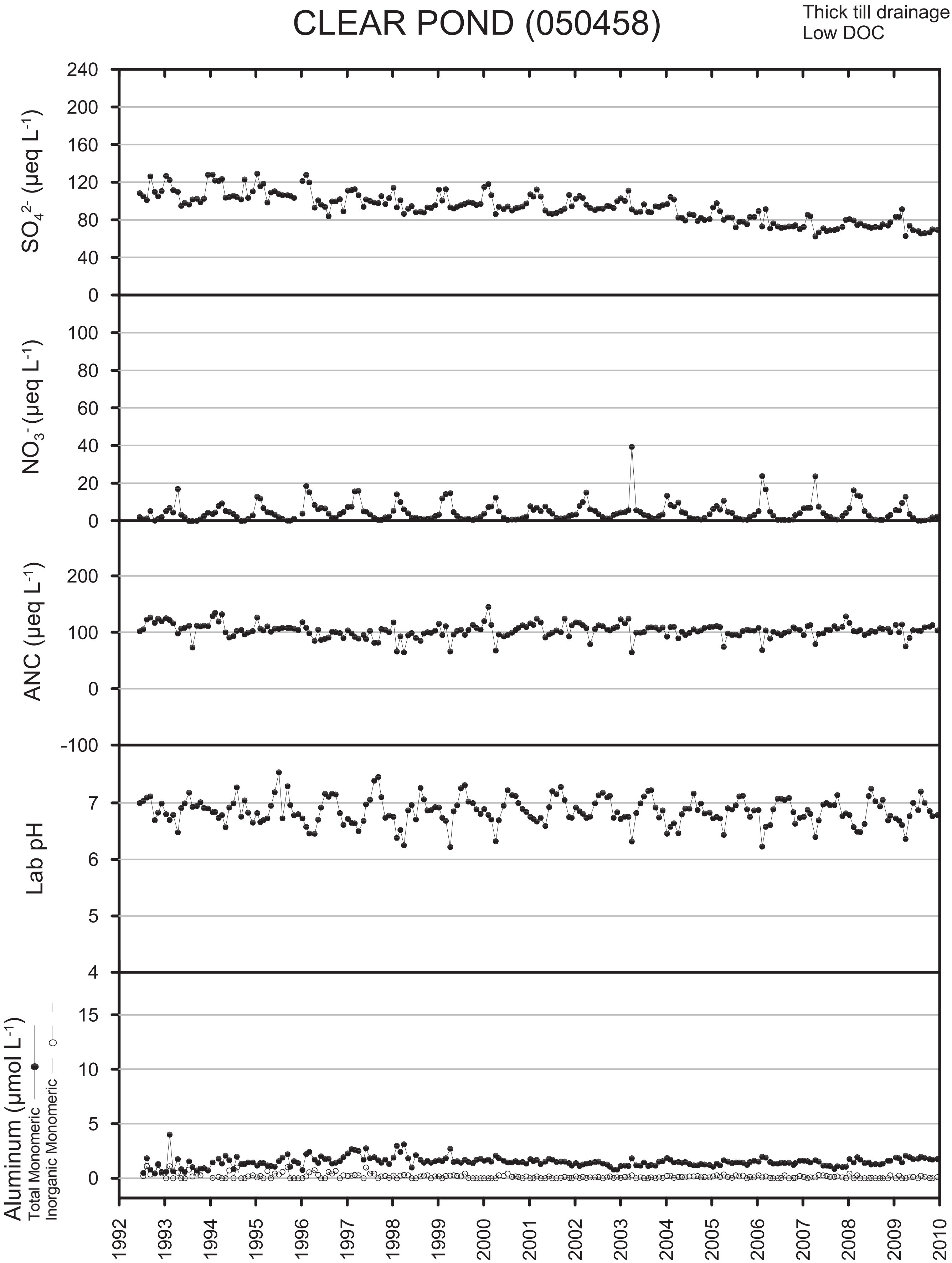


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
April-95	Rainbow smelt	1	131	131	10	1
April-95	Cutlips minnow	2	80	85	13	2
April-95	Common shiner	9	65	86	29	9
April-95	Bluntnose minnow	24	45	72	39	24
April-95	Creek chub	1	90	90	8	1
April-95	Banded killifish	45	35	85	95	645
April-95	Pumpkinseed	2	35	59	3	2
October-87	Brook trout	1	149	149	11	1
October-87	Cutlips minnow	25	60	118	117	37
October-87	Common shiner	6	57	112	30	6
October-87	Bluntnose minnow	21	55	76	60	21
October-87	Longnose dace	3	58	69	9	3
October-87	Creek chub	1	104	104	10	1
October-87	White sucker	3	65	94	15	3
October-87	Brown bullhead	4	62	172	69	4
October-87	Banded killifish	26	61	82	94	110
October-87	Pumpkinseed	26	33	92	78	32

Watershed disturbance: The 1916 fire protection source show heavy disturbance where 41.9% of the area was logged for softwoods; 27.7% was identified as waste or denuded lands; 16.6% was burned over and 4.8% was considered grazed or farm land. The watershed did not show any disturbance from the November 1950 blowdown and July 1995 microburst storms (ALSC 2003). Logging began in the late 1800s into the early 1900s and has continued over the past 50 years (Charles, D. F. et al. 1990). The watershed experienced light ice damage from the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1985 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Charles, D. F., Binford, M. W., Furlong, E. T., Hites, R. A., Mitchell, M. J., Norton, S. A., Oldfield, F., Paterson, M. J., Smol, J. P., Uutala, A. J., White, J. R., Whitehead, D. R., and Wiese, R. J. 1990. Paleoecological investigation of recent lake acidification in the Adirondack Mountains, N.Y. Journal of Paleolimnology 3: 195-241.

Dixit, S. S., Cumming, B. F., Birks, H. J. B., Smol, J. P., Kingston, J. C., Uutala, A. J., Charles, D. F., and Camburn, K. E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Dixit, S. S. and Smol, J. P. 1994. Diatoms as indicators in the environmental monitoring and assessment program-surface waters (EMAP-SW). Environmental Monitoring and Assessment 31: 275-306.

Driscoll, C. T., Blette, V., Yan, C., Schofield, C. L., Munson, R., and Holsapple, J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll, C. T. and Newton, R. M. 1985. Chemical characteristics of Adirondack lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll, C. T., Yan, C., Schofield, C. L., Munson, R., and Holsapple, J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Sullivan, T. J., Charles, D. F., Bernert, J. A., McMartin, B., Vaché, K. B., and Zehr, J. 1999. Relationship between landscape characteristics, history, and lakewater acidification in the Adirondack Mountains, New York. Water, Air, and Soil Pollution 112: 407-427.

Wood, L. W. 1978. Limnology of remote lakes in the Adirondack region of New York State with emphasis on acidification problems. New York State Department of Health, Albany, NY.

This page intentionally left blank.

Nate Pond 050577

Lat. 43° 52' 23'' N   Long. 074° 05' 45'' W

Lake: Nate Pond lies in the Upper Hudson watershed at 613 m. The 8.3 ha headwater lake has three inlets (Figure 1) and a free flowing outlet (ALSC 1989). The outlet flows southwest to Mink Pond which drains into the Hudson River. Nate Pond reaches a maximum depth of 6.4 m (Figure 2).

Nate Pond is classified as a medium till drainage lake, with high dissolved organic carbon. The lake is considered moderately sensitive to acidification. The ALTM program began monitoring the lake in June 1992. This lake is accessed by helicopter.

Lake chemistry: The ELS surveyed the pond on 15 Oct 1984 finding: Field pH 6.84, ANC 85.0 µeq L^{-1}, SO_4^{2-} 135.0 µeq L^{-1}, NO_3^- 0.6 µeq L^{-1}, Ca 139.6 µeq L^{-1}, Mg 57.3 µeq L^{-1}, DOC 4.32 mg L^{-1}-C (Kanciruk, P. et al. 1986). The ALS survey on 07 Aug 1987 found: Lab pH 6.7, ANC 78.2 µeq L^{-1}, SO_4^{2-} 119.51 µeq L^{-1}, NO_3 LTD, Ca^{2+} 125.76 µeq L^{-1}, Mg^{2+} 54.31 µeq L^{-1}, DOC 6.2 mg L^{-1} -C (ALSC 1989). Table 1 summarizes recent water chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 28 Oct 1987, the ALS found submergent vegetation covered 20% of the pond bottom, while emergent and floating vegetation each covered 1% of the lake surface. The following species of aquatic plants were identified: Sphagnum spp.; Sparganium spp.; Carex spp.; Dulichium spp.; Juncus spp.; Hypericum spp.; Fontinalis spp.; Equisetum spp.; Potamogeton spp.; Eriocaulon spp.; Iris spp.; Myrica spp.; and Nymphaea spp. Also identified was Poaceae and numerous Algae. A dip-net survey on that date found the following Insecta: Ephemeroptera Leptophlebiidae, Coenagriidae, Ephemerellidae, and Aeshnidae; Trichoptera Limnephilidae; Diptera Chironomidae; and Hemiptera Corixidae. Also found were Gastropoda Basommatophora Lymnaeidae, Hirudinea Unspecified and Demospong Haplosclerina Spongillidae. A thermocline was found between 3 and 4 m on 07 Aug 1987 (ALSC 1989).

Fisheries: The pond has no history of stocking, liming or reclamation. Refer to Table 3 for recent netting history.

Figure 1. Catchment

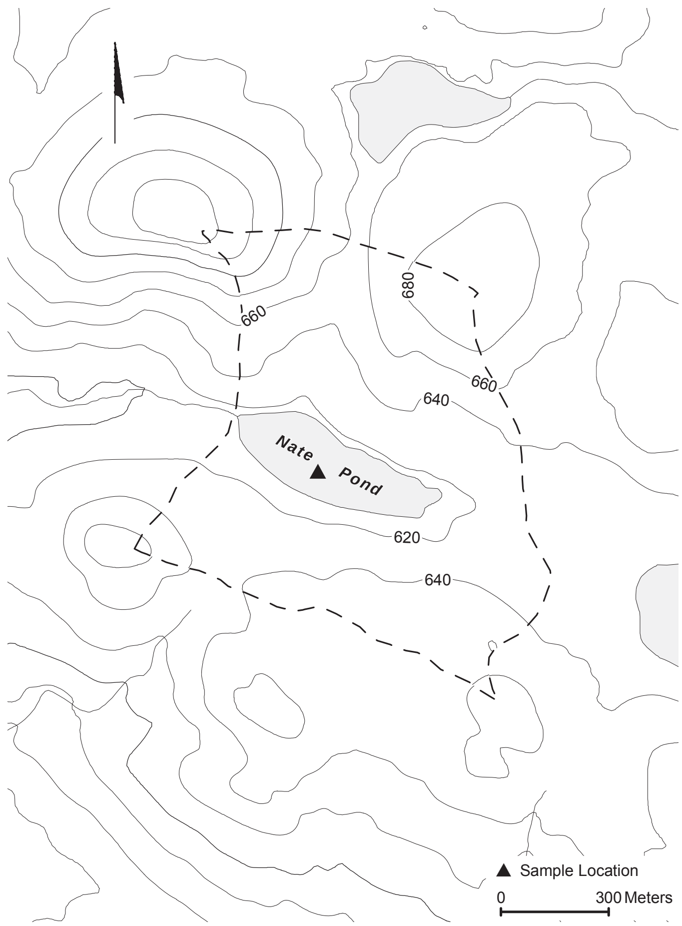
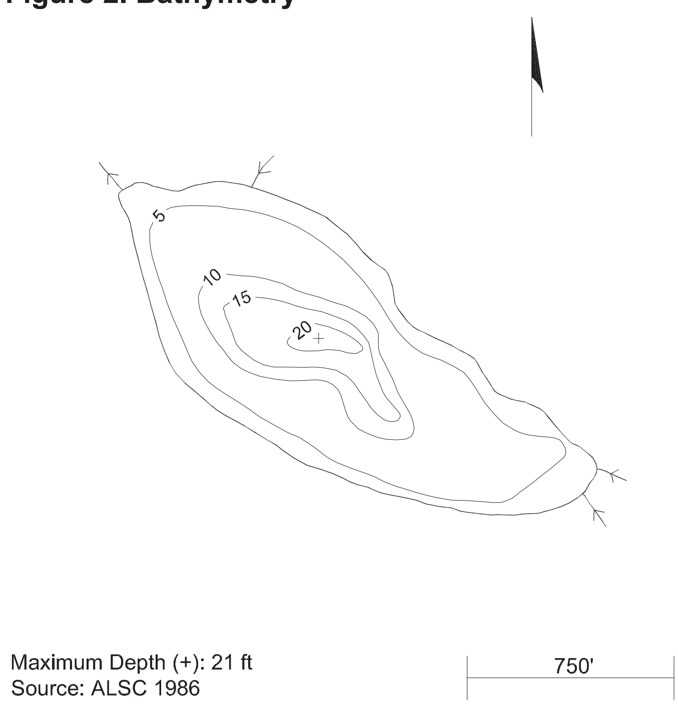


Figure 2. Bathymetry



Intensive studies: Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Nate Pond was one of five ALTM lakes in a probability sample of 37 Adirondack lakes where sediment diatom and chrysophyte assemblages were used to infer present day (1979-80) and pre-industrial lake chemistry (Cumming, B. F. et al. 1992).Bukaveckas and Robbins-Forbes (2000) characterized the attenuation of photosynthetic radiation in relation to lake chemistry in this lake as part of a regional survey (Bukaveckas, P. A. and Robbins-Forbes, M. 2000). Ito evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 – 2000 (Ito, M. et al. 2006). McNeil and others (2007) conducted a regional survey of foliar nitrogen July/August 2003 that included study plots in this watershed.

Deposition: The nearest NADP deposition monitoring site is 16 km northwest at Huntington Wildlife Forest. The nearest NYSDEC wet deposition monitoring site is 57 km southwest at Piseco Lake.

Watershed: Nate Pond and most of its watershed lie on charnockite, mangerite, pyroxene-quartz syenite gneiss with low to no ANC (Roy, K. M. et al. 1997). The southern area of the watershed is underlain by undivided metasedimentary rock and related migmatite. The entire watershed is overlain by till (APA 2001). The highest elevation in the watershed is 750 m. The maximum relief is 137 m. In 1987, the ALS found the shoal water substrate comprised of 45% sand and gravel, 20% boulder and rubble, and 35% muck/silt/organic (ALSC 1989).

Land cover/use: In 1987 the watershed was described as: 40% deciduous-coniferous mixed forest; 30% coniferous forest; 20% deciduous forest; and 10% shrub-sapling vegetation. The immediate shoreline was a mix of 75% deciduous forest, 10% shrub-sapling vegetation, 5% deciduous-coniferous mixed forest, and 5% wetland (ALSC 1989). Total wetland area for the watershed is 4.5 ha and comprises 5% of the watershed. The predominant wetland covertype is forested needle-leaf evergreen (ALSC 2003). The pond lies in the Vanderwhacker Mountain

Table 1. Lake Chemistry

050577			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	94.11	147.20	122.46	73.80	112.16	84.54	µeq L^{-1}
NO_3^-	-0.13	31.47	10.54	0.00	13.23	3.56	µeq L^{-1}
Cl^-	6.49	13.26	8.65	4.95	9.32	6.39	µeq L^{-1}
F^-	3.16	5.26	3.93	3.15	4.26	3.66	µeq L^{-1}
ANC	7.45	88.28	65.54	25.40	104.09	71.85	µeq L^{-1}
DIC	18.32	201.48	107.26	74.93	263.92	120.52	µmol L^{-1} -C
DOC	283.07	451.75	357.65	412.93	490.96	441.66	µmol L^{-1} -C
SiO_2	28.13	125.16	71.66	47.43	123.49	81.69	µmol L^{-1}
Ca^{2+}	82.84	171.67	138.23	77.85	127.75	108.57	µeq L^{-1}
Mg^{2+}	24.69	65.83	51.16	31.27	54.31	44.02	µeq L^{-1}
Na^+	17.40	43.06	32.99	22.18	40.89	31.45	µeq L^{-1}
K^+	6.14	11.77	8.82	5.12	9.21	6.34	µeq L^{-1}
NH_4^+	-0.94	3.71	1.00	-1.12	4.60	0.56	µeq L^{-1}
AL_TD	1.04	8.01	3.48	1.72	7.23	3.87	µmol L^{-1}
AL_TM	0.34	5.74	1.89	1.76	3.74	2.39	µmol L^{-1}
AL_OM	-0.00	2.93	1.24	1.67	3.15	2.19	µmol L^{-1}
AL_IM	0.06	2.82	0.64	0.00	1.33	0.24	µmol L^{-1}
LABPH	5.33	6.78	6.16	5.53	6.78	6.21	
AIREQPH	5.42	7.08	6.36	6.00	7.09	6.69	
TRUECOLOR	20	35	24	30	55	41	Pt Co
SCONDUCT	20.02	29.85	25.49	17.17	27.30	21.45	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	613 m
Maximum depth	6.4 m
Mean depth	2.3 m
Volume	19.4 x 10^4 m^3
Surface area	8.3 ha
Watershed area	89.2 ha
Watershed ratio	0.09
Hydraulic retention time (year)	0.29
Watershed	Upper Hudson
County, Town	Essex, Minerva
USGS Quadrangle	Dutton Mtn.
Land use classification	Vanderwhacker Mountain Wild Forest

Figure 3. Chemistry Time Series

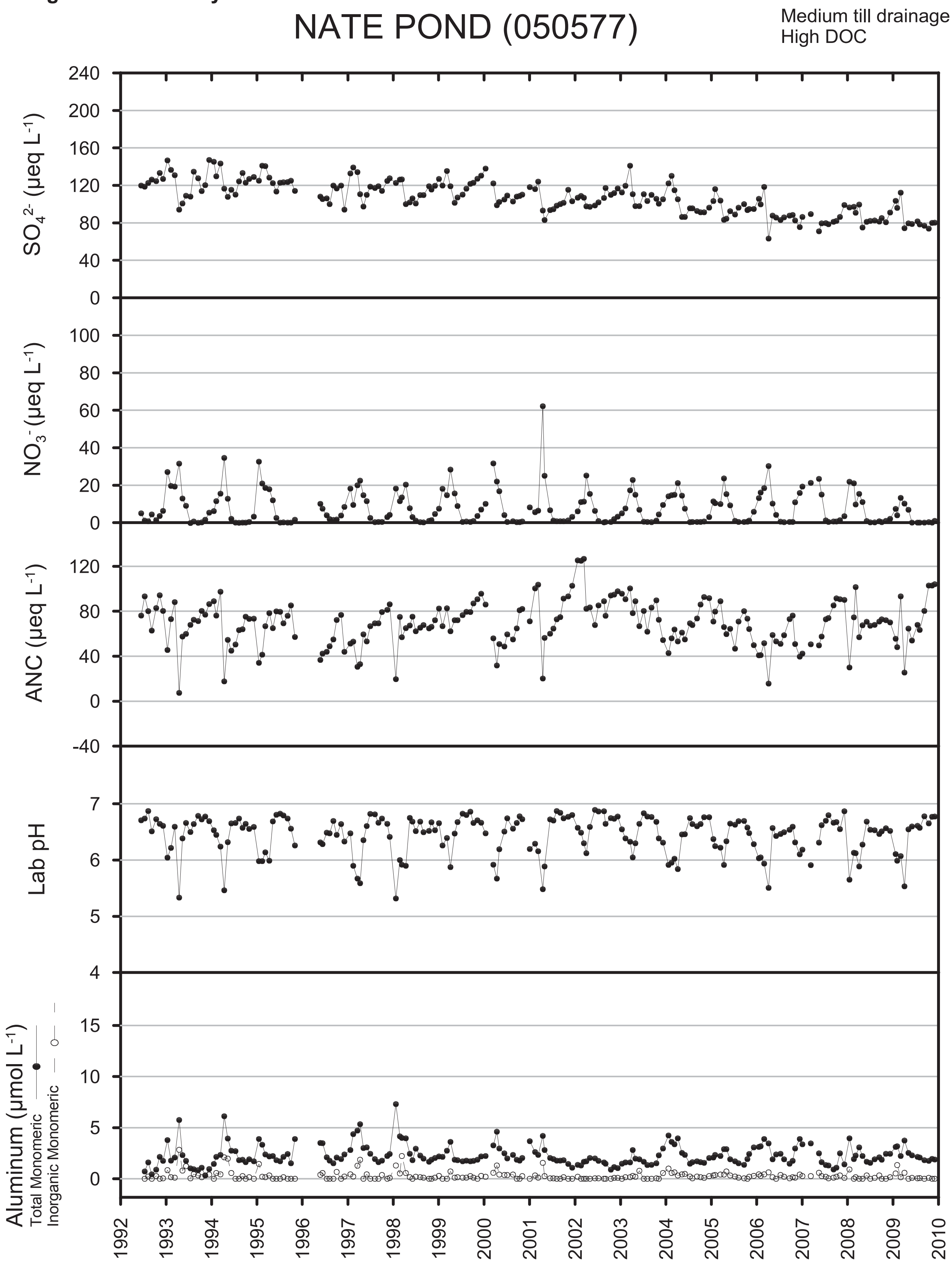


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
October-05	Brook trout	2	162	285	282	2
October-05	Golden shiner	25	66	118	188	156
October-05	Creek chub	25	55	137	269	102
October-05	Redbreast sunfish	25	71	155	517	126
October-87	Brook trout	26	105	447	7219	26
October-87	Golden shiner	21	87	115	168	21
October-87	Creek chub	2	178	180	100	2

Wild Forest (NYSDEC 2005). North of the lake, a section of the watershed is privately owned by the Moose Pond Club and is classified as Resource Management. There is a foot trail that follows an old skid road along the northern shoreline to the outlet.

Watershed disturbance: The 1916 fire protection source data reveal 91.3% of the watershed as virgin and second growth timber with no slash and 0.6% of the watershed as logged for softwoods with considerable amounts of slash. The watershed was not impacted by the November 1950 blowdown, the July 1995 microburst or the January 1998 ice storms (ALSC 2003; NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1985 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Bukaveckas, P. A. and Robbins-Forbes, M. 2000. Role of dissolved organic carbon in the attenuation of photosynthetically active and ultraviolet radiation in Adirondack lakes. Freshwater Biology 43: 339-354.

Cumming, B. F., Smol, J. P., Kingston, J. C., Charles, D. F., Birks, H. J. B., Camburn, K. E., Dixit, S. S., Uutala, J., and Selle, A. R. 1992. How much acidification has occurred in Adirondack region lakes (New York, USA) since preindustrial times? Canadian Journal of Fisheries and Aquatic Sciences 49: 128-141.

Dixit, S. S., Cumming, B. F., Birks, H. J. B., Smol, J. P., Kingston, J. C., Uutala, A. J., Charles, D. F., and Camburn, K. E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Ito, M., Mitchell, M. J., Driscoll, C. T., and Roy, K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

Kanciruk, P., Eilers, J. M., McCord, R. A., Landers, D. H., Brakke, D. F., and Linthurst, R. A. 1986. Characteristics of Lakes in the Eastern United States: Volume III. Data Compendium of Site Characteristics and Chemical Variables. U.S. Environmental Protection Agency No. EPA/600/4-86/007c.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

New York State Department of Environmental Conservation (NYSDEC) 2005. Vanderwhacker Mountain Wild Forest Unit Management Plan/ Environmental Impact Statement. New York State Department of Environmental Conservation, Ray Brook, NY.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

This page left intentionally blank.

Long Pond   050649

Lat. 43° 50’ 15’’ N   Long. 074° 28’ 50’’ W

Lake: Long Pond lies in the Upper Hudson watershed at 574 m. This 17 ha headwater lake has no inlets with an outlet that seeps through a bog (Figure 1). This lake reaches a maximum depth of 4.0 m (Figure 2).

Long Pond is classified as a thin till drainage lake, with high dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992.

Lake chemistry: Long Pond was sampled during the ALS survey on 11 Aug 1987 finding: Lab pH 4.51, ANC -23.6 µeq L^{-1}, SO_4^{2-} 77.24 µeq L^{-1}, NO_3 LTD, Ca^{2+} 39.42 µeq L^{-1}, Mg^{2+} 27.16 µeq L^{-1}, DOC 12.7 mg L^{-1} -C (ALSC 1989). Table 1 summarizes recent water sample chemistry taken at the outlet. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 08 Sep 1987, the ALS found submergent vegetation covering10% of the lake bottom, while emergent vegetation occupied 2% of the surface and floating vegetation 3% of the surface. ALS identified the following aquatic plants: Sphagnum spp.; Carex spp.; Nuphar spp.; Hypericum spp.; Utricularia spp. and numerous Algae. The dip-net survey on that date found the following Insecta: Odonata Libellulidae; Coenagriidae and Aeshnidae; Trichoptera Polycentropodidae; Coleoptera Dytiscidae; Diptera Chironomidae and Heleidae; and Hemiptera Notonectidae and Belostomatidae. Also found were Arthropoda Arachnoid Hydracarina Unspecified. The ALS found the lake thermally stratified between 2 and 3 m on 11 Aug 1987 (ALSC 1989). The AEAP reported the average value of chlorophyll a as 5.0 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: Long Pond has no history of fish stocking. The ALSC surveyed the lake on 08 Sep 1987 and 16 Jun 1998 and captured no fish in either survey.

Intensive studies: Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). Landscape characteristics and disturbance history have been evaluated within this watershed (Sullivan, T. J. et al. 1999). Long Pond was studied as part of the Adirondack/Catskill comparison study from 1992-

Figure 1. Catchment

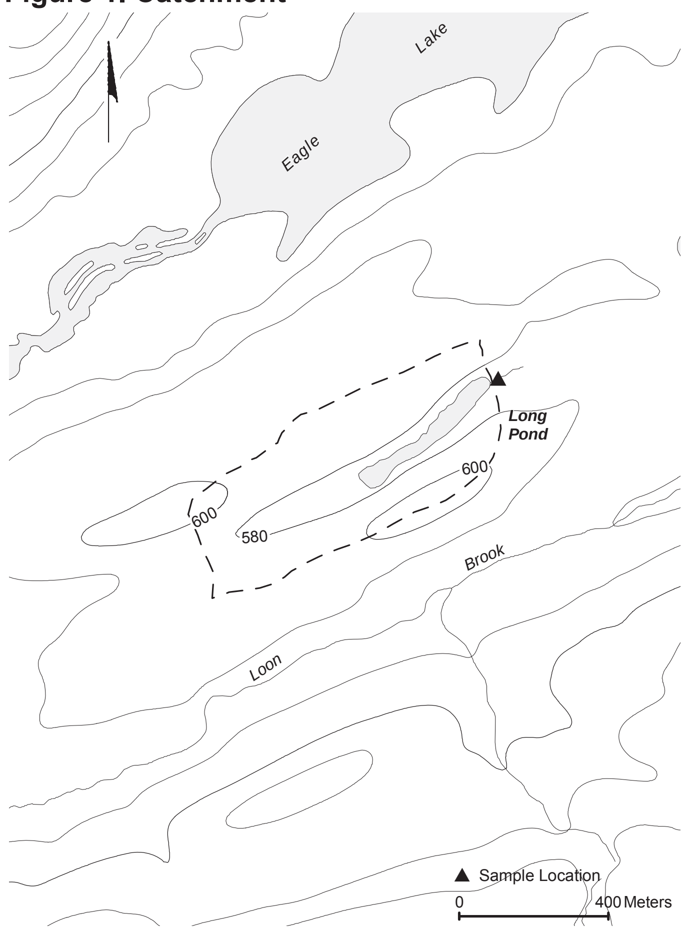
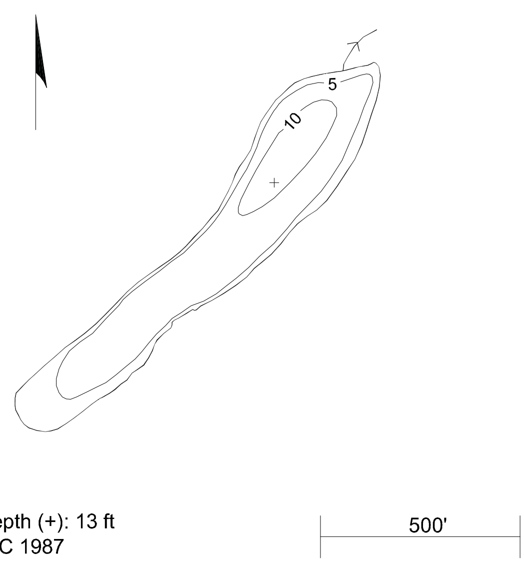


Figure 2. Bathymetry



Maximum Depth (+): 13 ft
Source: ALSC 1987

2001 (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005). Long Pond is part of the AEAP (Momen, B. et al. 2006). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 26 km northeast at Huntington Wildlife. The nearest NYSDEC wet deposition monitoring site is 43 km south at Piseco Lake.

Watershed: The Long Pond entire watershed lies on interlayered metasedimentary rock and granitic gneiss with medium to high ANC (Roy, K. M. et al. 1997). The watershed is comprised of basal soils. Wetlands occupy approximately 18% of the watershed and are located across the center of the watershed under 580 m elevation. The watershed rises to a maximum elevation of 600 m. The maximum relief is 26 m. In 1987, the shoal water substrate was identified as 50% muck/silt and 50% organic (ALSC 1989).

Land cover/use: In 1987, the ALS found that deciduous-coniferous mixed forest covered 60% of the watershed, deciduous forest 20%, coniferous forest 10%, shrub-sapling 5%, and wetland 5%. Sixty percent of the pond shoreline is a scrub shrub wetland fringe. Coniferous forest and boulder rock ledge predominate on both sides of the pond (ALSC 1989). Total wetland area is 5.3 ha and comprises 18% of the watershed. The predominant wetland cover types are scrub-shrub broad leaf evergreen (10.7%) and forested needle-leaf evergreen (5.8%) with some scrub-shrub needle leaf evergreen (1.5%) (ALSC 2003).
The northern portion of the watershed is classified as Resource Management and is undeveloped private land. The remaining 75% of the watershed lies within the Blue Ridge Wilderness area of the Forest Preserve (APA 2001). There is a narrow, unmarked foot path that skirts the northern shoreline of the pond.

Watershed disturbance: The 1916 fire protection map shows considerable slash remaining after logging for softwood on 92% of the watershed. Approximately 7% of the watershed was moderately disturbed (25 to 50% blowdown) by the 1950 storm. The watershed was not disturbed by the July1995 microburst or January 1998 ice storms (ALSC 2003; NYSDEC 1998).

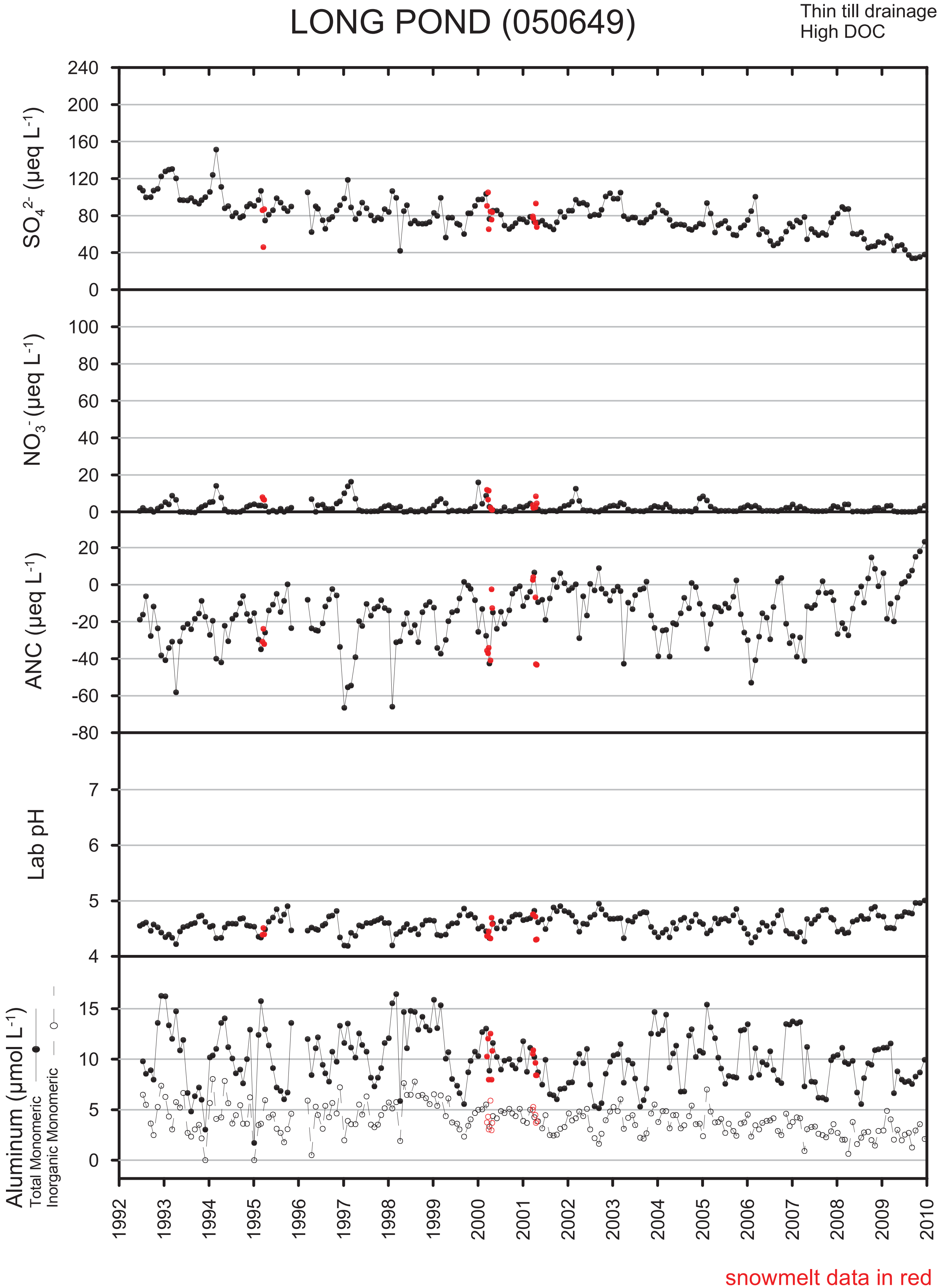
Table 1. Lake Chemistry

050649			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	92.86	130.54	106.81	34.03	58.20	43.69	µeq L^{-1}
NO_3^-	-0.27	8.82	2.65	0.00	3.34	1.13	µeq L^{-1}
Cl^-	5.08	18.90	9.78	4.58	13.20	7.96	µeq L^{-1}
F^-	2.63	5.05	4.18	2.69	5.95	4.11	µeq L^{-1}
ANC	-58.15	-8.71	-26.95	-19.82	23.13	1.76	µeq L^{-1}
DIC	42.46	402.13	164.85	77.43	492.88	207.92	µmol L^{-1} -C
DOC	584.04	1371.73	937.93	762.87	1469.14	1215.92	µmol L^{-1} -C
SiO_2	6.16	107.18	53.95	8.09	115.50	66.02	µmol L^{-1}
Ca^{2+}	40.92	83.34	60.42	24.45	61.00	47.10	µeq L^{-1}
Mg^{2+}	27.98	44.44	34.08	13.99	30.45	25.64	µeq L^{-1}
Na^+	14.79	30.88	20.30	13.92	23.49	18.39	µeq L^{-1}
K^+	4.60	10.49	7.72	7.93	13.81	10.50	µeq L^{-1}
NH_4^+	-0.72	5.04	1.80	-0.39	7.98	3.60	µeq L^{-1}
AL_TD	6.93	19.57	12.99	10.67	19.87	15.80	µmol L^{-1}
AL_TM	3.03	16.23	9.43	6.63	11.56	8.94	µmol L^{-1}
AL_OM	2.49	9.97	5.79	4.60	8.19	6.11	µmol L^{-1}
AL_IM	0.00	6.66	3.75	1.25	4.89	2.83	µmol L^{-1}
LABPH	4.22	4.73	4.48	4.50	5.00	4.71	
AIREQPH	4.21	4.72	4.48	4.54	5.06	4.77	
TRUECOLOR	25	140	85	100	320	227	Pt Co
SCONDUCT	21.42	37.86	27.60	16.51	24.68	19.18	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	574 m
Maximum depth	4.0 m
Mean depth	2.0 m
Volume	3.3×10^4 m^3
Surface area	1.7 ha
Watershed area	29.6 ha
Watershed ratio	0.06
Hydraulic retention time (year)	0.15
Watershed	Upper Hudson
County, Town	Hamilton, Indian Lake
USGS Quadrangle	Blue Mountain Lake
Land use classification	Blue Ridge Wilderness

Figure 3. Chemistry Time Series



Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1985 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns, D. A., McHale, M. R., Driscoll, C. T., and Roy, K. M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Dixit, S. S., Cumming, B. F., Birks, H. J. B., Smol, J. P., Kingston, J. C., Uutala, A. J., Charles, D. F., and Camburn, K. E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen, B., Lawrence, G. B., Nierzwicki-Bauer, S. A., Sutherland, J. W., Eichler, L. W., Harrison, J. P., and Boylen, C. W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Sullivan, T. J., Charles, D. F., Bernert, J. A., McMartin, B., Vaché, K. B., and Zehr, J. 1999. Relationship between landscape characteristics, history, and lakewater acidification in the Adirondack Mountains, New York. Water, Air, and Soil Pollution 112: 407-427.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T. J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Carry Pond   050669

Lat. 43° 40' 54'' N   Long. 074° 29' 21'' W

Lake: Carry Pond lies in the Upper Hudson watershed at 652 m. It has no inlets or outlets and is the highest elevation seepage lake of the seven in the 52 ALTM lakes set. A small open water area exists within the seepage depression about 100 m of the southern shore (Figure 1). Carry Pond reaches a maximum depth of 4.6 m (Figure 2).

Carry Pond is classified as a mounded seepage lake, with low dissolved organic carbon and is considered sensitive to acidification. The ALTM program began monitoring the pond in June 1992. This lake is accessed by helicopter.

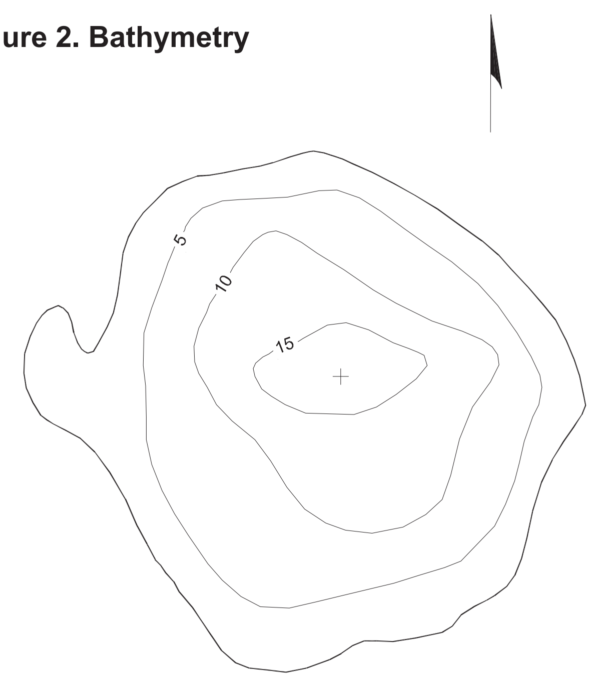
Lake chemistry: Carry Pond was sampled during the ALS on 06 Aug 1987 finding: Lab pH 4.73, ANC -15.7 μeq L^{-1}, SO_4^{2-} 81.82 μeq L^{-1}, NO_3^- LTD, Ca^{2+} 38.92 μeq L^{-1}, Mg^{2+} 13.99 μeq L^{-1}, DOC 0.3 mg L^{-1}-C (ALSC 1989). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 24 Sep 1987, the ALS found submergent vegetation covered 20% of the pond bottom, while emergent and floating vegetation covered 2% and 5% of the surface, respectively. ALS identified the following aquatic plants: Sphagnum spp.; Sparganium spp.; Carex spp.; Eleocharis spp.; Dulichium spp.; Scirpus spp.; Juncus spp.; Nuphar spp.; and Hypericum spp.. Poaceae and numerous Algae were also identified. A dip-net survey on that same date found the following Insecta: Odonata Libellulidae, Coenagriidae and Aeshnidae; Trichoptera Phryganeidae; Coleoptera Dytiscidae; Diptera Chironomidae; Hemiptera Corixidae, Notonectidae, Nepidae and Mesoveliidae. Also found were Crustacea Amphipoda Unspecified. The ALS found no evidence of a thermocline on 06 Aug 1987 (ALSC 1989). The AEAP reported the average value of chlorophyll a was 2.03 μg L^{-1} in 2003 (Momen, B. et al. 2006a).

Fisheries: NYSDEC began stocking Carry Pond annually with brook trout in 1942 (ALSC 1989). The ALTM has netted the lake. Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Figure 1. Catchment

Figure 2. Bathymetry



Maximum Depth (+): 15 ft
Source: NYSDEC, ALSC Rev. 1987

300'

Intensive studies: The lake has been studied by the AEAP since 1994 (Momen, B. et al. 2006; Methé, B. A. et al. 1998; Methé, B. A. and Zehr, J. P. 1999; Momen, B. et al. 1999)

Soils: A soil plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 31 km west at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 26 km south at Piseco Lake.

Watershed: Carry Pond lies in a bowl-like depression in 100% alluvial in-wash. The highest elevation in the watershed is 660 m. The maximum relief is 8 meters. In 1987, the shoal water substrate was characterized as 60% muck/silt/organic, 35% sand/gravel, and 5% rubble (ALSC 1989).

Land cover/use: In 1987, the watershed was described as: 55% deciduous forest; 30% deciduous-coniferous forest mix; 10% shrub-sapling; and 5% coniferous forest. A conifer fringe surrounded the immediate shoreline (ALSC 1989). Total wetland area is 4.4 ha and comprises 21.3% of the watershed. The wetlands are predominated by forested needle-leaf evergreen (3.6 ha) and forested broad leaf deciduous (0.8 ha) (ALSC 1989). The lake and its watershed lie totally within the West Canada Lake Wilderness. An unmarked foot trail makes the pond accessible from the north.

Watershed disturbance: The 1916 fire protection source data reveal 96.3% of the watershed as green timber, of virgin and second growth, with no slash. The watershed was not affected by the November 1950 blowdown, the July 1995 microburst or the January 1998 ice storm (ALSC 2003; NYSDEC 1998).

Table 1. Lake Chemistry

050669			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	61.21	88.28	75.72	15.40	36.77	29.81	μeq L^{-1}
NO_3^-	-0.23	29.19	5.27	0.00	8.38	1.71	μeq L^{-1}
Cl^-	0.85	9.31	5.64	4.68	7.11	5.56	μeq L^{-1}
F^-	0.79	1.11	0.97	0.66	1.28	0.93	μeq L^{-1}
ANC	-23.40	1.55	-11.62	-0.38	13.74	9.17	μeq L^{-1}
DIC	11.66	255.60	89.22	14.99	144.03	63.33	μmol L^{-1} -C
DOC	129.13	257.26	186.54	275.66	363.48	318.77	μmol L^{-1} -C
SiO_2	-4.49	13.81	5.06	1.67	6.99	4.44	μmol L^{-1}
Ca^{2+}	32.94	71.36	43.67	23.72	41.09	28.93	μeq L^{-1}
Mg^{2+}	13.99	21.39	17.76	11.52	12.55	11.99	μeq L^{-1}
Na^+	6.52	10.87	8.41	6.94	9.13	7.87	μeq L^{-1}
K^+	0.51	11.00	5.22	3.10	7.93	6.12	μeq L^{-1}
NH_4^+	-0.11	11.86	3.77	-0.21	9.15	3.60	μeq L^{-1}
AL_TD	1.30	2.19	1.66	1.24	2.85	1.95	μmol L^{-1}
AL_TM	1.46	4.10	2.41	1.69	2.22	2.00	μmol L^{-1}
AL_OM	-0.28	10.56	1.36	1.56	2.15	1.97	μmol L^{-1}
AL_IM	0.00	3.70	1.70	0.00	0.63	0.08	μmol L^{-1}
LABPH	4.43	5.19	4.76	5.15	6.14	5.44	
AIREQPH	4.57	5.29	4.82	5.39	6.13	5.66	
TRUECOLOR	5	15	10	30	55	44	Pt Co
SCONDUCT	12.94	23.06	17.31	6.38	11.12	8.84	μS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	652 m
Maximum depth	4.6 m
Mean depth	2.2 m
Volume	6.2 x 10^4 m^3
Surface area	2.8 ha
Watershed area	20.8 ha
Watershed ratio	0.13
Hydraulic retention time (year)	NA
Watershed	Upper Hudson
County, Town	Hamilton, Lake Pleasant
USGS Quadrangle	Indian Lake
Land use classification	West Canada Lake Wilderness

Figure 3. Chemistry Time Series

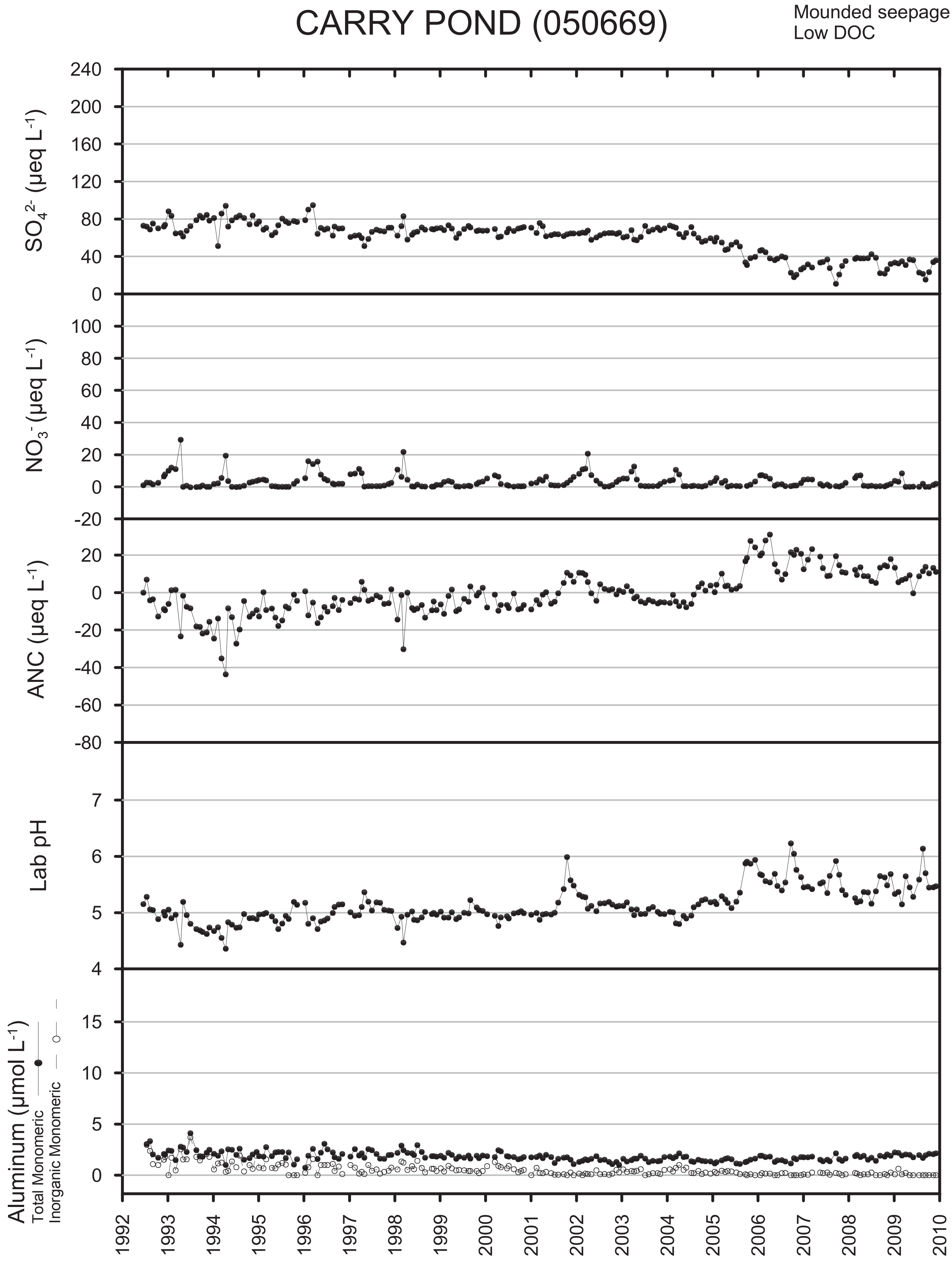


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	525	6
1981	Brook trout	450	5
1982	Brook trout	500	3
1983	Brook trout	500	3
1984	Brook trout	370	9
1985	Brook trout	550	11
1986	Brook trout	650	3
1987	Brook trout	500	3
1988	Brook trout	500	3
1989	Brook trout	550	5
1990	Brook trout	545	3
1991	Brook trout	500	4
1992	Brook trout	500	6
1993	Brook trout	500	7
1994	Brook trout	400	8
1995	Brook trout	460	5
1996	Brook trout	500	10
1997	Brook trout	530	6
1998	Brook trout	530	9
1999	Brook trout	500	6
2000	Brook trout	500	5
2001	Brook trout	450	5
2002	Brook trout	500	10
2003	Brook trout	500	4
2004	Brook trout	200	3
2005	Brook trout	200	4
2006	Brook trout	220	3

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-94	Brook trout	6	250	410	4327	6
September-87	No fish caught					

References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1985 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Methé, B. A., Hiorns, W. D., and Zehr, J. P. 1998. Contrasts between marine and freshwater bacterial community composition: Analyses of communities in Lake George and six other Adirondack lakes. Limnological Oceanography 43: 368-374.

Methé, B. A. and Zehr, J. P. 1999. Diversity of bacterial communities in Adirondack lakes: Do species assemblages reflect lake water chemistry? Hydrobiologia 401: 77-96.

Momen, B., Lawrence, G. B., Nierzwicki-Bauer, S. A., Sutherland, J .W., Eichler, L. W., Harrison, J. P., and Boylen, C. W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

Momen, B., Zehr, J. P., Boylen, C. W., and Sutherland, J. W. 1999. Determinants of summer nitrate concentration in a set of Adirondack lakes, New York. Water, Air, & Soil Pollution 111: 19-28.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T. J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

This page left intentionally blank.

Arbutus Lake   050684

Lat. 43˚ 58' 58" N   Long. 074˚ 14' 09" W

Lake: Arbutus Lake lies in the Upper Hudson River watershed at 516 m. Archer Creek flows into the lake from the north and forms the single major inlet (Figure 1). Seven small wetlands connect with the lake shoreline. The largest forested wetland connects with a beaver meadow on Archer Creek. The 49 ha lake reaches a depth of 7.9 m (Figure 2). At the outlet is a V-notch weir. Weekly flow and discharge data have been collected by SUNY College of Environmental Science and Forestry since October 1990.

Arbutus Lake is a medium till drainage lake with low dissolved organic carbon. The lake is considered moderately sensitive to acidification. This is one of the original ALTM waters and has been monitored monthly at the outlet since February 1983.

Lake chemistry: Arbutus Lake was not surveyed during the ALS, but was sampled as part of the ELS (1A1-052) on 15 Oct 1984 . The survey found: Field pH 6.76, ANC 75.2 µeq L^{-1}, SO_4^{2-} 133.6 µeq L^{-1}, NO_3^- 0.6 µeq L^{-1}, Ca^{2+} 148.3 µeq L^{-1}, Mg^{2+} 44.3 µeq L^{-1}, DOC 3.92 mg L^{-1}-C (Kanciruk, P. et al. 1986). Table 1 summarizes recent water chemistry taken at the outlet. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: In 1990 and 1991, Bukavecas and Shaw (1998) found phosphorus as the limiting nutrient and a chlorophyll a average of 2.96 µg L^{-1}.

Fisheries: Fish stocking data are not available. The ALTM has surveyed the lake. Refer to Table 4 for recent fish netting results.

Intensive studies: Arbutus Lake is one of the most intensively studied ALTM waters. Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). The lake was studied under RILWAS in 1985 (Driscoll, C. T. and Newton, R. M. 1985). During the 1986 and 1987 snowmelts, Schaefer and Driscoll (1993) evaluated episodic acidification at the outlet. A phytoplankton and zooplankton experiment was conducted in 1990 (Bukaveckas, P. and Shaw, W. 1998). Arbutus Lake and Dart's Lake were analyzed in the early 1990s for nitrogen and carbon isotopic

Figure 1. Catchment

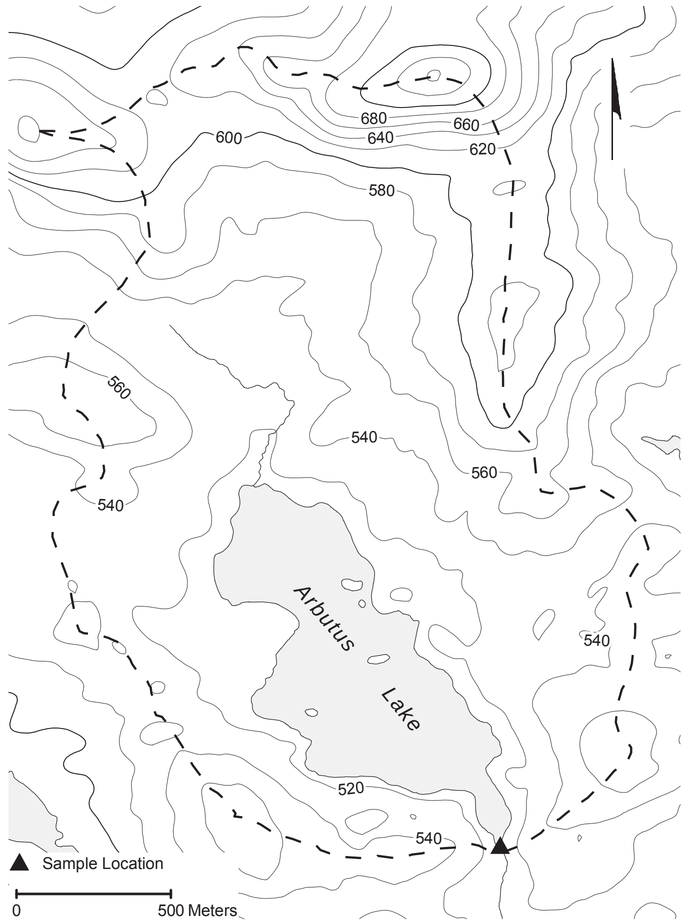


Figure 2. Bathymetry

compostion in seston and sediment (Owen, J. S. et al. 1999). A detailed GIS is available that includes a Digital Elevation Model (SUNY ESF 2009). In 1994 an H-flume equipped with automated discharge logging and sample collection was installed at Archer Creek.

Biogeochemical and hydrologic response studies are ongoing. From 1992 through 2001, Arbutus Lake was a study watershed for the Adirondack/Catskill comparison (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005). Arbutus Lake as an example of a relatively insensitive watershed using the model PnET-BGC (Chen, L. and Driscoll, C. T. 2004; Chen, L. et al. 2004). Detailed mercury deposition and cycling studies are being conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995). Common loons were surveyed for mercury content in 1998-2000 (Schoch, N. and Evers, D. C. 2002) and in 2003-2004 (Schoch, N. et al. 2004). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: Located within the watershed is a combined meteorological station. Since 1978, the station has participated as part of the National Atmospheric Deposition Program (NADP) National Trends Network (NTN). The site also participates in the National Mercury Deposition Network (MDN) (NADP 2009). Through 2001, on a walk-up tower adjacent to the Arbutus Watershed, monitoring air chemistry and dry deposition are part of the Atmospheric Integrated Research Monitoring Network (AIRMoN). In 2002, a Clean Air Status and Trends

Table 1. Lake Chemistry

050684			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	108.26	148.24	128.93	76.08	103.55	85.48	µeq L^{-1}
NO_3^-	-0.16	23.30	7.77	0.00	9.62	2.84	µeq L^{-1}
Cl^-	7.33	12.13	9.83	6.66	11.79	8.30	µeq L^{-1}
F^-	3.84	5.11	4.66	3.92	4.78	4.47	µeq L^{-1}
ANC	44.84	81.09	68.66	63.95	76.53	70.52	µeq L^{-1}
DIC	58.28	188.99	111.56	74.10	238.11	120.29	µmol L^{-1} -C
DOC	304.13	427.19	356.57	356.42	474.98	416.63	µmol L^{-1} -C
SiO_2	30.62	101.36	71.79	44.56	86.88	66.39	µmol L^{-1}
Ca^{2+}	126.25	189.13	154.70	116.77	140.73	124.75	µeq L^{-1}
Mg^{2+}	35.38	55.13	45.40	32.09	40.32	35.58	µeq L^{-1}
Na^+	26.10	36.10	31.14	26.10	34.80	28.81	µeq L^{-1}
K^+	6.91	9.46	7.99	3.84	5.88	4.69	µeq L^{-1}
NH_4^+	-0.61	2.61	0.79	-1.07	1.83	0.42	µeq L^{-1}
AL_TD	0.48	5.00	2.33	0.55	3.97	2.24	µmol L^{-1}
AL_TM	0.19	10.27	1.86	1.62	2.52	1.96	µmol L^{-1}
AL_OM	0.05	2.19	0.88	1.59	2.30	1.87	µmol L^{-1}
AL_IM	0.00	8.86	1.01	0.00	0.56	0.12	µmol L^{-1}
LABPH	5.91	6.87	6.49	5.92	6.73	6.41	
AIREQPH	6.47	7.08	6.80	6.79	7.05	6.89	
TRUECOLOR	15	35	25	30	40	36	Pt Co
SCONDUCT	23.87	29.94	26.61	19.82	25.48	21.80	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	516 m
Maximum depth	7.9 m
Mean depth	2.8 m
Volume	134.5 x 10^4 m^3
Surface area	48.9 ha
Watershed area	354 ha
Watershed ratio	0.14
Hydraulic retention time (year)	0.5
Watershed	Upper Hudson
County, Town	Essex, Newcomb
USGS Quadrangle	Newcomb
Land use classification	Private Land - Resource Management

Figure 3. Chemistry Time Series

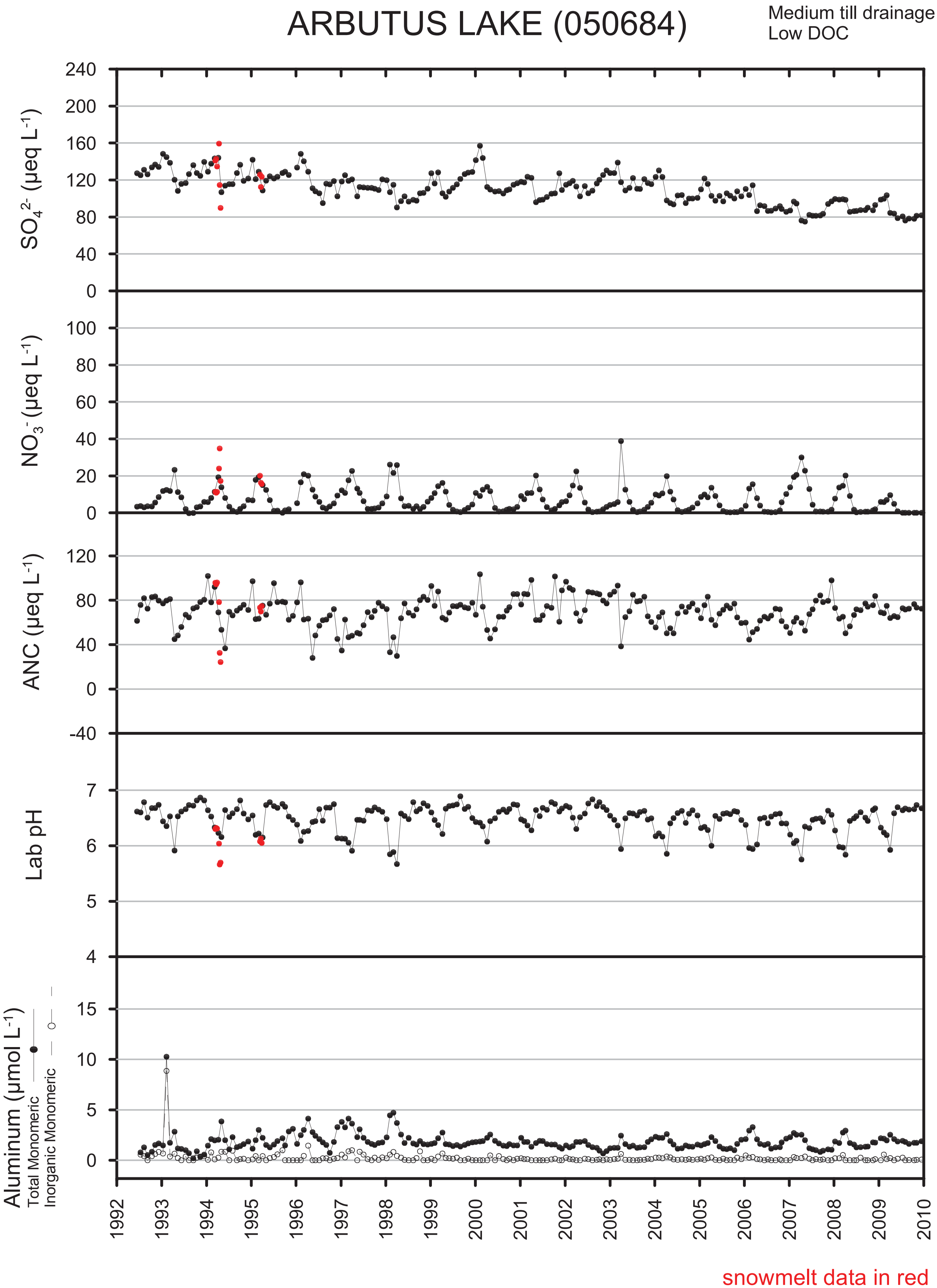


Table 3. Precipitation NADP NY20 Newcomb, NY

	1993		2009	
	Average Concentration	Total Deposition	Average Concentration	Total Deposition
Parameter	μeqL^{-1}	$kgha^{-1}$	μeqL^{-1}	$kgha^{-1}$
SO_4^{2-}	1.68	17.100	0.710	7.670
NO_3^-	1.49	15.110	0.730	7.840
Cl^-	0.09	0.960	0.050	0.500
Ca^{2+}	0.06	0.630	0.070	0.700
Mg^{2+}	0.013	0.132	0.008	0.086
Na^+	0.052	0.530	0.020	0.216
K^+	0.01	0.130	0.010	0.108
NH_4^+	0.18	1.870	0.160	1.710
Lab H+	4.38	0.420	4.800	0.169
Conductivity	22.1		20.32	
Precipitation (cm)		101.6		107.8

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-01	Brook trout	33	171	419	10178	33
June-01	Northern redbelly dace	27	44	111	56	157
June-01	Blacknose dace	22	51	76	46	23
June-01	Brown bullhead	28	82	210	1321	220

Network (CASTNET) site was installed (U.S.Environmental Protection Agency 2009). Selected annual rainfall values can be found in Table 3. The nearest NYSDEC wet deposition monitoring site is 50 km north at Paul Smiths. Additional information may be found at the websites maintained by the NADP and the Huntington Forest research facility via the links menu found at www.adirondacklakessurvey.org.

Watershed: The watershed is primarily underlain by granitic gneiss with some gabbro-amphibolite. The parent material is a thin, bouldery glacial till. Soil depth varies, but is typically less than 1 m, and is dominated by coarse, loamy, mixed, frigid Typic Haplorthods. Greenwood mucky peats occupy wetlands in the bottoms of the valleys (McHale, M. R. et al. 2000). Till comprises 98.4% of the watershed, while 1.6% has exposed bedrock (ALSC 2003). To the northeast, the watershed rises to a maximum elevation of 741 m. The watershed has 225 m of relief with an average slope of 11% (McHale, M. R. et al. 2000). Approximately 15% of the watershed is above 600 m.

Land cover/use: Northern hardwood forest predominates the watershed. Conifers prevail along the lake shore, stream riparian zones and higher elevations. Dominant species include: American beech, sugar maple, yellow birch, red spruce, and balsam fir (McHale, M. R. et al. 2000). Total wetland area is 17.5 ha, or 4.9% of the watershed. The predominant wetland types are forested needle-leaved evergreen (13.5 ha), emergent persistent (2.5 ha), forested broad leaved deciduous (0.7 ha), scrub/shrub needle-leaf evergreen (0.4 ha), and forested dead vegetation (0.4 ha) (ALSC 2003).

The lake and its watershed are classified as Resource Management and lie within the SUNY ESF Huntington Wildlife Forest. The watershed is largely undeveloped. Seasonal roads, cabins and outbuildings that support the research community are at the southeastern shore of the lake.

Watershed disturbance: The 1916 fire protection source data reveal 87.9% of the watershed as virgin and second growth green timber with no slash. No damage was reported from the November 1950 blowdown and July 1995 microburst storms (ALSC 2003). There is a history of logging within the watershed. In the winter of 1960-61, a total of 1.5 million cubic meters of timber, primarily softwoods, were removed from about 162 ha in and around the watershed (McHale, M. R. et al. 2000). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Bukaveckas, P. and Shaw, W. 1998. Phytoplankton responses to nutrient and grazer manipulations among northeastern lakes of varying pH. Canadian Journal of Fisheries and Aquatic Sciences 55: 958-966.

Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns, D. A., McHale, M. R., Driscoll, C. T., and Roy, K. M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Chen, L. and Driscoll, C. T. 2004. Modeling the response of soil and surface waters in the Adirondack and Catskill regions of New York to changes in atmospheric deposition and historical land disturbance. Atmospheric Environment 38: 4099-4109.

Chen, L., Driscoll, C. T., Gbondo-Tugbawa, S. S., Mitchell, M. J., and Murdoch, P. S. 2004. The application of an integrated biogeochemical model (PnET-BGC) to five forested watersheds in the Adirondack and Catskill regions of New York. Hydrological Processes 18: 2631-2650.

Dixit, S. S., Cumming, B. F., Birks, H. J. B., Smol, J. P., Kingston, J. C., Uutala, A. J., Charles, D. F., and Camburn, K. E. 1993. Diatom assemblages from Adirondack Lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

Driscoll, C. T., Blette, V., Yan, C., Schofield, C. L., Munson, R., and Holsapple, J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll, C. T. and Newton, R. M. 1985. Chemical characteristics of Adirondack Lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll, C. T., Yan, C., Schofield, C. L., Munson, R., and Holsapple, J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Kanciruk, P., Eilers, J. M., McCord, R. A., Landers, D. H., Brakke, D. F., and Linthurst, R. A. 1986. Characteristics of Lakes in the Eastern United States: Volume III. Data Compendium of Site Characteristics and Chemical Variables. U.S. Environmental Protection Agency No. EPA/600/4-86/007c.

McHale, M. R., Mitchell, M. J., McDonnell, J. J., and Cirmo, C. P. 2000. Nitrogen solutes in an Adirondack forested watershed: Importance of dissolved organic nitrogen. Biogeochemistry 48: 165-184.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology 41: 5191-5197.

NADP. National Atmospheric Deposition Program. 2009.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Owen, J. S., Mitchell, M. J., and Michener, R. H. 1999. Stable nitrogen and carbon isotopic composition of seston and sediment in two Adirondack lakes. Canadian Journal of Fisheries and Aquatic Sciences 56: 2186-2192.

Schaefer, D. A. and Driscoll, C. T. 1993. Identifying sources of snowmelt acidification with a watershed mixing model. Water, Air, and Soil Pollution 67: 345-365.

Schoch, N., Evers, D., Simonin, H., Glennon, Michale, and Adams, David 2004. Long-Term Monitoring and Assessment of Mercury Based on Integrated Sampling Efforts Using the Common Loon, Prey Fish, Water, and Sediment.

Schoch, N. and Evers, D. C. 2002. Monitoring Mercury in Common Loons: New York Field Report, 1998-2000. BioDiversity Research Institute No. BRI 2001-01.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T.J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

SUNY ESF. Huntington Forest Research Overview. 2009.

U.S.Environmental Protection Agency. HWF187 (Huntington Wildlife Forest). 2009.

Lake Colden   050706

Lat. 44°07’ 09” N   Long. 073° 58’ 59” W

Lake: Lake Colden lies in the Upper Hudson watershed at 843 m. This 15.4 ha lake is the second highest in the ALTM program. Avalanche Lake is a tributary along with 2-3 other inlet streams. The outlet dam is wood and stone with a head height of about 1.5 m (ALSC 1989). The lake reaches a maximum depth of 7.3 m (Figure 2).

Lake Colden is classified as a thin till chain drainage lake with low dissolved organic carbon. It is considered sensitive to acidification. The ALTM program has been monitoring lake chemistry on a monthly basis since June 1992.

Lake chemistry: Lake Colden was sampled during the ALS on 18 Aug 1987 finding: Lab pH 5.13, ANC 0.6 µeq L^{-1}, SO_4^{2-} 106.60 µeq L^{-1}, NO_3^- 1.46 µeq L^{-1}, Ca^{2+} 79.84 µeq L^{-1}, Mg^{2+} 18.10 µeq L^{-1}, DOC 3.5 mg L^{-1}-C (ALSC 1989). Table 1 summarizes recent ALTM chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 19 Oct 1987, the following aquatic plants were identified: Fontinalis spp.; Sparganium spp.; Potamogeton spp.; Najas spp.; Eriocaulon spp.; numerous Algae and Poeceae. Submergent vegetation covered 60% of the bottom of the lake. The surface of the lake was occupied by 8% emergent plants. A dip-net survey on that day found: Crustacea Decapoda; Insecta, Ephemeroptera Leptophlebiidae; Odonata Libellulidae; Hemiptera Notonectidae; Megaloptera Sialidae; Trichoptera Phryganeidae; Coleoptera Dytiscidae; and Diptera Culicidae and Chironomidae (ALSC 1989). Charles and others (1990) reported total phosphorus was 3.8 µg L^{-1}, chlorophyll a was 0.7 µg L^{-1} and a Secchi depth was 6.3 m.

Fisheries: NYSDEC stocked brook trout from 1941 through 1972. The ALSC surveyed the lake on 20 Oct 1987 and on 29 Sep 2004. No fish were caught in either survey.

Intensive studies: Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). McNeil and others (2007) conducted a regional survey of foliar nitrogen in July/August 2003 that included study plots in this watershed.

Figure 1. Catchment

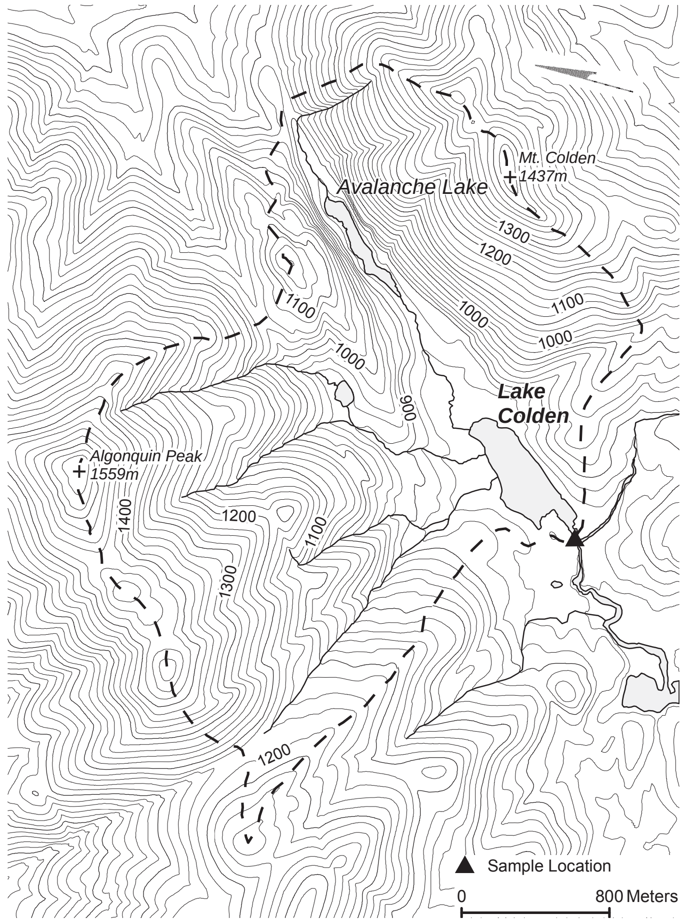
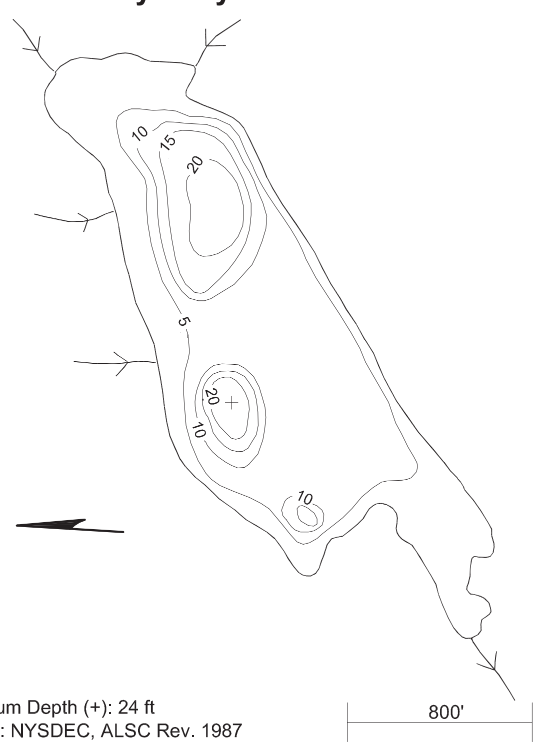


Figure 2. Bathymetry



Maximum Depth (+): 24 ft
Source: NYSDEC, ALSC Rev. 1987

Deposition: The nearest NADP deposition monitoring site is 25 km south at Huntington Wildlife Forest in Newcomb. The nearest NYSDEC wet deposition monitoring site is 32 km north at Whiteface Mountain.

Watershed: The Lake Colden watershed lies on metanorthosite and anorthositic gneiss bedrock with medium to high ANC (Roy, K. M. et al. 1997). Till comprises 58% of the watershed, while the remaining 42% is exposed bedrock. Basal soils are concentrated in elevations lower than 800 meters, primarily around the lake, while a majority (85%) of the watershed is comprised of shallow soils and rock outcrops. The highest point in the watershed is Algonquin Peak at 1559 m. The maximum relief is 716 m. In 1987, the ALS described the shoal water substrate around the lake as 50% muck/silt/organic, 30% sand/gravel, and 20% boulder/rubble (ALSC 1989).

Land Cover/Use: In 1987, coniferous forest covered 80% of the watershed, deciduous-conifer mixed forest 10%, and shrub/sapling/wetland 10%. The immediate shoreline area was 70% coniferous forest, 12% shrub/sapling mix, 10% wetland and open grass; 7% boulder rock ledge, and 1% developed. The lake has a wetland complex at the eastern end (ALSC 1989). Total wetland area is 12.5 ha and comprises about 1.9% of the watershed. The predominant wetland vegetation types are: scrub/shrub needle-leaf evergreen (5.2 ha); forested needle-leaved evergreen (2.6 ha); emergent persistent marsh (2.6 ha); and scrub/shrub broad-leaf deciduous (2.0 ha) (ALSC 2003).

Lake Colden and its watershed occur entirely within the High Peaks Wilderness Area (HPWA), the largest (780 km^2) designated wilderness in New York. Fourteen campsites, two lean-tos and one ranger outpost (near Cold Brook) are found within the lakes watershed. The Lake Colden ranger outpost was destroyed by fire in March 1998 and replaced in the fall of that year. Hiking trails meet at, and circumnavigate the lake. The dam at Lake Colden is one of four functional and maintained dams in the HPWA (NYSDEC 1999).

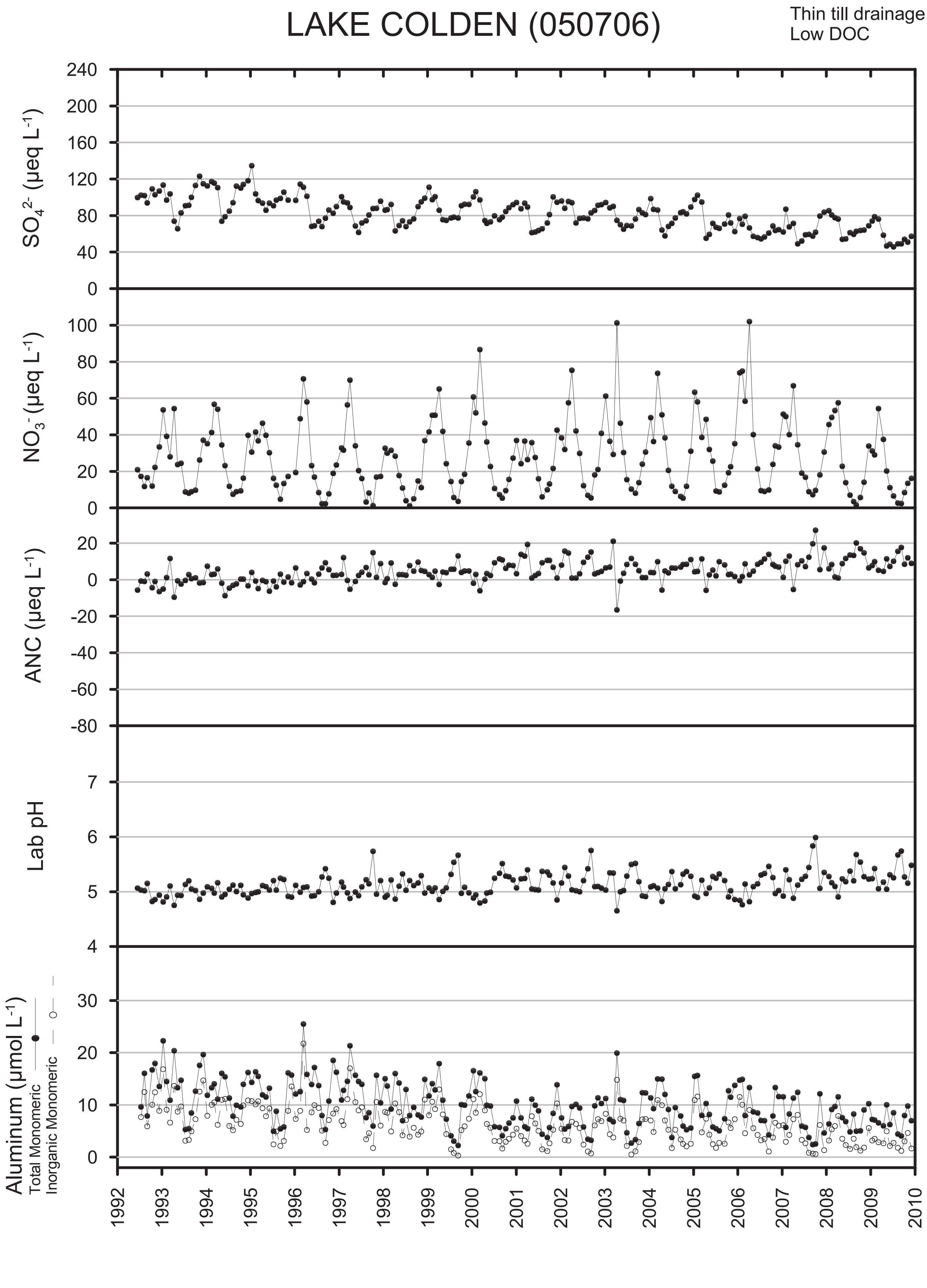
Table 1. Lake Chemistry

050706			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	65.58	123.05	97.40	45.76	78.70	57.43	μeq L^{-1}
NO_3^-	8.02	54.35	26.83	2.38	54.29	19.40	μeq L^{-1}
Cl^-	4.23	12.41	6.98	2.82	12.02	5.08	μeq L^{-1}
F^-	0.58	1.21	0.76	0.40	1.32	0.87	μeq L^{-1}
ANC	-9.62	11.58	-0.37	4.51	17.68	9.87	μeq L^{-1}
DIC	23.31	319.70	75.83	29.14	184.83	57.49	μmol L^{-1} -C
DOC	233.78	414.28	347.70	233.70	488.15	391.17	μmol L^{-1} -C
SiO_2	43.77	108.68	82.34	55.25	117.00	92.28	μmol L^{-1}
Ca^{2+}	50.90	96.31	76.35	46.91	76.85	58.67	μeq L^{-1}
Mg^{2+}	11.52	19.75	17.35	9.87	20.57	14.44	μeq L^{-1}
Na^+	10.87	25.23	17.51	12.18	26.97	18.13	μeq L^{-1}
K^+	1.28	6.39	2.79	0.32	2.30	1.11	μeq L^{-1}
NH_4^+	-2.27	5.93	1.40	-1.36	2.27	0.36	μeq L^{-1}
AL_TD	5.78	27.80	19.17	11.54	22.05	15.06	μmol L^{-1}
AL_TM	5.30	22.27	13.77	4.03	10.04	7.07	μmol L^{-1}
AL_OM	2.13	6.73	4.56	2.67	5.74	4.21	μmol L^{-1}
AL_IM	3.14	16.83	9.21	1.21	4.97	2.86	μmol L^{-1}
LABPH	4.75	5.20	4.95	5.04	5.74	5.27	
AIREQPH	4.73	5.33	4.96	5.05	5.75	5.27	
TRUECOLOR	15	30	23	25	45	33	Pt Co
SCONDUCT	16.26	27.64	21.10	11.56	21.74	14.94	μS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	843 m
Maximum depth	7.3 m
Mean depth	2.3 m
Volume	35.5 x 10^4 m^3
Surface area	15.4 ha
Watershed area	656.3 ha
Watershed ratio	0.02
Hydraulic retention time (year)	0.08
Watershed	Upper Hudson
County, Town	Essex, Keene
USGS Quadrangle	Mt. Marcy
Land use classification	High Peaks Wilderness

Figure 3. Chemistry Time Series



Watershed disturbance: In the 19th century, the area supported a logging industry that denuded vast areas of the watershed and left it prone to wildfires. During the summer and fall of 1903, an estimated 600,000 acres of land burned in the Adirondacks, including areas of the High Peaks Watershed. Contributing to the fire storms were dry logging slash, an extended drought, and unseasonably high winds. Fire storms raged again in 1908 and 1909. Lumbering practice reforms were made in 1912 to reduce future fire risk (NYSDEC 1999).

The 1916 fire protection source data reveal 93.4% of the watershed as having green timber of virgin and secondary growth with no slash and 3.6% of the watershed as logged for softwood only with considerable slash. A November 1950 storm caused 50-100% severe blow down over 4.3% of the watershed (ALSC 2003). Clean up of trails blocked by fallen trees was not complete until 1955 (NYSDEC 1999). The watershed was not impacted by the July 1995 microburst storm (ALSC 2003). The watershed experienced light ice damage from the January 1998 ice storm (NYS DEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1985 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Charles, D. F., Binford, M. W., Furlong, E. T., Hites, R. A., Mitchell, M. J., Norton, S. A., Oldfield, F., Paterson, M. J., Smol, J. P., Uutala, A. J., White, J. R., Whitehead, D. R., and Wiese, R. J. 1990. Paleoecological investigation of recent lake acidification in the Adirondack Mountains, N.Y. Journal of Paleolimnology 3: 195-241.

Dixit, S. S., Cumming, B. F., Birks, H. J. B., Smol, J. P., Kingston, J. C., Uutala, A. J., Charles, D. F., and Camburn, K. E. 1993. Diatom assemblages from Adirondack lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

New York State Department of Environmental Conservation 1999. High Peaks Wilderness Complex Unit Management Plan, Ray Brook, NY.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Avalanche Lake 050707

Lat. 44° 07’ 51’’ N Long. 073° 58’ 13’’ W

Lake: Avalanche Lake lies in the Upper Hudson watershed at 873 m. This 4.4 ha headwater lake is the highest in the ALTM program. A single permanent inlet drains from the northeast (Figure 1). The narrow lake is constrained by Mt. Colden and Avalanche Mt. In 1987, an active beaver dam was present at the outlet (ALSC 1989). The lake reaches a maximum depth of 7 m (Figure 2).

Avalanche Lake is a thin till drainage-lake with low dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992.

Lake chemistry: Avalanche Lake was sampled during the ALS 18 Aug 1987 finding: Lab pH 4.99, ANC -1.7 µeq L^{-1}, SO_4^{2-} 96.19 µeq L^{-1}, NO_3^- 3.24 µeq L^{-1}, Ca^{2+} 74.85 µeq L^{-1}, Mg^{2+} 18.93 µeq L^{-1}, DOC 4.2 mg L^{-1}-C (ALSC 89). Table 1 summarizes recent ALTM chemistry taken at the outlet. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 21 Oct 1987, the ALS found submergent vegetation covered 5% of the lake bottom, while emergent plants covered 2% of the water surface. ALS identified the following aquatic plants: Sparganium spp.; Eleocharis spp.; Eriocaulon spp. and Poaceae. On that date, a dip net survey identified the following Insecta: Hemiptera Corixidae; Trichoptera Phryganeidae; Coleoptera Dytiscida and Gyrinidae; and Diptera Chironomidae. Also found was Oligochaeta Unspecified (ALSC 1989). Charles and others (1990) reported total phosphorus was 4.4 µg L^{-1}, chlorophyll a was 1.3 µg L^{-1} and Secchi depth was 4.8 m.

Fisheries: The NYSDEC limed the lake in 1981 and 1982. The lake was stocked with brook trout from 1982 through 1987. The ALSC surveyed the lake on 21 Oct. 1987 and on 29 Sep. 2004. No fish were captured in either survey. Refer to Table 3 for recent fish stocking history.

Intensive studies: Sediment diatom assemblages were characterized as part of the PIRLA paleolimnological studies (Dixit, S. S. et al. 1993). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Figure 1. Catchment

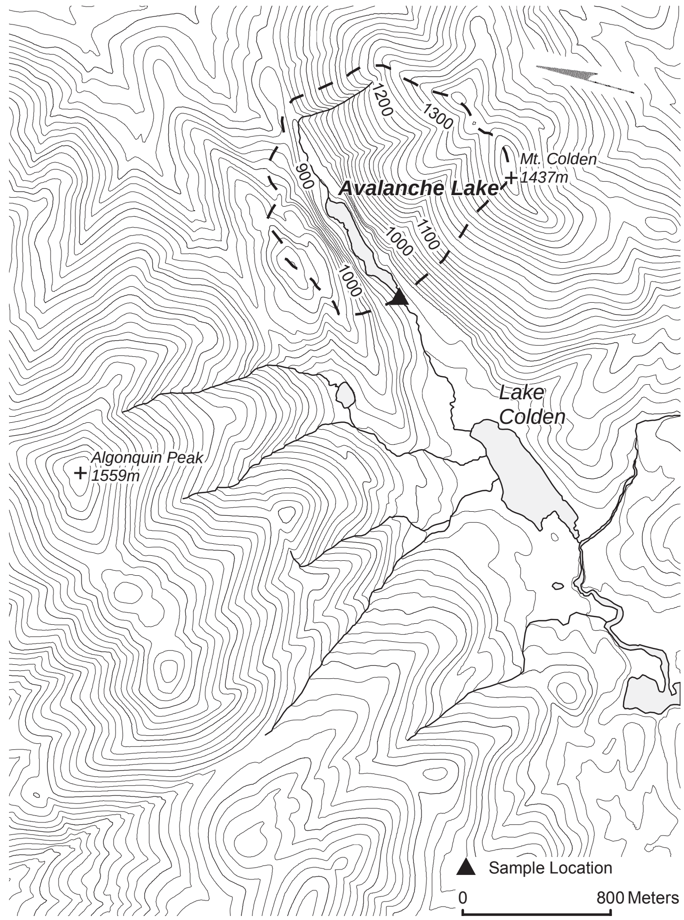
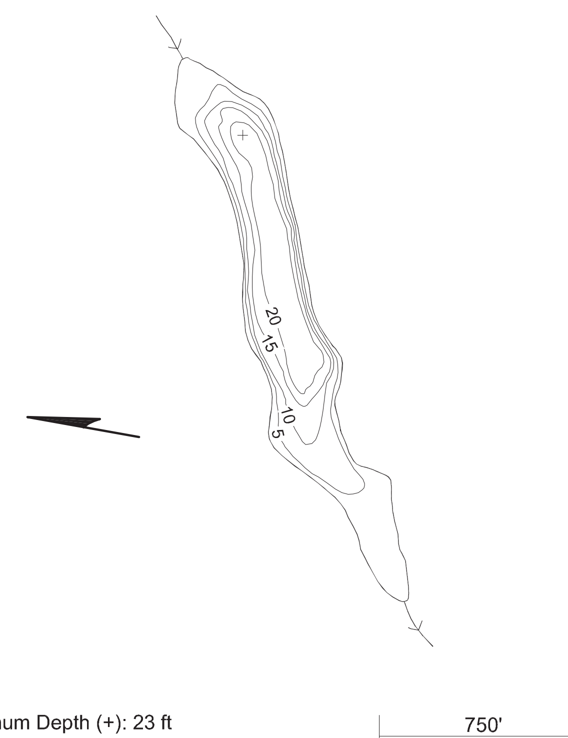


Figure 2. Bathymetry



Maximum Depth (+): 23 ft
Source: NYSDEC, ALSC Rev. 1987

Deposition: The nearest NADP deposition and NYSDEC wet deposition monitoring sites are co-located 30 km north at Whiteface Mountain.

Watershed: The Avalanche Lake watershed lies on metanorthosite and anorthositic gneiss with medium to high ANC (Roy, K. M. et al. 1997). In the high peaks region, deposited glacial till, a mixture of clay, silt, sand, and stone are more common near and around the base of mountains where hardwoods and mixed conifers dominate (NYSDEC 1999). Exposed bedrock comprises 39 % of the watershed at elevations above 1100 m; the remaining 61 % is basal till. Basal tills appear in the lower elevations surrounding the lake. The 119 ha watershed is characterized by very steep slopes resulting in 90% of the shoreline as steep cliffs. Approximately 75% of the watershed is above 1000 m. At 1437 m, Mt. Colden is the highest peak within the watershed. The maximum relief is 564 m. In 1987, the ALS found the shoal water substrate comprised of 65% bedrock/ boulder/rubble, 30% muck/ silt/organic, and 5% sand (ALSC 1989).

Land cover/use: In 1987, the ALS described the watershed as: 60% high elevation coniferous forest, 20% deciduous-conifer mix, and 20% shrub-sapling mix. The immediate shoreline consisted of 90% boulder rock ledge and 10% mix of coniferous forest and shrub-sapling vegetation (ALSC 1989). Total wetland area is 1.7 ha, or 1.5% of the watershed**.** The predominant wetland types are forested, needle-leaved evergreen (1 ha), emergent persistent marsh (0.6 ha), and scrub/shrub needle-leaf evergreen (0.1 ha) (ALSC 2003). The pond and watershed are located in the High Peaks Wilderness Area (NYSDEC 1999). A hiking trail runs along the western shore of the pond, including a series of foot bridges with supports that are drilled into the rock walls along Avalanche Mountain.

Watershed disturbance: In the 19th century, the area around Avalanche Lake supported a logging industry that denuded vast areas of the watershed and left it prone to wildfires. During the summer and fall of 1903, an estimated 600,000 acres of land burned in the Adirondacks, including areas of the High Peaks Watershed. Contributing to the fire storms were dry logging slash, an extended drought and unseasonably high winds. Fire storms raged again in 1908 and 1909. Lumbering practice reforms were made in 1912 to reduce future fire risk (NYSDEC 1999).

Table 1. Lake Chemistry

050707			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	60.79	140.33	100.28	38.69	71.62	50.34	µeq L^{-1}
NO_3^-	13.69	82.51	36.29	6.84	68.26	25.89	µeq L^{-1}
Cl^-	5.08	11.00	7.19	3.20	8.15	5.24	µeq L^{-1}
F^-	0.53	1.21	0.79	0.58	1.06	0.79	µeq L^{-1}
ANC	-34.83	7.88	-7.49	-6.46	19.17	8.68	µeq L^{-1}
DIC	28.31	214.80	71.67	32.47	156.52	70.56	µmol L^{-1} -C
DOC	231.04	588.45	425.57	341.52	699.35	533.41	µmol L^{-1} -C
SiO_2	40.44	125.82	78.65	51.59	107.60	80.41	µmol L^{-1}
Ca^{2+}	51.40	101.80	77.39	49.40	71.86	59.06	µeq L^{-1}
Mg^{2+}	13.17	20.57	17.62	11.52	16.46	13.75	µeq L^{-1}
Na^+	11.31	22.62	16.53	13.05	20.01	16.19	µeq L^{-1}
K^+	1.28	4.60	2.52	0.77	2.56	1.61	µeq L^{-1}
NH_4^+	0.28	7.21	2.25	-0.79	4.49	0.97	µeq L^{-1}
AL_TD	9.90	34.69	23.27	16.17	26.50	20.16	µmol L^{-1}
AL_TM	8.57	28.98	17.40	7.02	14.34	10.43	µmol L^{-1}
AL_OM	2.78	9.60	6.40	4.01	7.78	5.75	µmol L^{-1}
AL_IM	5.79	19.38	11.00	2.45	8.34	4.69	µmol L^{-1}
LABPH	4.37	5.11	4.78	4.74	5.55	5.09	
AIREQPH	4.37	5.11	4.76	4.71	5.55	5.08	
TRUECOLOR	25	45	33	35	70	53	Pt Co
SCONDUCT	17.16	41.61	24.42	11.72	26.19	15.91	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	873 m
Maximum depth	7.0 m
Mean depth	3.3 m
Volume	14.6 x 10^4 m^3
Surface area	4.4 ha
Watershed area	115.2 ha
Watershed ratio	0.04
Hydraulic retention time (year)	0.20
Watershed	Upper Hudson
County, Town	Essex, Keene
USGS Quadrangle	Keene Valley
Land use classification	High Peaks Wilderness

Figure 3. Chemistry Time Series

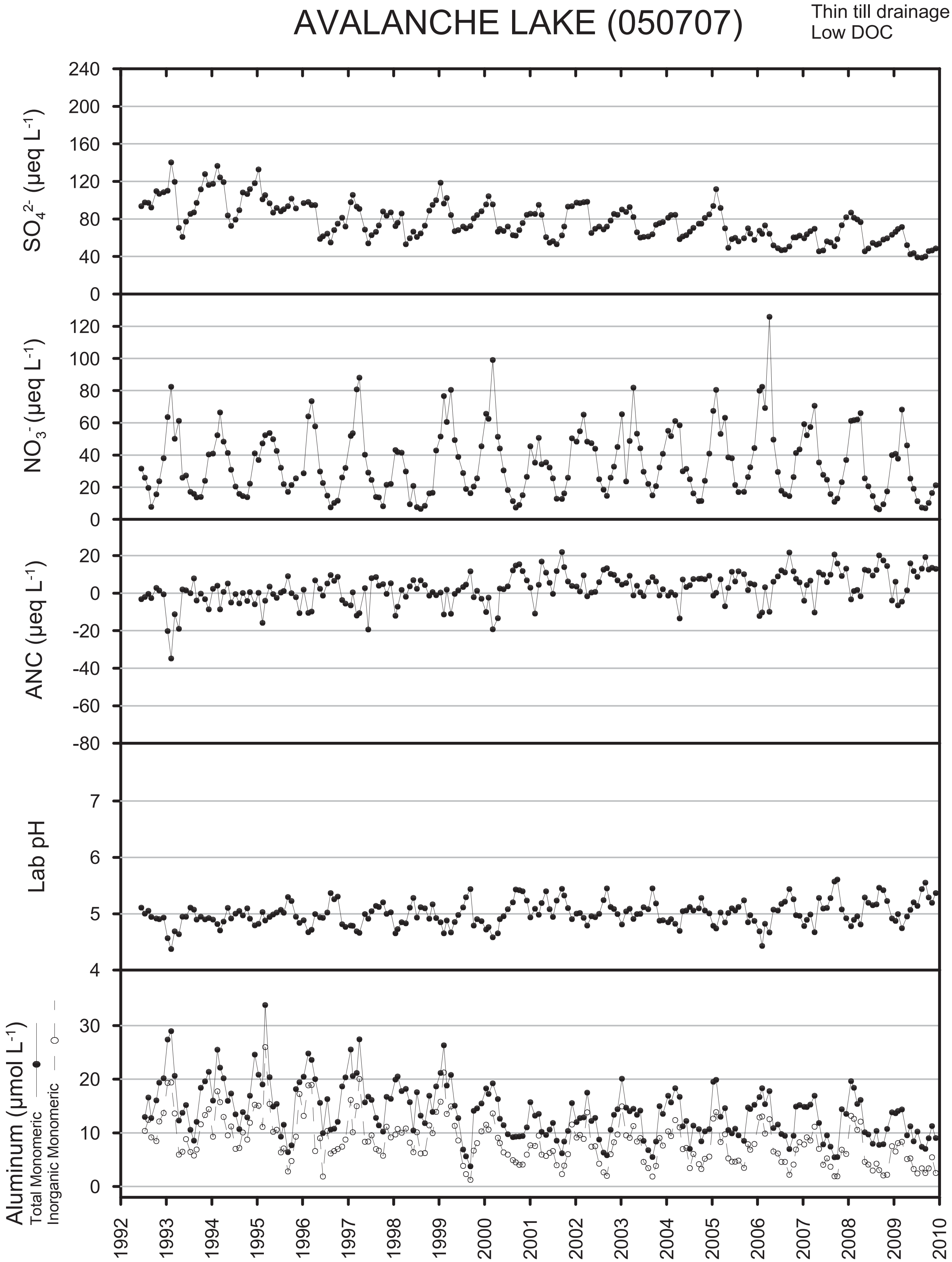


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1982	Brook trout	956	30
1983	Brook trout	929	25
1984	Brook trout	481	4
1985	Brook trout	715	5
1986	Brook trout	650	3
1987	Brook trout	650	7

The 1916 fire protection source data show 95.9% of the watershed as virgin and second growth green timber with no slash. The November 1950 storm caused severe blow down over 1.9% of the watershed with 50 to 100% damage to the tree crowns (ALSC 2003). Clean up of blocked trails was not complete until 1955 (NYSDEC 1999). The watershed experienced light ice damage from the January 1998 ice storm (NYSDEC 1998). Mud slides occurred on slopes of Mt Colden on 17 Sept 1999 caused by hurricane Floyd. Two slides had direct impact on the lake, a very large slide on the watershed boundary, and a smaller one on the northeastern shore of the lake itself. On 15 Mar 2007, there was an avalanche on Mt. Colden in the draw called the Trap Dike on the southeastern shore of the lake. This slide sent debris onto and across the entire lake surface to the far shore.

References

Adirondack Lakes Survey Corporation (ALSC) 1989. Adirondack Lakes Survey 1987 Field Studies Report Volumes 16-18. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 2003. Grant F-48-R Study 13: Chemical and Biological Assessment of Adirondack Waters April 1, 1992 – March 31, 2001 Study Completion Report. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Charles, D. F., Binford, M. W., Furlong, E. T., Hites, R. A., Mitchell, M. J., Norton, S. A., Oldfield, F., Paterson, M. J., Smol, J. P., Uutala, A. J., White, J. R., Whitehead, D. R., and Wiese, R. J. 1990. Paleoecological investigation of recent lake acidification in the Adirondack Mountains, N.Y. Journal of Paleolimnology 3: 195-241.

Dixit, S. S., Cumming, B. F., Birks, H. J. B., Smol, J. P., Kingston, J. C., Uutala, A. J., Charles, D. F., and Camburn, K. E. 1993. Diatom assemblages from Adirondack lakes (New York, USA) and the development of inference models for retrospective environmental assessment. Journal of Paleolimnology 8: 27-47.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

New York State Department of Environmental Conservation 1999. High Peaks Wilderness Complex Unit Management Plan, Ray Brook, NY.

NYS DEC. Icing Zones. 1998. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY

This page intentionally left blank.

Little Simon Pond 060182

Lat. 44° 09' 42'' N Long. 074° 26' 36'' W

Lake: Little Simon Pond lies in the Raquette River watershed at 546 m elevation. The 58.1 ha headwater lake flows into Simon Pond approximately 2 km downstream. Five perennial streams discharge into Little Simon Pond, two of which enter wetlands at the southwestern end of the lake. There is also evidence of intermittent and ephemeral tributaries (Heinemann, J. et al. 1985). One small island occurs at the southern end of the pond (Figure 1). The lake is privately owned and has been a potable water source for the Village of Tupper Lake. A concrete dam is at the outlet. The lake reaches a maximum depth of 32.0 m (Figure 2)

Little Simon Pond is classified as a medium till drainage lake, with low dissolved organic carbon. It is considered moderately sensitive to acidification. The ALTM program has been monitoring lake chemistry at the outlet since June 1992.

Lake Chemistry: Little Simon Pond was sampled during the ALS on 12 Aug 1985 finding: Lab pH 5.71, ANC 11.4 µeq L^{-1}, SO_4^{2-} 152.40 µeq L^{-1}, NO_3^- 5.99 µeq L^{-1}, Ca^{2+} 113.78 µeq L^{-1}, Mg^{2+} 31.27 µeq L^{-1}, DOC 2.8 mg L^{-1}-C (ALSC 1986). Since Little Simon Pond has a recent liming history, it is not reported in the ALTM overall water chemistry trend analyses. Table 1 summarizes recent water chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: The Lake Acidification Mitigation Project (LAMP) surveyed the lake in June through August of 1984 and found the crustacean community composed of three dominant copepods: the calanoid Diaptomus minutus, and the cyclopoids Mesocyclops edax and Cyclops scutifer. The survey found two cladocerans Bosmina longirostris and Daphnia catawba. Rotifers found were: Keratella taurocephala, Keratella hiemalis, Polyarthra spp., Collotheca spp., and Gastropus stylifer. Chlorophyll a concentrations ranged from 0.5 to 2.6 mg m^{-3}. The lake is very deep and experiences strong stratification in the summer. The lake is typically mixed by late fall (October-November) and ice covered by early December (Heinemann, J. et al. 1985). The ALS found the thermocline between 8 and 10 m on 12 Aug. 1985 (ALSC 1986).

Figure 1. Catchment

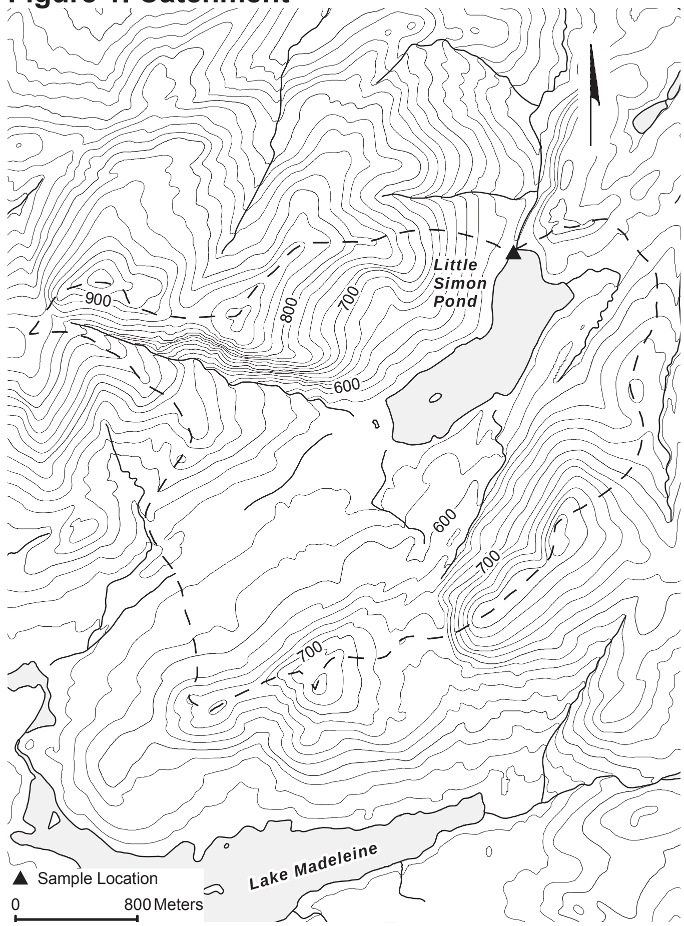
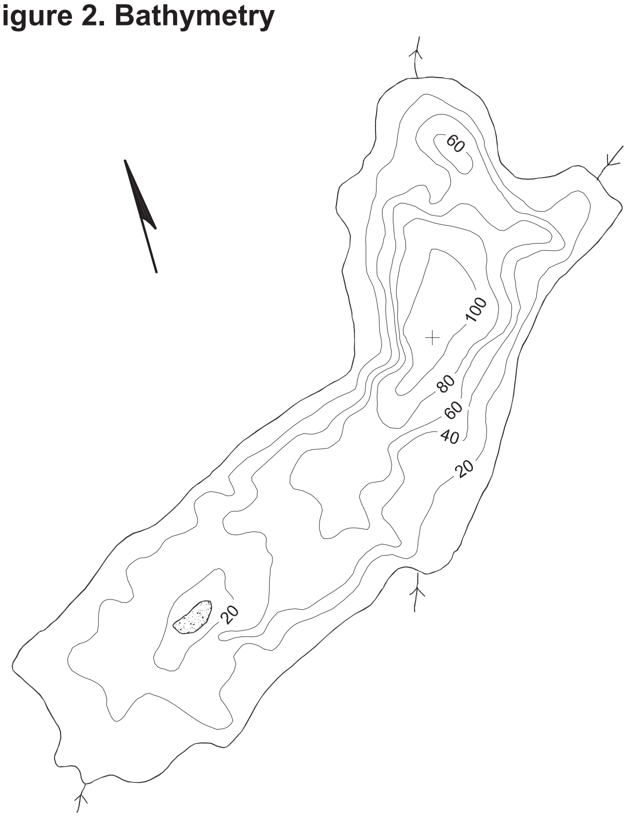


Figure 2. Bathymetry



Maximum Depth (+): 105 ft
Source: ALSC Rec'd c. 1984

Fisheries: NYS DEC stocked the lake with landlocked salmon, lake trout and brook trout intermittently between 1915 and 1940. Brook trout were stocked from 1970 to 1983. Little Simon Pond is now privately managed. The lake was limed in 1985 during the LAMP study (Heinemann, J. et al. 1985) and has been limed annually since 1990 by the private land owner (Bath, D. W. 2003). Refer to Table 3 for recent netting history.

Intensive studies: Little Simon Pond was part of the Lake Acidification Mitigation Project (LAMP), which also included Woods Lake (040576), and Cranberry Pond, to assess the chemical and biological effects of liming on lake ecosystems. LAMP model calibrations were made from detailed geologic, hydrologic, bathymetric, baseline biota and chemistry data collected in the survey (Heinemann, J. et al. 1985). Little Simon Pond was one of 20 Adirondack lakes studied to evaluate regional trends in chrysophyte-inferred lake water pH changes (Cumming, B. F. et al. 1994; Smol, J. P. et al. 1998). Ito and others (2005) evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 – 2000. McNeil and others (2007) conducted a regional survey of foliar nitrogen in July/ August 2003 that included study plots in this watershed.

Deposition: The nearest NADP deposition monitoring site is 27 km southeast at Huntington Wildlife. The nearest NYSDEC wet deposition monitoring site is 34 km northeast at Paul Smiths.

Watershed: Little Simon Pond and its watershed are underlain primarily (92%) by mangerite, pyroxene-hornblende syenite gneiss . A band of biotite and/or hornblende granite gneiss occupies approximately 6% of the watershed along the southern portion. Leucogranitic gneiss, found at higher elevations, occupies 2% of the watershed. General soils source data reveal 55% of the watershed as basal till along three quarters of the shoreline of Little Simon Pond and the entire eastern portion of the watershed. The western portion of the watershed is Potsdam 36% overall with the highest elevations showing Rawsonville 9% overall. The surficial geology source data show 81% of the watershed as till, silt to boulders, with the remaining 19% as exposed bedrock (APA 2001). Bedrock outcrops occur on both sides at the higher elevations. Unconsolidated deposits occur in parts of the watershed near the areas drained by the northeast inlet and along the base of Buck Mountain to the southwest. Other areas of unconsolidated deposits occur at the lake outlet and at the southwest shore of the lake. The rest of

Table 1. Lake Chemistry

060182			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	111.39	143.45	128.15	78.62	101.52	86.49	µeq L^{-1}
NO_3^-	5.68	49.44	20.68	7.47	40.25	14.24	µeq L^{-1}
Cl^-	7.90	11.56	9.26	6.52	10.71	7.87	µeq L^{-1}
F^-	1.79	3.26	2.86	1.82	3.08	2.61	µeq L^{-1}
ANC	9.12	132.24	74.14	17.28	109.91	75.43	µeq L^{-1}
DIC	88.25	190.66	138.83	78.26	162.35	117.83	µmol L^{-1} -C
DOC	252.60	406.87	287.55	286.15	373.32	326.02	µmol L^{-1} -C
SiO_2	69.23	105.52	88.64	82.68	110.51	92.52	µmol L^{-1}
Ca^{2+}	129.25	226.06	175.74	108.79	172.17	147.58	µeq L^{-1}
Mg^{2+}	26.33	41.97	35.18	20.57	24.69	22.93	µeq L^{-1}
Na^+	22.62	30.01	25.01	22.18	29.58	24.41	µeq L^{-1}
K^+	5.63	6.91	6.29	2.81	4.60	3.93	µeq L^{-1}
NH_4^+	-1.39	3.27	0.91	-0.56	1.50	0.41	µeq L^{-1}
AL_TD	2.59	16.16	7.46	3.69	13.75	6.45	µmol L^{-1}
AL_TM	0.16	12.37	3.48	1.78	5.15	2.59	µmol L^{-1}
AL_OM	0.16	4.86	2.06	1.75	3.60	2.16	µmol L^{-1}
AL_IM	0.00	9.07	1.54	0	1.67	0.46	µmol L^{-1}
LABPH	5.30	6.98	6.01	5.53	6.86	6.24	
AIREQPH	5.48	7.33	6.32	6	7.15	6.67	
TRUECOLOR	10	30	19	20	35	27	Pt Co
SCONDUCT	26.21	32.66	28.25	19.72	25.67	23.30	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	546 m
Maximum depth	32.0 m
Mean depth	11.0 m
Volume	631.3 x 10^4 m^3
Surface area	58.1 ha
Watershed area	774 ha
Watershed ratio	0.08
Hydraulic retention time (year)	1.28
Watershed	Raquette
County, Town	Franklin, Altamont
USGS Quadrangle	Tupper Lake
Land use classification	Private – Resource Management

Figure 3. Chemistry Time Series

LITTLE SIMON POND (060182)

Medium till drainage
Low DOC

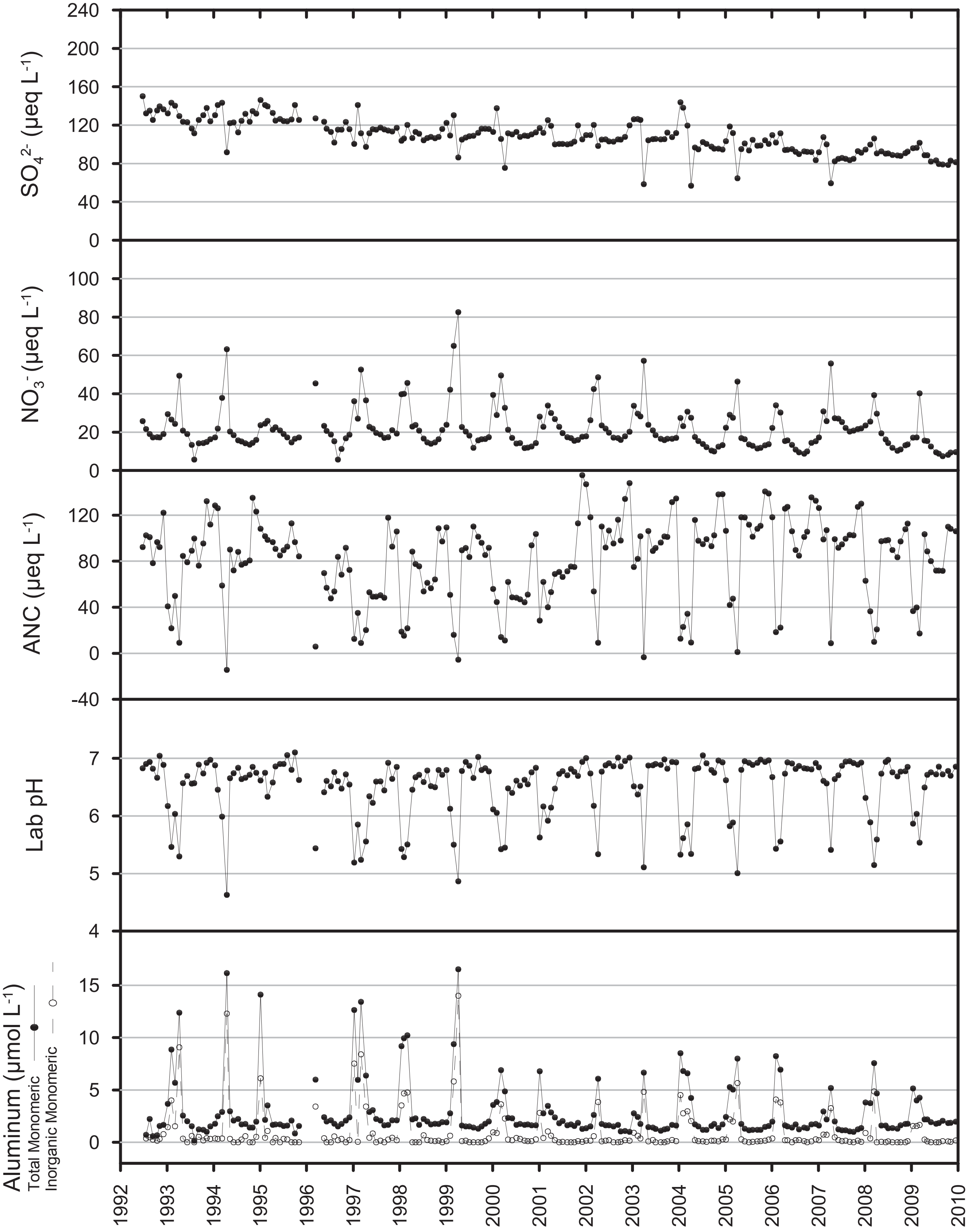


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-02	Brook trout	16	161	391	1864	16
June-02	Lake trout	1	225	225	80	1
June-02	Creek chub	45	76	125	411	179
June-02	White sucker	37	55	344	2103	111
November-85	Brook trout	70	-	-	-	-
November-85	Lake trout	1	-	-	-	-
November-85	Creek chub	49	-	-	-	-

the 774 ha watershed is covered with shallow deposits of 3 m or less. Swamp deposits occur with the wetlands along the southwestern inlet (Heinemann, J. et al. 1985). There is a lookout tower on Mt. Morris, the watershed's highest elevation, at 956 m. The maximum relief is 410 m. In 1985, the ALS characterized the shoal water substrate as 60% sand and gravel, 25% boulder and rubble, 10% bedrock and 5% organic (ALSC 1986).

Land cover/use: In 1985, the ALS found deciduous-coniferous mixed forest covered 70% of the watershed while 20% was deciduous forest, and 10% coniferous forest. The lake shoreline was predominately fringed with conifers described as: 40% deciduous-coniferous forest, 30% coniferous forest, and 20% deciduous forest (ALSC 1986). Total wetland area is 38.3 ha and comprises 5.3% of the watershed. The predominant wetland type is forested needle-leaved evergreen. Most of the wetlands occur along the main inlet stream. Small scrub shrub wetlands occur at the shoreline where inlets enter the lake. The lake and its watershed are classified as Resource Management according to the APA Land Use and Development Plan Map. There is a private gravel road along the northwest part of the lake, which leads to a private camp with several outbuildings along the shoreline.

Watershed disturbance: The 1916 fire protection map shows most of the watershed (86%) as virgin or second growth green timber with no slash. The northeast portion (6%) of the watershed, in the higher elevations of Mt. Morris is shown as waste and denuded lands with little flammable material. The November 1950 storm left 27% of the watershed with severe (50-100%) blowdown, and an additional 6% moderately (25-50%) damaged. The watershed was not impacted by the July 1995 microburst storm (APA 2001). This watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1986. Adirondack Lakes Survey 1985 Field Studies Report Volumes 6-10. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Bath, D. W. 2003 Long term monitoring pond descriptions. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Cumming, B. F., Davey, K. A., Smol, J. P., and Birks, H. J. B. 1994. When did acid-sensitive Adirondack lakes (New York, USA) begin to acidify and are they still acidifying? Canadian Journal of Fisheries and Aquatic Sciences 51: 1550-1568.

Heinemann, J., Gloss, S., Schofield, C., Whitehead, D., Bukaveckas, P., DePinto, J., Young, T., Driscoll, C., and Staubitz, W. 1985. Lake Acidification Mitigation Project (LAMP). Electric Power Research Institute No. 1397-03-85-CR Volume I.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar Nitrogen Responses to Elevated Atmospheric Nitrogen Deposition in Nine Temperate Forest Canopy Species. Environmental Science & Technology 41: 5191-5197.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Smol, J. P., Cumming, B. F., Dixit, A. S., and Dixit, S. S. 1998. Tracking recovery patterns in acidified lakes: A paleolimnological perspective. Restoration Ecology 6: 318-326.

This page intentionally left blank.

Sagamore Lake 060313

Lat. 43° 45' 57'' N Long. 074° 37' 43'' W

Lake: Sagamore Lake lies in the Raquette River watershed at 580 m. The primary tributary to this 68.0 ha lake flows from the eastern end of the watershed. This tributary is formed from two streams, East Inlet and Lost Brook which drains from 3.2 ha Aluminum Pond (Figure 1). Two other smaller inlets occur on the south shore of Sagamore Lake. The lake outlet is uncontrolled and drains into South Inlet 1.25 km downstream. The lake reaches a maximum depth of 22.9 m (Figure 2).

Sagamore Lake is classified as a medium till chain drainage lake, with high dissolved organic carbon. It is considered moderately sensitive to acidification. The ALTM program began monitoring the lake at the outlet in June 1992. In addition, weekly sampling during snowmelt has been on-going since 1998.

Lake chemistry: Sagamore Lake was sampled during the ALS on 08 Jul 1986 finding: Lab pH 6.04, ANC 28.4 µeq L^{-1}, SO_4^{2-} 134.91 µeq L^{-1}, NO_3^- 1.46 µeq L^{-1}, Ca^{2+} 120.77 µeq L^{-1}, Mg^{2+} 45.26 DOC 7.1 mg L^{-1} -C (ALSC 1987). Table 1 summarizes recent water chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 09 Oct 1986 the ALS identified the following aquatic plants: Sphagnum spp.; Sparganium spp.; Carex spp.; Equisetum spp. and Eriocaulon spp. A dip-net survey on that date found the following Insecta: Odonata Macromiidae and Gomphidae; Ephemeroptera Leptophlebiidae, Heptageniidae and Unspecified; Megaloptera Sialidae; Trichoptera Molannidae; and Coleoptera Elmidae. Also found were Crustacea: Amphipoda Unspecified ; Decapoda Astacidae as well as Pelecypod Veneroida Sphaeriidae. The lake was thermally stratified between 4 and 5 m on 8 Jul. 1986 (ALSC 1987). The AEAP reported an average value of chlorophyll a of 1.29 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: Sagamore Lake was stocked with brook trout three times between 1955 and 1961. Lake and brook trout are considered Natural Spawning Adequate (NSA) (NYSDEC 2005). Refer to Table 3 for netting history.

Figure 1. Catchment

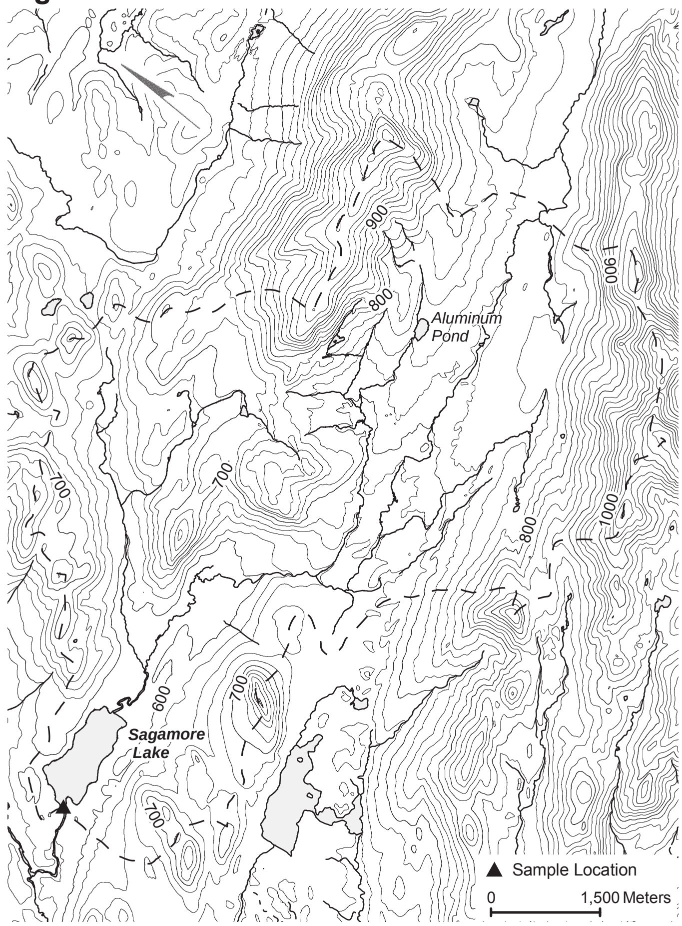
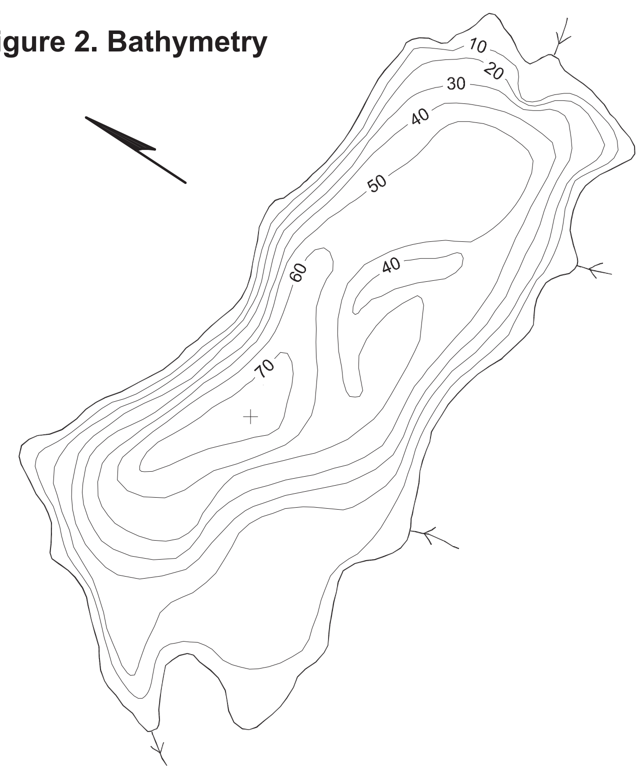


Figure 2. Bathymetry



Maximum Depth (+): 75 ft
Source: NYSDEC, ALSC Rev. 1986

Intensive studies: The Integrated Lake-Watershed Acidification Study (ILWAS) considered Sagamore Lake the intermediately sensitive of the three lakes that included Woods Lake (ALTM) and Panther Lake. All three study lakes had detailed soils and bedrock maps developed to evaluate acidification and aluminum mobilization processes (Schofield, C. L. et al. 1985). Sullivan and others (1996) evaluated landscape changes with sediment records at this site. Sagamore Lake was studied by the Mercury Response Project to evaluate mercury in fish, sampled on 30 Sep. 1992 and 11 Oct. 2005 (Dittman, J. A. and Driscoll, C. T. 2009). The lake has been studied by the Adirondack Effects Assessment Program since 1994 (Momen, B. et al. 2006). Sagamore Lake was studied as part of the Adirondack/Catskill comparison study from 1992-2001 (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 18 km west at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 30 km west at Nick's Lake.

Watershed: The lake and watershed are primarily underlain by inter-layered meta-sedimentary rock and granitic gneiss. Approximately 2% of the watershed is underlain by amphibolite, or pyroxenic amphibolite, both of which have medium to high ANC. The remaining 17% of the watershed lies on charnockite, granitic and quartz syenite gneiss that are found in the southeast. This rock has relatively no to low ANC (Roy, K. M. et al. 1997). Eighty-three percent of the watershed is overlain by till, 10.2% by exposed bedrock, 4.6% kame deposits, and 2.5% by outwash sand and gravel. Kame deposits surround the lake. Bedrock outcrops generally occur above 700 m. Sand and gravel deposits are associated with the Aluminum Pond watershed. Basal till comprises 51.5% of the overall watershed, and shallow to bedrock soils 34.3% in areas above 700 m. Organic soils make up 4.3% of the

Table 1. Lake Chemistry

060313			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	108.06	154.07	135.00	66.06	105.40	82.65	µeq L^{-1}
NO_3^-	9.29	45.11	21.98	1.09	25.11	10.39	µeq L^{-1}
Cl^-	6.49	12.41	9.24	6.74	10.97	7.97	µeq L^{-1}
F^-	3.63	4.90	4.15	3.34	4.15	3.86	µeq L^{-1}
ANC	9.75	67.03	34.47	22.13	76.42	47.82	µeq L^{-1}
DIC	40.80	159.85	82.84	44.96	141.54	89.02	µmol L^{-1} -C
DOC	407.79	704.93	532.17	471.23	924.80	664.11	µmol L^{-1} -C
SiO_2	89.21	170.59	133.20	95.53	161.60	126.14	µmol L^{-1}
Ca^{2+}	90.82	164.68	127.75	80.34	109.79	98.74	µeq L^{-1}
Mg^{2+}	34.56	58.42	49.03	31.27	47.73	40.43	µeq L^{-1}
Na^+	21.31	46.11	32.73	24.79	40.45	33.17	µeq L^{-1}
K^+	7.16	9.21	7.97	4.60	6.91	5.89	µeq L^{-1}
NH_4^+	-1.39	1.05	0.33	-0.50	1.90	0.26	µeq L^{-1}
AL_TD	7.19	16.38	11.20	8.71	12.12	10.30	µmol L^{-1}
AL_TM	1.78	10.46	6.11	4.06	6.41	4.76	µmol L^{-1}
AL_OM	0.93	17.31	4.96	3.00	5.68	4.00	µmol L^{-1}
AL_IM	0.00	4.81	1.78	0.00	1.78	0.81	µmol L^{-1}
LABPH	5.12	6.64	5.65	5.52	6.30	5.93	
AIREQPH	5.21	6.84	5.77	5.79	6.67	6.27	
TRUECOLOR	35	60	45	50	140	84	Pt Co
SCONDUCT	22.57	30.42	26.69	18.58	24.28	20.91	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	580 m
Maximum depth	22.9 m
Mean depth	10.5 m
Volume	713.1 x 10^4 m^3
Surface area	68.0 ha
Watershed area	4,723.0 ha
Watershed ratio	0.01
Hydraulic retention time (year)	0.20
Watershed	Raquette
County, Town	Hamilton, Long Lake
USGS Quadrangle	Raquette lake
Land use classification	Blue Ridge Wilderness

Figure 3. Chemistry Time Series

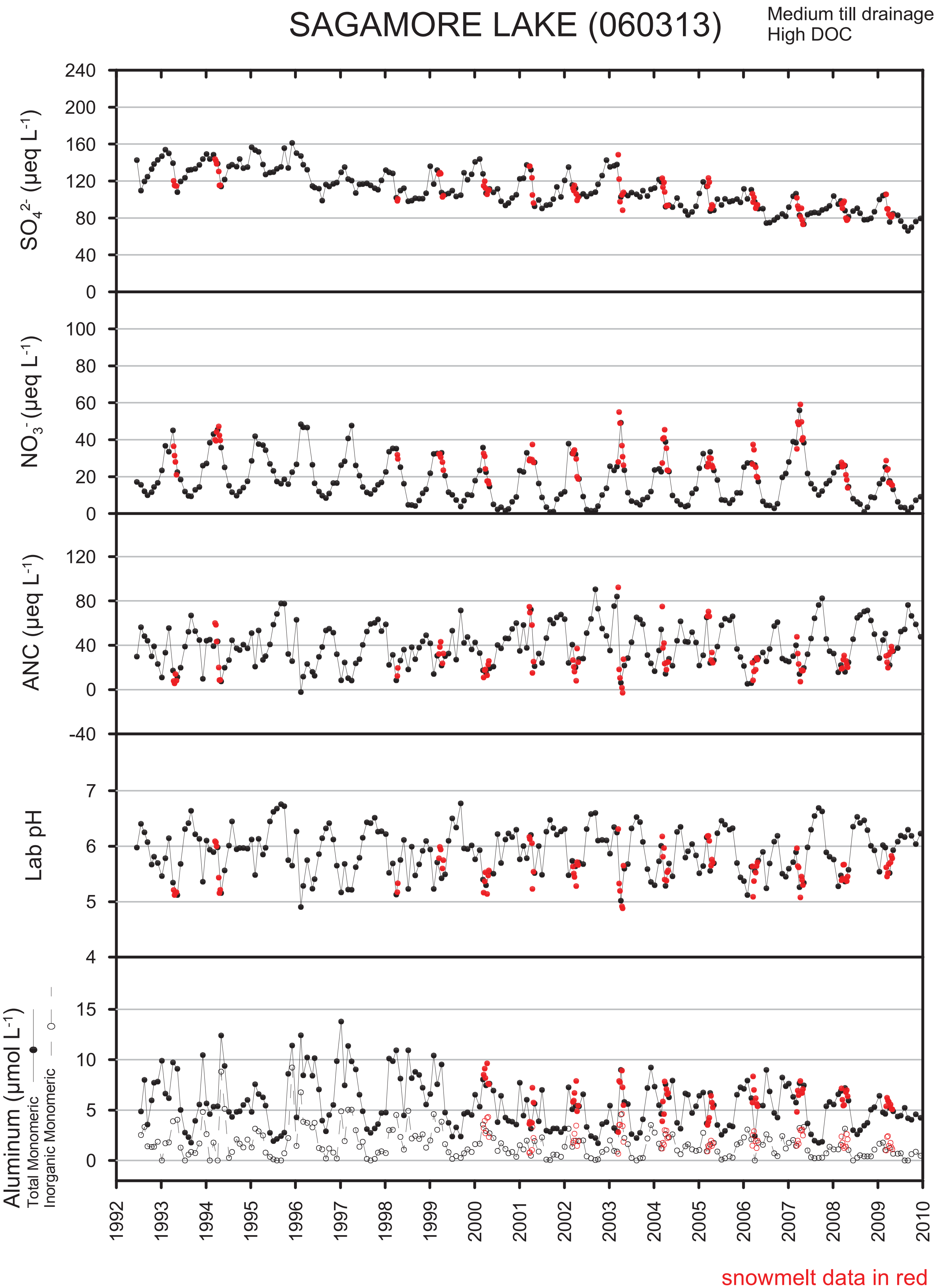


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-01	Brook trout	7	185	240	671	7
June-01	Lake trout	7	366	695	6125	7
June-01	Lake chub	3	102	115	29	3
June-01	Creek chub	1	151	151	39	1
June-01	Longnose sucker	8	263	480	4252	8
June-01	White sucker	29	93	430	9036	76
June-01	Brown bullhead	12	134	205	824	12
June-01	Pumpkinseed	4	100	125	97	4
June-01	Smallmouth bass	1	195	195	95	1
June-01	Yellow perch	9	80	177	163	13
October-86	Lake whitefish	1	521	521	1000	1
October-86	Brook trout	17	169	292	1645	17
October-86	Lake trout	27	350	555	20625	27
October-86	Creek chub	10	175	198	610	10
October-86	Longnose sucker	12	364	430	8290	12
October-86	White sucker	25	174	390	6075	63
October-86	Brown bullhead	9	162	205	760	9
October-86	Yellow perch	25	144	187	1195	47

watershed, while glacial outwash covers approximately 10% (APA 2001). The highest elevation in the watershed is Wakely Mountain at 1148 m. The maximum relief is 568 m. In 1986, the ALS found the shoal water substrate around the lake comprised of 60% gravel/sand; 35% boulder/rubble and 5% organic (ALSC 1987).

Land cover/use: In 1986, the ALS found deciduous-coniferous mixed forest covered 85% of the watershed, while the remaining cover was 10% deciduous and 5% coniferous forest. The immediate shoreline consisted of 69% coniferous forest, 20% deciduous-coniferous mixed forest, 5% shrub-sapling mix, 5% boulder-rock ledge and 1% developed (ALSC 1987). Total wetland area is 626 ha and comprises 13% of the watershed. The predominant wetland type is forested needle-leaf evergreen (428 ha). The largest area of emergent marsh is associated with the main inlet. Smaller patches of emergent marsh and broad leaf evergreen scrub-shrub are found along the eastern shoreline. Major wetlands occur over the glacial outwash sections of the watershed between Aluminum Pond and higher elevations to the south (APA 2001).

The lake and watershed occur almost exclusively within the Blue Ridge Wilderness (NYSDEC 2005). Historic Camp Sagamore is a 7 ha private in-holding at the outlet. This private land is classified as Resource Management. Camp Sagamore was built in 1897 by W.W. Durant for his personal use, later owned by the Vanderbilt family and is currently owned and operated by the Sagamore Institute of the Adirondacks, Inc (Sagamore Institute of the Adirondacks, Inc. 2009). A gravel road leads to a complex of buildings on the Sagamore property on the southeast corner of the lake. A hiking trail circumnavigates the lake.

Watershed disturbance: The 1916 fire protection source data shows the watershed as 100% green timber with no slash**.** The November 1950 storm source data shows 33% of the watershed was severely disturbed (50-100% blowdown) in the northern portion of the watershed. Less than 1% of the watershed was moderately disturbed with 25-50% blowdown occurring in the southwestern corner. The July 1995 microburst storm source data shows 24% of the watershed, in the same northern portion, had low levels (0-30% change in crowns) of disturbance. The remaining portion of the watershed was outside the study area (APA 2001). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1985 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns, D. A., McHale, M. R., Driscoll, C. T., and Roy, K. M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Dittman, J. A. and Driscoll, C. T. 2009. Factors influencing changes in mercury concentrations in lake water and yellow perch (*Perca flavescens*) in Adirondack lakes. Biogeochemistry 93: 179-196.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen, B., Lawrence, G. B., Nierzwicki-Bauer, S. A., Sutherland, J. W., Eichler, L. W., Harrison, J. P., and Boylen, C. W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

New York State Department of Environmental Conservation (NYSDEC) 2005. Blue Ridge Wilderness and Wakely Mountain Primitive Area Draft Unit Management Plan, Ray Brook, NY.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Sagamore Institute of the Adirondacks, Inc. 2009. Great Camp Sagamore. http://www.greatcampsagamore.org/.

Schofield, C. L., Galloway, J. N., and Hendrey, G. R. 1985. Surface Water Chemistry in the ILWAS Basins. Water, Air, & Soil Pollution 26: 403-423.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T. J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Sullivan, T. J., McMartin, B., and Charles, D. F. 1996. Re-examination of the role of landscape change in the acidification of lakes in the Adirondack Mountains, New York. The Science of the Total Environment 183: 231-248.

Raquette Lake Reservoir 060315A

Lat. 43° 47’ 42’’ N Long. 074° 39’ 05’’ W

Lake: Raquette Lake Reservoir lies in the Raquette River watershed at 564 m. This small 1.5 ha headwater lake has one major inlet at its southern end (Figure 1). A concrete dam forms the outlet that flows into Raquette Lake about 1.7 km downstream. The lake reaches a maximum depth of 3.0 m near the outlet (Figure 2).

Raquette Lake Reservoir is classified as a medium till drainage lake, with high dissolved organic carbon. The lake is considered moderately sensitive to acidification. The ALTM program began monthly monitoring the lake at the outlet in June 1992. In addition, weekly sampling during snowmelt has been ongoing since 1998.

Lake chemistry: Raquette Lake Reservoir was sampled during the ALS on 11 Jul 1985 finding: Lab pH 6.61, ANC 66.8 µeq L^{-1}, SO_4^{2-} 153.44 µeq L^{-1}, NO_3^- 0.32 µeq L^{-1}, Ca^{2+} 136.24 µeq L^{-1}, Mg^{2+} 51.84 µeq L^{-1}, DOC 7.1 mg L^{-1} -C (ALSC 1986). Table 1 summarizes recent water chemistry at the outlet. Monthly plots of the major analytes are show in Figure 3.

Aquatic biota: On 10 Oct 1985, the ALS found submergent vegetation covered 10% of the lake bottom, while emergent and floating plants occupied 4% and 1% of the lake surface, respectively.
Aquatic plants identified were: Sparganium spp.; Potamogeton spp.; Nuphar spp.; Carex spp.; Equisetum spp.; Juncus spp.; Iris spp.; Sphagnum spp.; Fontinalis spp.; Isoetes spp.; Scirpus spp.; and several Algae.
A dip-net survey on that date found the following Insecta: Odonata Coenagriidae; Ephemeroptera Leptophlebiidae; and Megaloptera Sialidae. The lake was thermally stratified between 1.5 and 2.0 m on 11 Jul 1985 (ALSC 1986). The AEAP reported an average value of chlorophyll a of 10.3 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Fisheries: NYSDEC annually stocked the lake with brook trout from 1957 to 1963. This lake is considered Natural Spawning Adequate for brook trout (NYSDEC 2006). Refer to Table 3 for recent netting history.

Intensive studies: Raquette Lake Reservoir has been studied by the AEAP (Momen, B. et al.2006). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Figure 1. Catchment

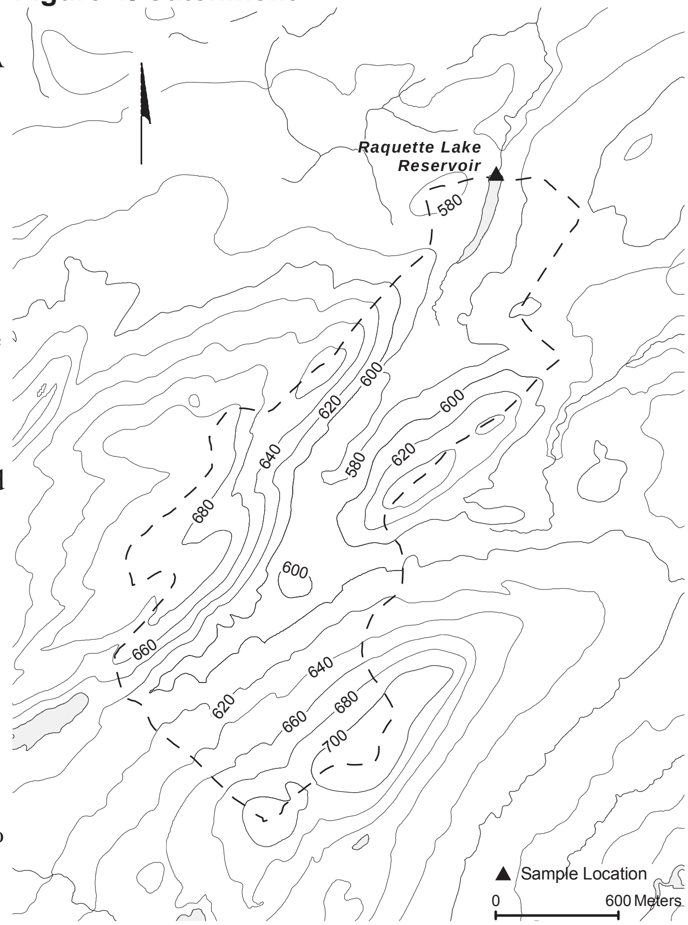
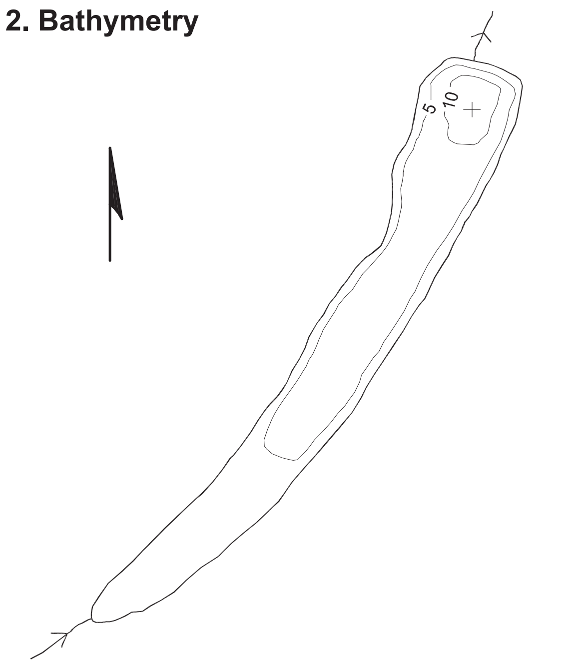


Figure 2. Bathymetry



Maximum Depth (+): 10 ft
Source: NYSDEC, ALSC Rev. 1985

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 16 km west at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 30 km southwest at Nick's Lake.

Watershed: The Raquette Lake Reservoir watershed lies primarily on inter-layered meta-sedimentary rock and granitic gneiss. Undivided metasedimentary rock and related migmatite found in a band near the outlet of the lake underlie 2% of the watershed. Till overlays 65% of the watershed, while exposed bedrock is primarily found above 650 m. A small area, 1% of the watershed near the outlet, is outwash sand and gravel. Basal till overlays 54% of the watershed area and encompases 100% of the immediate shoreline of the lake. Becket, Tunbridge and Rawsonville soils predominate (APA 2001). The maximum elevation in the watershed is 717 m and the maximum relief is 153 m. The ALS described the shoal water substrate around the lake as: 50% sand/gravel, 40% bedrock/boulder and rubble, and 10% muck/silt (ALSC 1986).

Land cover/use: In 1985 the ALS described the watershed as: 50% coniferous forest, 45% deciduous forest, 3% wetland and 2% shrub/sapling mixed vegetation. The immediate shoreline was fringed with 70% coniferous forest, 20% deciduous forest, 5% shrub/sapling, and 5% wetland/open grass vegetation (ALSC 1986). Total wetland area is 13.2 ha and comprises 4.3% of the watershed. The predominant wetland vegetation types are: scrub-shrub broad-leaf deciduous (5.6 ha) in association with the major inlet in the south. Forested needle-leaf evergreen (7.5 ha) is found in patches in the upland areas associated with scrub-shrub wetland (APA 2001).

Table 1. Lake Chemistry

060315A			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	104.93	164.06	141.37	47.38	116.37	79.34	µeq L^{-1}
NO_3^-	2.26	34.94	16.33	0.00	32.98	9.19	µeq L^{-1}
Cl^-	7.62	13.82	10.60	5.81	13.79	8.74	µeq L^{-1}
F^-	3.21	4.63	3.81	2.42	3.63	3.24	µeq L^{-1}
ANC	-21.54	62.36	23.61	3.72	61.58	27.96	µeq L^{-1}
DIC	49.95	179.83	98.31	72.43	267.25	136.62	µmol L^{-1} -C
DOC	311.71	995.16	593.09	411.20	980.80	683.57	µmol L^{-1} -C
SiO_2	92.70	174.59	123.98	56.42	168.09	106.60	µmol L^{-1}
Ca^{2+}	101.80	157.69	122.43	69.37	91.82	82.59	µeq L^{-1}
Mg^{2+}	34.56	55.13	44.30	23.04	37.85	31.03	µeq L^{-1}
Na^+	19.57	44.80	31.90	20.01	37.84	29.84	µeq L^{-1}
K^+	6.39	11.51	8.23	2.56	12.37	6.99	µeq L^{-1}
NH_4^+	-1.39	2.33	0.50	-0.84	2.77	0.54	µeq L^{-1}
AL_TD	8.04	17.35	13.77	9.30	15.42	12.29	µmol L^{-1}
AL_TM	3.20	13.71	8.39	4.89	8.36	6.44	µmol L^{-1}
AL_OM	0.87	9.04	5.06	2.82	8.63	4.73	µmol L^{-1}
AL_IM	0.00	7.20	3.35	0.00	2.96	1.73	µmol L^{-1}
LABPH	4.64	6.24	5.20	5.03	5.85	5.39	
AIREQPH	4.57	6.70	5.22	5.06	6.38	5.60	
TRUECOLOR	30	90	48	40	200	94	Pt Co
SCONDUCT	23.77	32.94	27.31	16.58	23.18	19.56	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	564 m
Maximum depth	3.0 m
Mean depth	1.6 m
Volume	2.4×10^4 m^3
Surface area	1.5 ha
Watershed area	305.5 ha
Watershed ratio	0.01
Hydraulic retention time (year)	0.01
Watershed	Raquette
County, Town	Hamilton, Long Lake
USGS Quadrangle	Raquette Lake
Land use classification	Moose River Plains Wild Forest

Figure 3. Chemistry Time Series

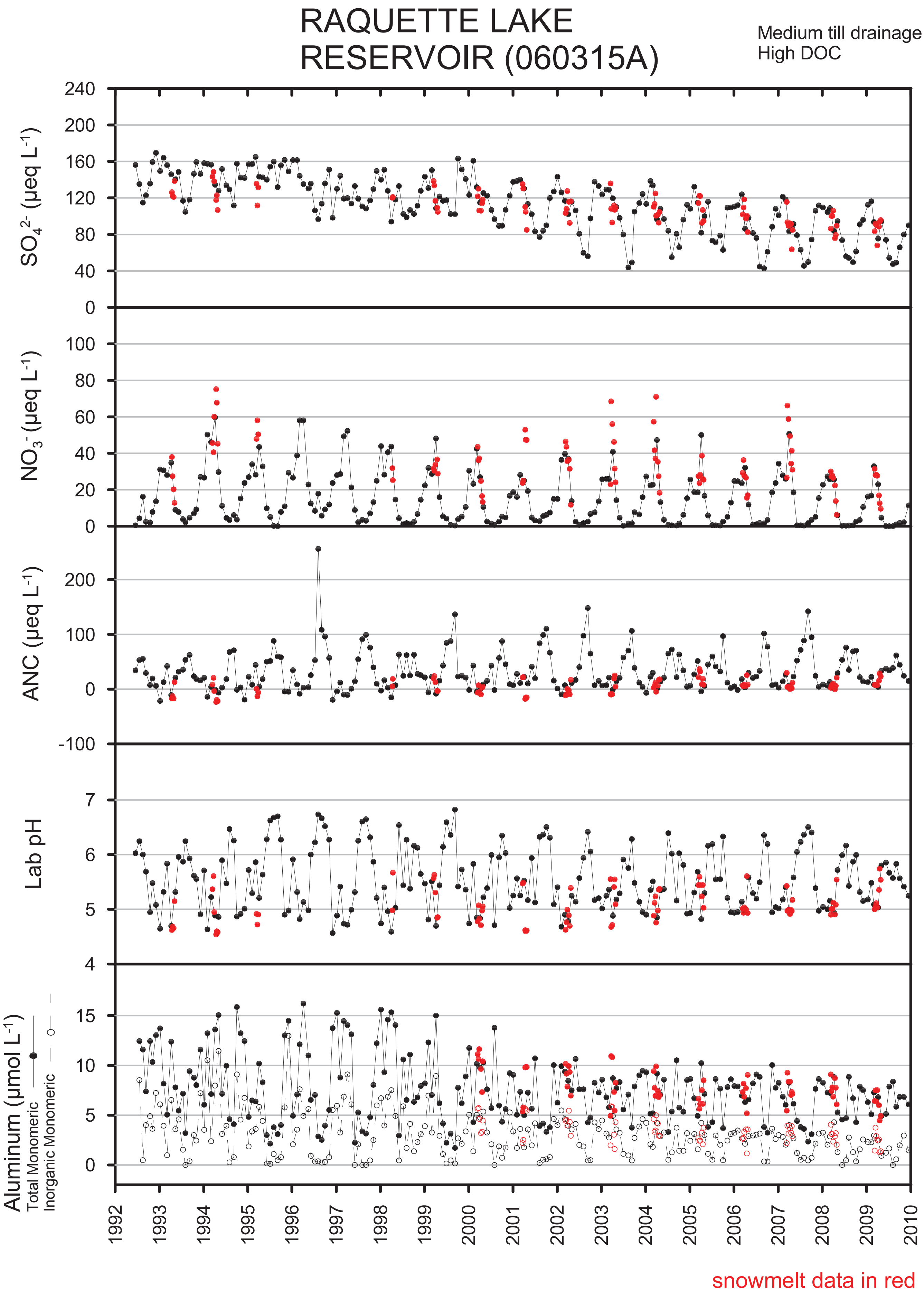


Table 3. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-01	Brook trout	22	154	285	2517	22
June-01	Brown bullhead	25	67	149	302	140
October-85	Brook trout	15	97	404	3543	17
October-85	Brown bullhead	16	71	206	858	21

The Raquette Lake Reservoir was created in 1931 by the construction of a 13-foot concrete dam in the course of an unnamed tributary to Raquette Lake. The lake served as a potable water source for the village of Raquette Lake until 2005. A gated road leads to the lake from the east. The watershed lies entirely within the Moose River Plains Wild Forest (NYSDEC 2006).

Watershed disturbance: The 1916 fire protection source data shows 100% of the watershed as virgin and second growth green timber with no slash. The November 1950 storm severely damaged 48% of the watershed with 50-100% blowdown, and moderately damaged 44% of the watershed with 25-50% blowdown. The July 1995 microburst storm affected 100% of the watershed with low (0-30% change in crowns) damage (APA 2001). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1986. Adirondack Lakes Survey 1985 Field Studies Report Volumes 6-10. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Lakes Survey Corporation (ALSC) 1985. Adirondack Lakes Survey 1984 Field Studies Report Volumes 1-5. Adirondack Lakes Survey Corporation, Ray Brook, NY.

McNeil, B. E., Read, J. M., and Driscoll, C. T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen, B., Lawrence, G. B., Nierzwicki-Bauer, S. A., Sutherland, J. W., Eichler, L. W., Harrison, J. P., and Boylen, C. W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

New York State Department of Environmental Conservation 2006. Moose River Plains Wild Forest Proposed Final Unit Management Plan, Lowville, NY.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T. J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Queer Lake 060329

Lat. 43° 48’ 49’’ N Long. 074° 46’ 38’’ W

Lake: Queer Lake lies in the Raquette River watershed on the Oswegatchie-Black River watershed divide at 597 m. The main tributary derives flow from an unnamed pond (060330) approximately 1500 m upstream (Figure 1). A number of intermittent streams occur along the shoreline of this 54.5 ha lake. In 1986, the ALS reported an inactive beaver dam at the main lake outlet. They noted a second wide intermittent outlet with immeasurable flow into the Oswegatchie-Black River watershed on May 21 (ALSC 1987). The primary lake outlet flows into Sucker Brook approximately 300 m downstream. The lake reaches a maximum depth of 21.3 m (Figure 2).

Queer Lake is classified as a thin till chain drainage lake, with low dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. This lake is accessed by helicopter.

Lake chemistry: Queer Lake was sampled during the ALS on 08 Jul 1986 finding: Lab pH 5.47, ANC 1.9 µeq L^{-1}, SO_4^{2-} 122.63 µeq L^{-1}, NO_3^- 3.24 µeq L^{-1}, Ca^{2+} 92.32 µeq L^{-1}, Mg^{2+} 27.16 µeq L^{-1}, DOC 2.3 mg L^{-1}-C (ALSC 1987). Table 1 summarizes recent water chemistry. Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: On 21 May 1986, the ALS found submergent vegetation covered 1% of the lake bottom. Aquatic plants identified were: Eriocaulon spp., Utricularia spp. and numerous Algae. A dip-net survey on that date found the following Insecta: Odonata Libellulidae; Ephemeroptera Leptophlebiidae; Trichoptera Limnephilidae; Coleoptera Dytiscidae; Diptera Chironomidae; Hemiptera Corixidae and Gerridae. Also found were Crustacea: Amphipoda Unspecified and Decapoda Astacidae; as well as Demospong Haplosclerina Spongillidae. The lake was thermally stratified between 6 and 8 m on 08 Jul 1986 (ALSC 1987). The AEAP reported an average value of chlorophyll a of 0.81 µg L^{-1} in 2003 (Momen, B. et al. 2006).

Figure 1. Catchment

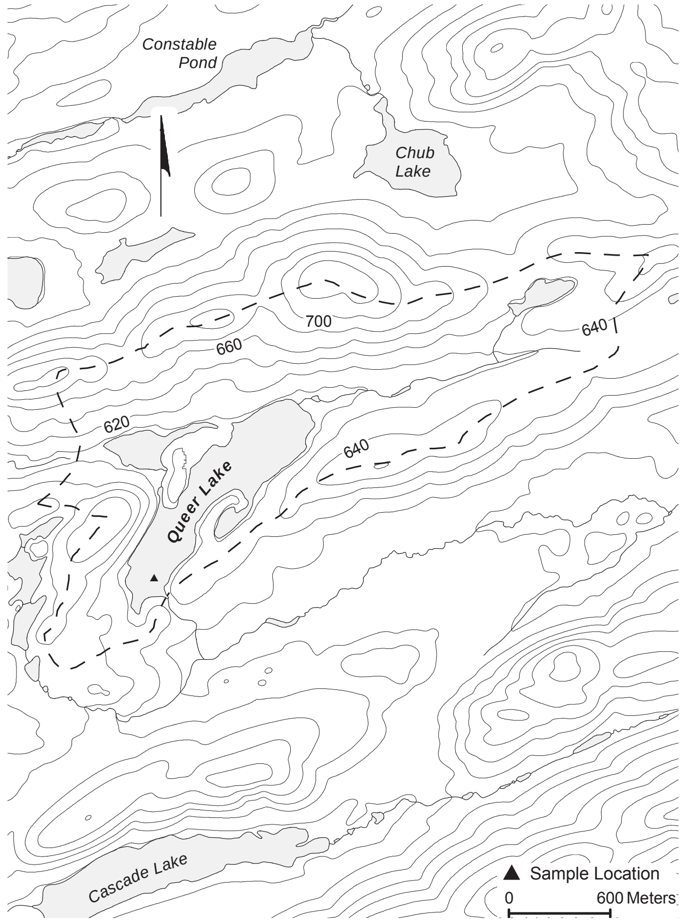
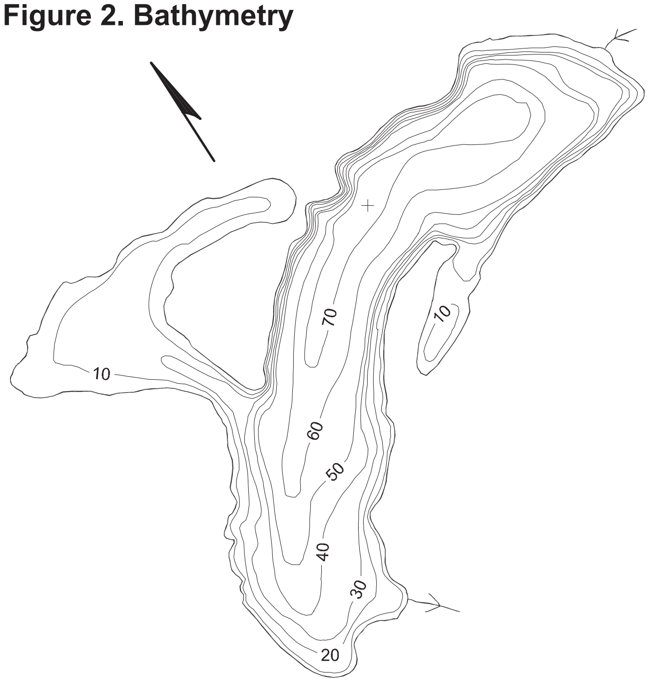


Figure 2. Bathymetry



Maximum Depth (+): 70 ft
Source: NYSDEC, ALSC Rec'd c.1984

1600'

Fisheries: NYSDEC manages the lake as a coldwater fishery (NYSDEC 1992) and stocked the lake with brook trout each year from 1942 to 1975 (ALSC 1987). Stocking resumed in 1996. Refer to Tables 3 & 4 for recent fish stocking and netting histories.

Intensive studies: Diatom stratigraphies were developed from sediment cores in the late 1980s (Charles, D. F. et al. 1990). Historical rates of mercury deposition were analyzed using sediment cores from 1982-1983 (Lorey, P. and Driscoll, C. T. 1999) and again in 1998 (Raynal, D. J. et al. 2004). Landscape characteristics and disturbance history have been evaluated within this watershed (Sullivan, T. J. et al. 1999). The lake has been studied by the AEAP (Momen, B. et al 2006). Ito et al. 2006 evaluated nitrogen deposition, export and the capacity for lake watersheds to remove, store or release nitrogen in this lake by estimating annual nitrogen input-output budgets during 1998 – 2000 (Ito, M. et al. 2006). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Deposition: The nearest NADP deposition monitoring site is 4 km southwest at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 20 km southwest at Nick's Lake.

Watershed: The lake and watershed lie on interlayered metasedimentary rock and granitic gneiss. Till overlies 89% of the watershed with the remaining 11% exposed bedrock found generally at elevations above 800 m. Basal till is found around the northwestern end of the lake and Tunbridge soils overlay the remaining area (APA 2001). The maximum elevation is 711 m. The maximum relief is 114 m. In 1986, the ALS reported the shoal water substrate around the lake comprised of 55% bedrock/ boulder/rubble, 35% sand/gravel and 10% muck/silt (ALSC 1987).

Land cover/use: In 1986 the ALS described the watershed as: 90% deciduous-conifer mixed forest, 5% deciduous, and 5% coniferous forest. The immediate lake shoreline was 78% deciduous/conifer mix, 20% coniferous forest and 2% boulder rock ledge (ALSC 1987). Total wetland area is 12 ha and comprises 3% of

Table 1. Lake Chemistry

060329			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	107.22	143.03	120.57	69.51	83.06	75.50	µeq L^{-1}
NO_3^-	12.40	48.06	20.33	4.25	11.79	7.68	µeq L^{-1}
Cl^-	7.05	13.26	8.96	6.30	8.39	7.07	µeq L^{-1}
F^-	3.05	5.26	3.89	3.13	3.78	3.28	µeq L^{-1}
ANC	-16.47	14.28	4.14	12.60	31.66	22.65	µeq L^{-1}
DIC	6.66	89.92	54.53	26.03	126.55	58.37	µmol L^{-1} -C
DOC	150.94	405.62	243.00	253.71	356.00	288.61	µmol L^{-1} -C
SiO_2	34.12	60.91	47.64	37.36	54.26	46.11	µmol L^{-1}
Ca^{2+}	75.85	130.25	94.73	74.85	83.34	77.30	µeq L^{-1}
Mg^{2+}	19.75	38.68	28.05	20.57	22.59	21.88	µeq L^{-1}
Na^+	13.05	22.62	17.25	16.09	20.01	17.82	µeq L^{-1}
K^+	6.91	13.04	8.55	5.12	7.16	6.06	µeq L^{-1}
NH_4^+	0.61	3.83	2.52	-0.21	2.61	1.10	µeq L^{-1}
AL_TD	2.71	19.57	7.37	1.32	6.82	3.98	µmol L^{-1}
AL_TM	2.24	16.59	5.96	1.66	3.60	2.35	µmol L^{-1}
AL_OM	0.33	3.97	1.67	1.72	2.82	2.08	µmol L^{-1}
AL_IM	1.52	12.65	4.29	0.00	1.59	0.32	µmol L^{-1}
LABPH	4.58	5.73	5.15	5.53	6.29	5.89	
AIREQPH	4.63	5.89	5.17	5.82	6.46	6.15	
TRUECOLOR	5	30	13	15	30	24	Pt Co
SCONDUCT	19.28	28.83	22.10	15.41	17.81	16.19	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	597 m
Maximum depth	21.3 m
Mean depth	10.9 m
Volume	596.0 x 10^4 m^3
Surface area	54.5 ha
Watershed area	375.4 ha
Watershed ratio	0.15
Hydraulic retention time (year)	2.1
Watershed	Raquette
County, Town	Hamilton, Long Lake
USGS Quadrangle	Eagle Bay
Land use classification	Pigeon Lake Wilderness

Figure 3. Chemistry Time Series

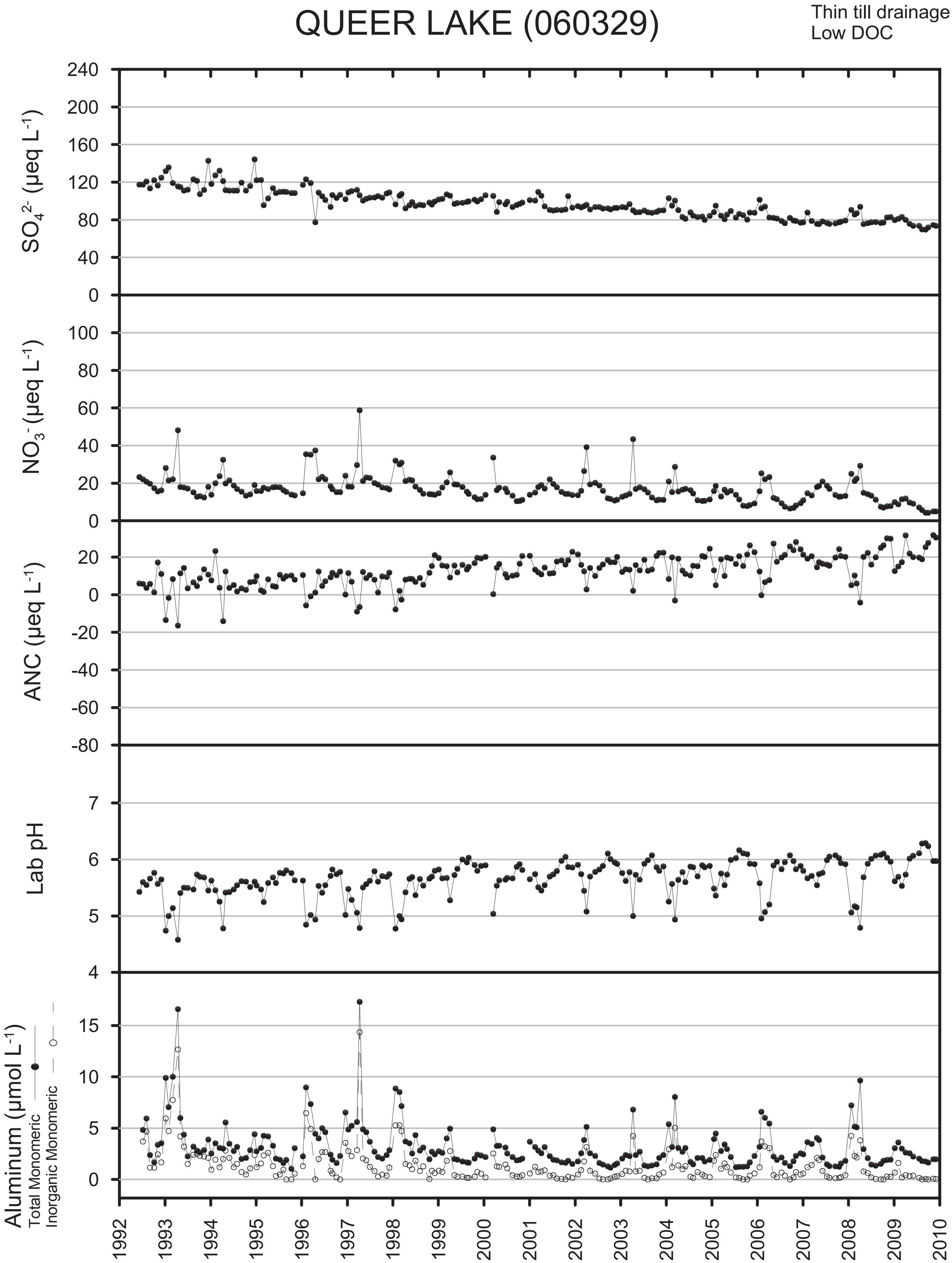


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1995	Brook trout	2050	62
1996	Brook trout	2200	96
1997	Brook trout	2310	77
1998	Brook trout	2310	66
1999	Brook trout	2200	32
2000	Brook trout	2200	28
2001	Brook trout	3960	39
2002	Brook trout	2200	52
2003	Brook trout	2200	52
2004	Brook trout	2200	52
2005	Brook trout	2200	52
2006	Brook trout	2420	39

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
June-99	Brook trout	20	160	362	3179	20
June-99	Lake trout	2	425	540	2200	2
June-99	Golden shiner	3	72	90	17	3
June-99	White sucker	4	485	510	5300	4
June-99	Brown bullhead	28	65	162	658	37
June-99	Banded killifish	11	58	97	57	12
June-99	Pumpkinseed	41	38	140	239	65
May-86	Brook trout	18	173	395	3880	18
May-86	Golden shiner	1	110	110	13	1
May-86	White sucker	2	480	530	2650	2
May-86	Brown bullhead	26	75	203	1077	217
May-86	Pumpkinseed	10	62	141	185	10

the watershed. The predominant wetland type is broad leaf deciduous scrub/shrub (APA 2001). The lake and watershed lie completely within the Pigeon Lakes Wilderness (NYSDEC 1992). A trail runs along the north shore of the lake. A lean-to and a number of primitive campsites are located along the shore.

Watershed disturbance: The 1916 fire protection source data show 100% of the watershed as green timber identified as virgin and second growth forest, with no slash (Roy, K. M. et al. 1997). The watershed map did not indicate any storm damage from the November 1950 blowdown. The entire watershed was damaged in a July 1995 microburst storm causing low damage (0-30% change) in the tree crowns (APA 2001). The watershed was not affected by a January 1998 ice storm (NYSDEC 1998).

References

Adirondack Lakes Survey Corporation (ALSC) 1987. Adirondack Lakes Survey 1986 Field Studies Report Volumes 11-15. Adirondack Lakes Survey Corporation, Ray Brook, NY.

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Charles,D.F., Binford,M.W., Furlong,E.T., Hites,R.A., Mitchell,M.J., Norton,S.A., Oldfield,F., Paterson,M.J., Smol,J.P., Uutala,A.J., White,J.R., Whitehead,D.R., and Wiese,R.J. 1990. Paleoecological investigation of recent lake acidification in the Adirondack Mountains, N.Y. Journal of Paleolimnology 3: 195-241.

Ito,M., Mitchell,M.J., Driscoll,C.T., and Roy,K. 2006. Nitrogen input-output budgets for lake-containing watersheds in the Adirondack region of New York. Biogeochemistry 72: 283-314.

Lorey,P. and Driscoll,C.T. 1999. Historical trends of mercury deposition in Adirondack Lakes. Environmental Science & Technology 33: 718-722.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

New York State Department of Environmental Conservation (NYSDEC) 1992. Pigeon Lake Wilderness Area Unit Management Plan. New York State Department of Environmental Conservation, Albany, NY.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Raynal, D. J., Mitchell, M. J., Driscoll, C. T., and Roy, K. M. 2004. Effects of Atmospheric Deposition of Sulfur, Nitrogen, and Mercury on Adirondack Ecosystems. New York State Energy Research and Development Authority No. Final 04-03.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Sullivan, T. J., Charles, D. F., Bernert, J. A., McMartin, B., Vaché, K. B., and Zehr, J. 1999. Relationship between landscape characteristics, history, and lakewater acidification in the Adirondack Mountains, New York. Water, Air, and Soil Pollution 112: 407-427.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan, T. J., Fernandez, I. J., Herlihy, A. T., Driscoll, C. T., McDonnell, T. C., Nowicki, N. A., Snyder, K. U., and Sutherland, J. W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

This page intentionally left blank.

Otter Lake 070729 & Otter Lake Stream 070728

Lat. 43° 10’ 52’’ N   Long. 074° 30’ 12’’ W

Lake: Otter Lake lies in the Mohawk River watershed at 505 m. The primary inlet is the outlet of Stewart Lake (070730) (Figure 1). The outlet of Otter Lake (070729) is free flowing and forms the primary inlet to a 4-ha impoundment called Fish Hatchery Pond, Otter Lake Outlet or Otter Lake Stream (070728). A concrete dam forms the outlet here that flows into Green Lake and ultimately to Canada Lake (Figure 1). The main Otter Lake has a surface area of 14.8 ha and a maximum depth of 4.0 m (Figure 2).

Otter Lake is a thin till chain drainage lake with low dissolved organic carbon. The lake is considered sensitive to acidification. Otter Lake Stream is one of the 17 original ALTM sites monitored on a monthly basis since June 1982 (Station 1, 070728). The ALTM began collecting a monthly sample at Otter Lake (Station 1, 070729) in July 1993.

Lake chemistry: Otter Lake was not sampled during the ALS, but was sampled as part of ELS (1A2-078) on 31 Oct 1984 finding: pH 5.06, ANC -2.0 µeq L^{-1}, SO_4^{2-} 137.5 µeq L^{-1}, NO_3^- 0.4 µeq L^{-1}, Ca 54.9 µeq L^{-1}, Mg 26.5 µeq L^{-1} (Kanciruk, P. et al. 1986). Table 1 summarizes recent ALTM samples collected at Otter Lake Stream (Station 1). Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: The ELS survey found the lake thermally mixed on 31 Oct 1984, a Secchi depth of 3.0 m and total phosphorus 9.0 µg L^{-1} (Kanciruk, P. et al. 1986).

Fisheries: NYSDEC has stocked the lake with brook trout. The ALTM has surveyed the lake. Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: Otter Lake Stream was studied by RILWAS in 1985 (Driscoll, C. T. and Newton, R. M. 1985). During 1986 and 1987, Schaefer and Driscoll (1993) evaluated snowmelt acidification in Otter Lake Stream. Otter Lake was a study watershed for the Adirondack/Catskill comparison in 1992-2001 (Burns, D. A. et al. 2006; Burns, D. A. et al. 2005). Detailed mercury deposition and cycling studies have been conducted within this watershed (Driscoll, C. T. et al. 1994; Driscoll, C. T. et al. 1995).

Figure 1. Catchment

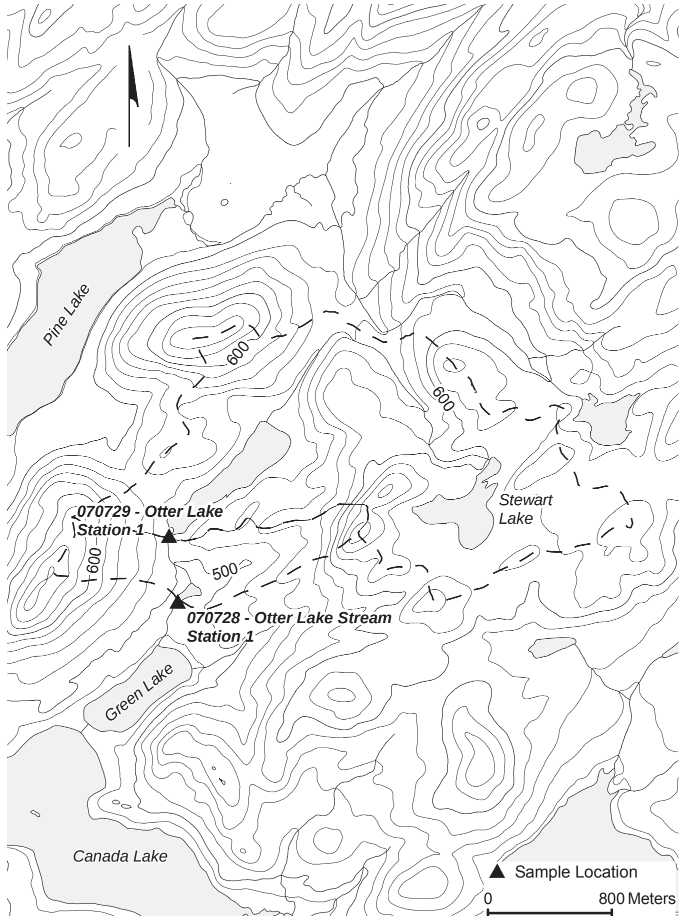
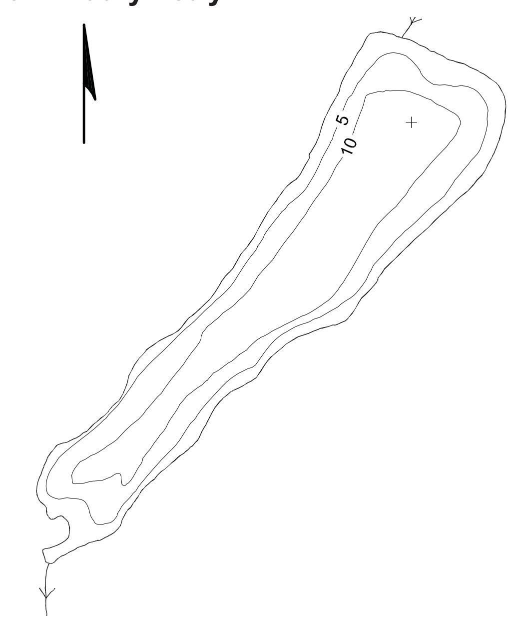


Figure 2. Bathymetry



Maximum Depth (+): 13 ft
Source: NYSDEC, ALSC Rev. 1984

1000'

Deposition: The nearest NADP deposition monitoring site is 73 km northwest at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 29 km north at Piseco Lake.

Watershed: The Otter Lake Stream watershed lies on crystalline silicate rock with 45% of the areas as quartz-feldspar paragneiss, 28% biotite-quartz-plagioclase paragneiss, 26% pyroxene-hornblende-quartz-plagioclase gneiss and less than 1% quartzite, graphitic schist and quartz-biotite schist. Till overlies 100% of the watershed (APA 2001). The highest elevations in the watershed are Camel's Hump Mountain to the east, Pine Mountain to the north, and Kane Mountain to the west. The maximum watershed elevation is 617 m at Kane Mountain. The maximum relief of the watershed is 112 m.

Land cover/use: Total wetland area within the Otter Lake watershed is 9 ha comprising 2% of the watershed. The total open water component is 30 ha. The predominant wetland type is emergent marsh. A small 1.0 ha wetland is contiguous with the shore line of Otter Lake at its northern end (APA 2001).

Otter Lake and its watershed lie almost entirely within the Shaker Mountain Wild Forest. There is a private 30 ha in-holding located between the outlet of the lake (070729) and the inlet of Otter Lake Outlet (070728). This private land is classified as Resource Management by the Adirondack Park Agency Land Use and Development Plan. A seasonal cabin and an outbuilding are located adjacent to the outlet of Otter Lake (070729). There is a seasonal gravel road along the western shoreline of Otter Lake Outlet that terminates at a small private parking area. A foot path crosses the outlet stream, via a wooden foot bridge, and follows the eastern side of the outlet up to Otter Lake.

Table 1. Lake/Stream Chemistry 070728 (Station 1)

070728			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	106.60	137.62	121.52	69.15	97.29	82.09	µeq L^{-1}
NO_3^-	-0.27	37.57	12.65	0.44	22.79	6.81	µeq L^{-1}
Cl^-	5.36	11.00	8.74	7.04	12.25	8.70	µeq L^{-1}
F^-	1.79	3.00	2.42	1.93	4.02	2.40	µeq L^{-1}
ANC	-7.49	15.73	5.18	5.23	35.02	19.29	µeq L^{-1}
DIC	33.30	86.59	60.36	42.46	77.94	58.79	µmol L^{-1} -C
DOC	120.72	316.71	178.96	134.29	277.43	213.33	µmol L^{-1} -C
SiO_2	12.15	87.04	56.57	33.06	82.05	62.79	µmol L^{-1}
Ca^{2+}	61.38	90.82	77.06	50.40	66.37	60.78	µeq L^{-1}
Mg^{2+}	25.51	36.21	31.20	19.75	27.16	24.20	µeq L^{-1}
Na^+	20.44	30.88	26.03	20.01	30.88	25.65	µeq L^{-1}
K^+	1.53	6.14	4.71	3.33	5.63	4.31	µeq L^{-1}
NH_4^+	-0.72	1.83	0.37	-0.38	1.79	0.46	µeq L^{-1}
AL_TD	2.19	17.20	7.87	1.66	10.60	5.12	µmol L^{-1}
AL_TM	1.23	12.90	6.00	1.73	5.23	2.88	µmol L^{-1}
AL_OM	0.63	4.15	1.68	1.63	2.74	2.12	µmol L^{-1}
AL_IM	0.55	10.56	4.32	0.00	2.48	0.78	µmol L^{-1}
LABPH	4.90	5.88	5.28	5.22	6.19	5.61	
AIREQPH	4.86	6.22	5.32	5.16	6.57	5.70	
TRUECOLOR	5	15	11	15	25	21	Pt Co
SCONDUCT	17.34	25.98	20.62	14.45	20.06	16.17	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	505 m
Maximum depth	4.0 m
Mean depth	2.3
Volume	34.1 x 10^4 m^3
Surface area	14.8 ha
Watershed area	340.8 ha
Watershed ratio	0.04
Hydraulic retention time (year)	0.14
Watershed	Mohawk
County, Town	Fulton, Caroga
USGS Quadrangle	Canada Lake
Land use classification	Shaker Mountain Wild Forest

Figure 3. Chemistry Time Series

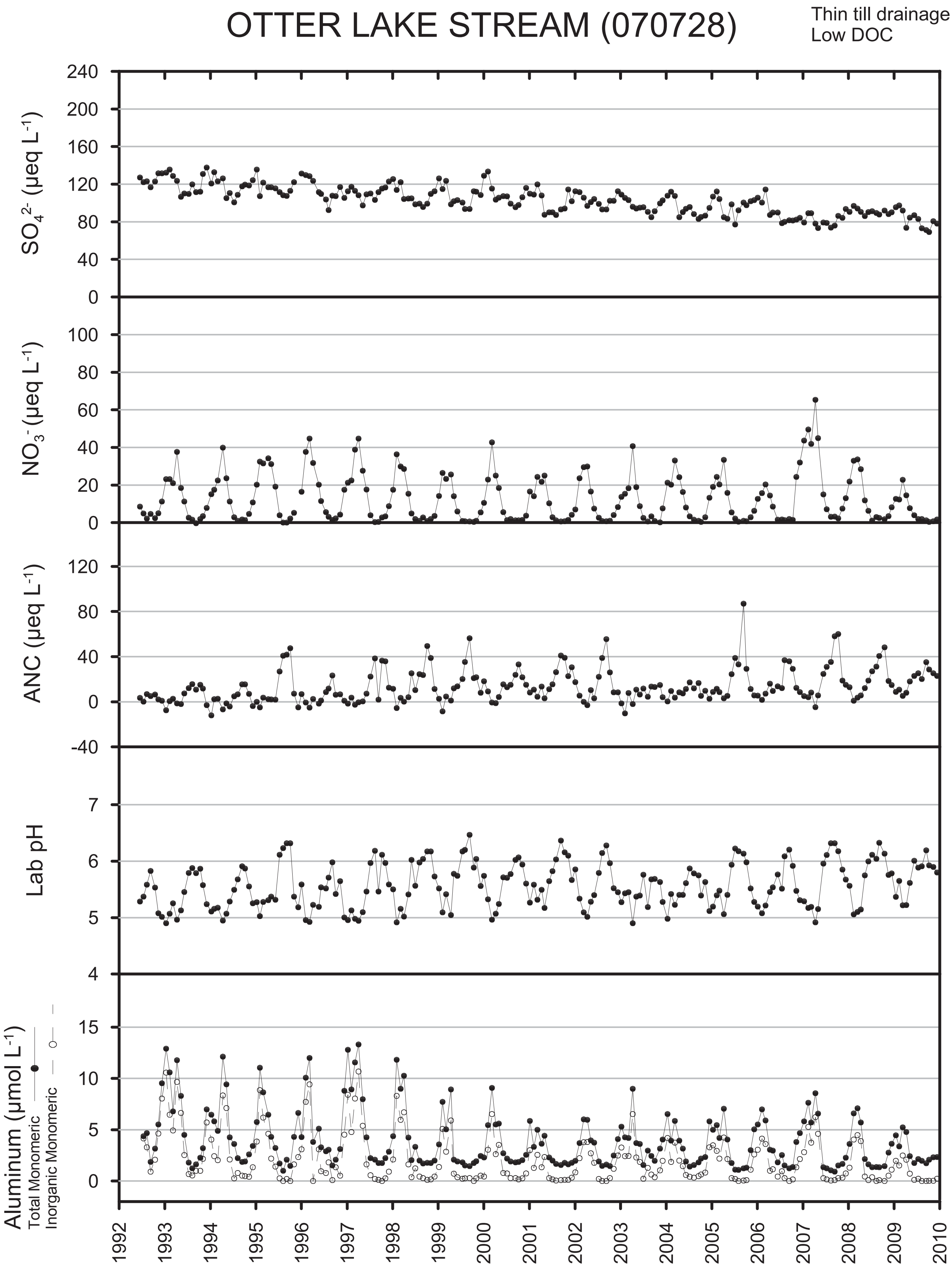


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	475	5
1996	Brook trout	1800	75
1997	Brook trout	1890	137
1998	Brook trout	1890	63
1999	Brook trout	1800	23

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams	Total Number
July-99	Brown bullhead	7	73	204	-	7

Watershed disturbance: The 1916 fire protection source data show 22% of the Otter Lake Stream watershed logged for both softwood and hardwood with much slash left on the ground. The remaining watershed was green timber identified as virgin and second growth forest. The watershed was not affected by the November 1950 blowdown and July 1995 microburst storms (APA 2001). The watershed was not affected by the January 1998 ice storm (NYSDEC 1998).

References

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

Burns, D. A., Driscoll, C. T., Lovett, G. M., McHale, M. R., Mitchell, M. J., Weathers, K., and Roy, K. M. 2005. An assessment of recovery and key processes affecting the response of surface waters to reduced levels of acid precipitation in the Adirondack and Catskill Mountains. New York State Energy Research and Development Authority No. 05-03.

Burns,D.A., McHale,M.R., Driscoll,C.T., and Roy,K.M. 2006. Response of surface water chemistry to reduced levels of acid precipitation: comparison of trends in two regions of New York, USA. Hydrological Processes 20: 1611-1627.

Driscoll,C.T., Blette,V., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1995. The role of dissolved organic carbon in the chemistry and bioavailability of mercury in remote Adirondack lakes. Water, Air, and Soil Pollution 80: 499-508.

Driscoll,C.T. and Newton,R.M. 1985. Chemical characteristics of Adirondack lakes. Environmental Science & Technology 19: 1018-1024.

Driscoll,C.T., Yan,C., Schofield,C.L., Munson,R., and Holsapple,J. 1994. The mercury cycle and fish in the Adirondack lakes. Environmental Science & Technology 28: 136A-143A.

Kanciruk, P., Eilers, J. M., McCord, R. A., Landers, D. H., Brakke, D. F., and Linthurst, R. A. 1986. Characteristics of Lakes in the Eastern United States: Volume III. Data Compendium of Site Characteristics and Chemical Variables. U.S. Environmental Protection Agency No. EPA/600/4-86/007c.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Schaefer,D.A. and Driscoll,C.T. 1993. Identifying sources of snowmelt acidification with a watershed mixing model. Water, Air, and Soil Pollution 67: 345-365.

G Lake 070859

Lat. 43° 25’ 05’’ N Long. 074° 38’ 10’’ W

Lake: G Lake lies in the Mohawk River watershed at 620 m. The 32.2 ha headwater lake has one major tributary (Figure 1). A man-made concrete dam was constructed at the outlet in 1950, but has since fallen into disrepair (NYSDEC 2006). The outlet flows north approximately 2 km where it meets the South Branch of West Canada Creek. The maximum depth of the lake is 9.8 m (Figure 2).

G Lake is classified as a thin till drainage lake, with low dissolved organic carbon. The lake is considered sensitive to acidification. The ALTM program began monitoring the lake in June 1992. This lake is accessed by helicopter. Snow core samples have been collected monthly in the watershed (Figure 1) since January 1999.

Lake chemistry: G Lake was not surveyed during the ALS nor during the ELS. A summary of recent ALTM chemistry is provided in Table 1.Monthly plots of the major analytes are shown in Figure 3.

Aquatic biota: In 2003, the AEAP reported the average value of chlorophyll a was 0.92 µg L^{-1} (Momen, B. et al. 2006).

Fisheries: NYSDEC stocks and manages the lake for brook trout. The ALTM has surveyed the lake. Refer to Tables 3 and 4 for recent fish stocking and netting histories.

Intensive studies: G Lake has been studied by the Adirondack Effects Assessment Program (Momen, B. et al. 2006). This lake was part of the Adirondack Cooperative Loon Project in 2003-2004 (Schoch, N. et al. 2004). During 1999 and 2000, mass-balance studies at three ALTM lakes (Grass, Constable and G) included the installation of snow core plots in these watersheds (Figure 1). McNeil and others (2007) conducted a regional survey of foliar nitrogen during July/August 2003 that included study plots in this watershed.

Soils: A soil reference plot was established in this watershed in 2003 (Sullivan, T. J. et al. 2006a; Sullivan, T. J. et al. 2006b).

Figure 1. Catchment

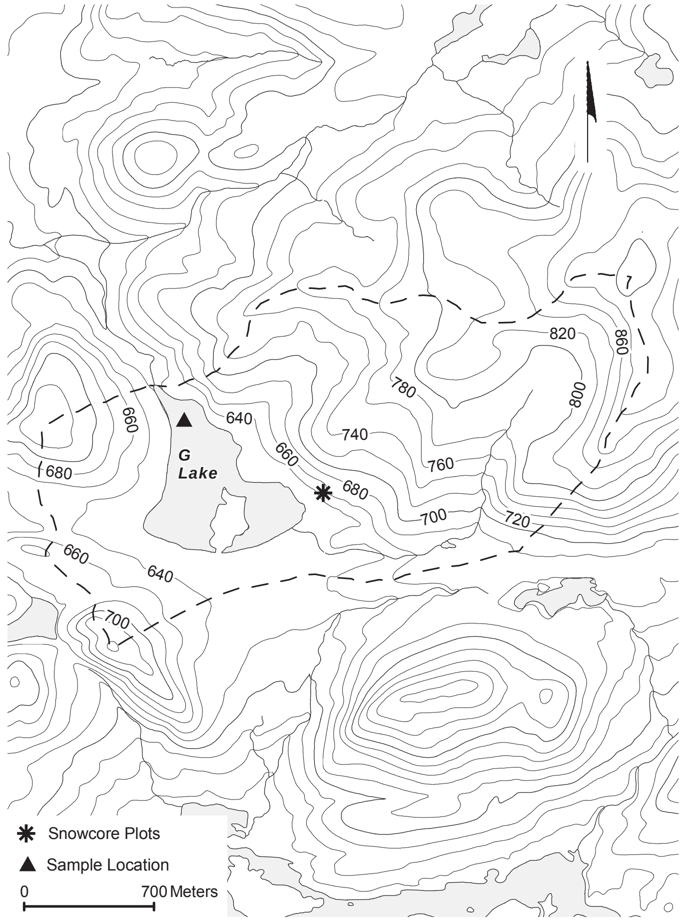
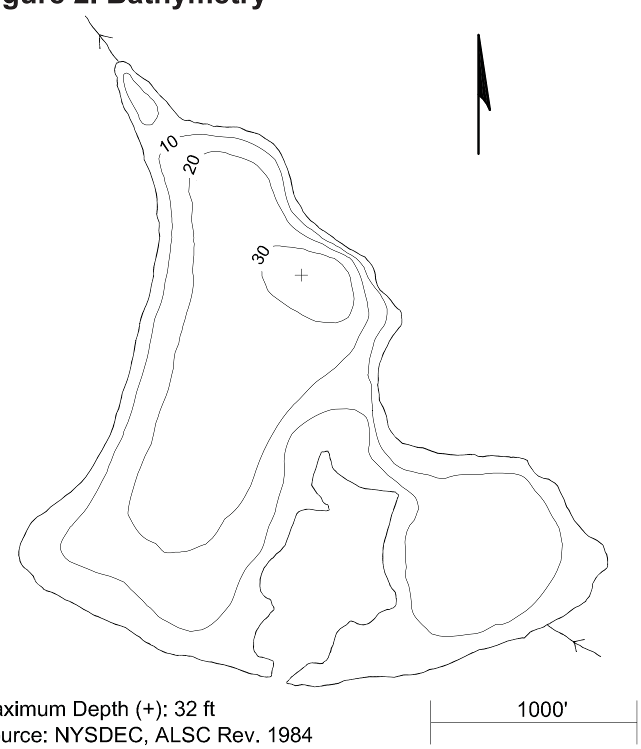


Figure 2. Bathymetry



Deposition: The nearest NADP deposition monitoring site is 45 km northwest at Moss Lake. The nearest NYSDEC wet deposition monitoring site is 10 km east at Piseco Lake.

Watershed: The G Lake watershed lies primarily on biotite and/or hornblende granitic gneiss with low to no ANC (Roy, K. M. et al. 1997). A small area in the eastern part of the watershed is underlain by charnockite, mangerite, and pyroxene-quartz syenite gneiss. Basal till (Becket soicomprises 60% of the watershed while 29% of the watershed is made up of Rawsonville soils (APA 2001). The highest elevation in the watershed is 913 m and the maximum relief is 293 m.

Land cover/use: The southern shore is fringed with a scrub shrub wetland dominated by sweet gale and leatherleaf. The peninsula is coniferous forest. The northern shore on both sides of the outlet is dominated with boulders and fringed with scrub/shrub wetlands giving way to coniferous forest (ALSC 1994). No wetlands data are currently available.

The lake is located completely within the Ferris Lake Wild Forest. There is a network of old roads around the lake and several primitive campsites on the shore (NYSDEC 2006).

Table 1. Lake Chemistry

070859			1993			2009	
Parameter	Min	Max	Avg	Min	Max	Avg.	Units
SO_4^{2-}	85.36	167.60	100.84	51.79	77.98	61.21	µeq L^{-1}
NO_3^-	-0.27	52.90	16.77	0.00	33.28	7.77	µeq L^{-1}
Cl^-	5.64	10.72	7.99	4.67	8.59	5.76	µeq L^{-1}
F^-	1.79	2.79	2.23	1.69	2.06	1.94	µeq L^{-1}
ANC	-18.40	14.33	1.73	-4.13	24.95	13.90	µeq L^{-1}
DIC	13.32	129.05	56.75	24.98	185.66	60.00	µmol L^{-1} -C
DOC	148.53	303.63	241.61	206.56	292.40	254.80	µmol L^{-1} -C
SiO_2	38.78	72.73	53.24	42.65	96.86	57.94	µmol L^{-1}
Ca^{2+}	58.89	81.84	67.49	33.44	60.38	47.84	µeq L^{-1}
Mg^{2+}	16.46	27.16	23.52	12.34	27.98	19.32	µeq L^{-1}
Na^+	15.66	23.05	19.50	16.53	24.36	19.32	µeq L^{-1}
K^+	3.07	6.14	4.63	1.57	3.58	2.49	µeq L^{-1}
NH_4^+	-0.55	3.99	1.36	-1.03	1.00	-0.06	µeq L^{-1}
AL_TD	1.41	29.54	10.09	2.78	15.83	6.79	µmol L^{-1}
AL_TM	1.14	18.35	7.43	1.70	9.27	3.67	µmol L^{-1}
AL_OM	0.57	3.23	1.87	1.74	4.30	2.43	µmol L^{-1}
AL_IM	0.52	15.31	5.55	0.00	5.67	1.33	µmol L^{-1}
LABPH	4.58	5.99	5.12	4.83	6.12	5.40	
AIREQPH	4.64	6.25	5.14	4.82	6.26	5.45	
TRUECOLOR	10	20	14	15	25	21	Pt Co
SCONDUCT	14.78	26.55	18.96	11.48	20.52	13.62	µS cm^{-1}

Table 2. Lake Characteristics

Parameter	Value
Elevation	620 m
Maximum depth	9.8 m
Mean depth	4.5 m
Volume	143.7 x 10^4
Surface area	32.2 ha
Watershed area	409.6 ha
Watershed ratio	0.08
Hydraulic retention time (year)	0.39
Watershed	Mohawk
County, Town	Hamilton, Arietta
USGS Quadrangle	Piseco Lake
Land use classification	Ferris Lake Wild Forest

Figure 3. Chemistry Time Series

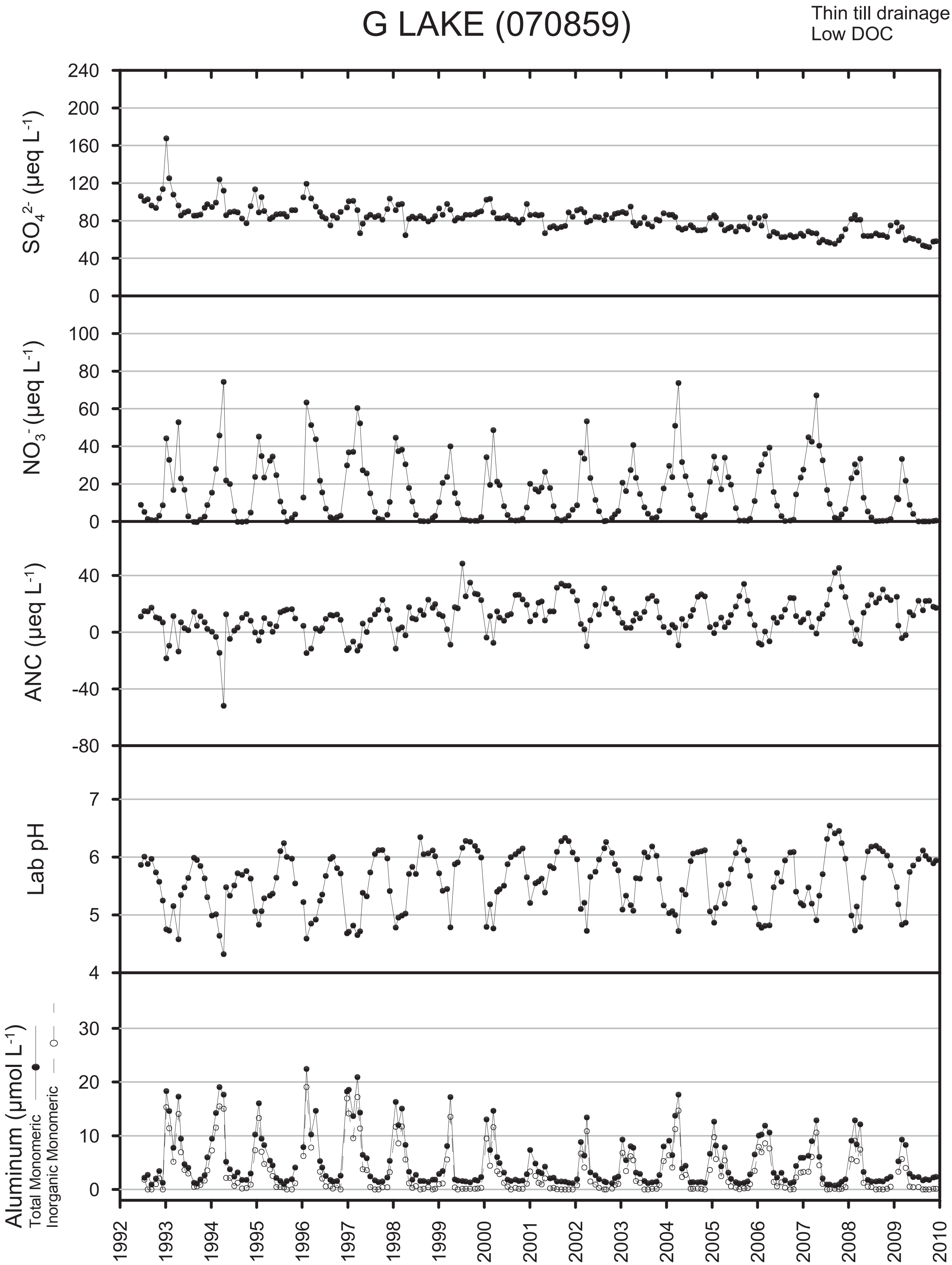


Table 3. Stocking History

Year Stocked	Species Stocked	Number Stocked	Total Weight Stocked (kg)
1980	Brook trout	1890	22
1981	Brook trout	1800	12
1982	Brook trout	1800	9
1983	Brook trout	1800	13
1984	Brook trout	1332	13
1985	Brook trout	1980	25
1986	Brook trout	1800	17
1987	Brook trout	1800	13
1988	Brook trout	1800	15
1989	Brook trout	1980	13
1990	Brook trout	1960	22
1991	Brook trout	1800	22
1992	Brook trout	1800	19
1993	Brook trout	1800	28
1994	Brook trout	1420	18
1995	Brook trout	1670	34
1996	Brook trout	1800	78
1997	Brook trout	1890	63
1998	Brook trout	1890	54
1999	Brook trout	1800	23
2000	Brook trout	1800	23
2001	Brook trout	1600	27
2002	Brook trout	1800	28
2003	Brook trout	1800	28
2004	Brook trout	1000	20
2004	Brown trout	800	18
2005	Brown trout	800	18
2005	Brook trout	1000	20
2006	Brook trout	1100	18
2006	Brown trout	800	28

Table 4. Netting History

Date Month-Year	Species	Number Measured	Length Min (mm)	Length Max (mm)	Weight Grams
June-94	Brook trout	24	172	526	5775
June-94	Golden shiner	35	66	164	354
June-94	Brown bullhead	29	59	185	1020

Watershed disturbance: The 1916 fire protection source data show 100% of the watershed as green timber of virgin and second growth with no slash. Source data from the November 1950 and July 1995 storms show no disturbance from these events (APA 2001). The watershed was not affected by the January 1998 ice storm (NYS DEC 1998).

References

Adirondack Park Agency (APA) 2001. Shared Adirondack Park Geographic Information CD-ROM. (Ver. 1.0). Adirondack Park Agency, Ray Brook, NY.

McNeil,B.E., Read,J.M., and Driscoll,C.T. 2007. Foliar nitrogen responses to elevated atmospheric nitrogen deposition in nine temperate forest canopy species. Environmental Science & Technology 41: 5191-5197.

Momen,B., Lawrence,G.B., Nierzwicki-Bauer,S.A., Sutherland,J.W., Eichler,L.W., Harrison,J.P., and Boylen,C.W. 2006. Trends in summer chemistry linked to productivity in lakes recovering from acid deposition in the Adirondack region of New York. Ecosystems 9: 1306-1317.

New York State Department of Environmental Conservation 2006. Ferris Lake Wild Forest Draft Unit Management Plan Draft Environmental Impact Statement. New York State Department of Environmental Conservation, Albany, NY.

NYSDEC 1998. Icing Zones. New York State Department of Environmental Conservation, Albany, NY.

Roy, K. M., Allen, E. B., Barge, J. W., Ross, J. A., Curran, R. P., Bogucki, D. J., Franzi, D. A., Kretser, W. A., Frank, M. M., Spada, D. M., and Banta, J. S. 1997. Influences on Wetlands and Lakes in the Adirondack Park of New York State: A Catalog of Existing and New GIS Data Layers for the 400,000-Hectare Oswegatchie/Black River Watershed. No. Adirondack Park Agency Final Report to U.S. Environmental Protection Agency, Ray Brook, NY.

Schoch, N., Evers, D., Simonin, H., Glennon, Michale, and Adams, David 2004. Long-Term Monitoring and Assessment of Mercury Based on Integrated Sampling Efforts Using the Common Loon, Prey Fish, Water, and Sediment. New York State Energy and Research Development Authority, Albany, NY.

Sullivan, T. J., Driscoll, C. T., Cosby, B. J., Fernandez, I. J., Herlihy, A. T., Zhai, J., Stemberger, R. S., Snyder, K. U., Sutherland, J. W., Nierzwicki-Bauer, S. A., Boylen, C. W., McDonnell, T. C., and Nowicki, N. A. 2006a. Assessment of the extent to which intensively-studied lakes are representative of the Adirondack Mountain region. New York State Energy Research and Development Authority No. 06-17.

Sullivan,T.J., Fernandez,I.J., Herlihy,A.T., Driscoll,C.T., McDonnell,T.C., Nowicki,N.A., Snyder,K.U., and Sutherland,J.W. 2006b. Acid-base characteristics of soils in the Adirondack Mountains, New York. Soil Science Society of America Journal 70: 141-152.

Adirondack Lakes Survey
www.adirondacklakessurvey.org

NYSERDA, a public benefit corporation, offers objective information and analysis, innovative programs, technical expertise and funding to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce their reliance on fossil fuels. NYSERDA professionals work to protect our environment and create clean-energy jobs. NYSERDA has been developing partnerships to advance innovative energy solutions in New York since 1975.

To learn more about NYSERDA programs and funding opportunities visit www.nyserda.org.

New York State
Energy Research and
Development Authority

17 Columbia Circle
Albany, New York 12203-6399

toll free: 1 (866) NYSERDA
local: (518) 862-1090
fax: (518) 862-1091

info@nyserda.org
www.nyserda.org

The Adirondack Long-Term Monitoring Lakes: A Compendium of Site Descriptions, Recent Chemistry and Selected Research Information

Final Report No. 11-12
August 2011