Part A: Synoptic Water Quality Investigation

Chapter 3: Purpose and Objectives

The purpose of Synoptic Water Quality Investigation is to systematically assess conventional limnological and water quality conditions in the 11 Finger Lakes. Specific objectives of this investigation include the following:

1. Assess current trophic status of the Finger Lakes and compare conditions between lakes;
2. Evaluate historical trends in trophic indicators for each of the Finger Lakes;
3. Assess current levels of major ions within the lakes and evaluate temporal trends;
4. Evaluate existing water quality conditions within the context of applicable regulatory criteria.

A second investigation, involving collection of sediment cores from each of the Finger Lakes to assess historical chemical patterns over time is presented in Part B.

Chapter 4: Design and Methods

This Investigation is composed of two components: (1) current synoptic investigation of the 11 lakes for conventional limnological parameters; and (2) review of findings from previous water quality studies within the Finger Lakes. The Synoptic Water Quality Investigation is designed to be conducted over a period of at least 5 years. It is felt that this is the minimum period of time necessary to accurately characterize this series of lakes, and to begin to assess water quality trends within this system of lakes.

The Synoptic Water Quality Investigation is composed of periodic sampling at a single deep water location on each of the 11 Finger Lakes during the growing season. The only exception to the single sample location per water body is for Cayuga Lake. Two additional sites have been established on the southern-shelf of Cayuga Lake to assess water quality concerns within this portion of the lake. Station locations and approximate water depths are provided in Table 4.1. Monitoring is conducted monthly during the growing season - in theory, May through October, however, in practice monitoring is frequently delayed until June. On these occasions, pre-stratification conditions may be missed for that particular year.

Table 4.1: Station locations and approximate water depths for Synoptic Water Quality Study

Lake	*Latitude*	*Longitude*	*Depth (m)*
Conesus	N 42° 45.645'	W 77° 42.839'	20
Hemlock	N 42° 44.102'	W 77° 36.873'	25
Canadice	N 42° 44.038'	W 77° 34.221'	25
Honeoye	N 42° 45.312'	W 77° 30.348'	8
Canandaigua	N 42° 45.973'	W 77° 19.058'	65
Keuka	N 42° 29.323	W 77° 09.297'	55
Seneca	N 42° 35.081'	W 76° 54.602'	70
Cayuga (deep)	N 42° 33.310'	W 76° 35.850'	50
Cayuga (shelf-W)	N 42° 28.070'	W 76° 31.120'	3
Cayuga (shelf-E)	N 42° 28.080'	W 76° 30.450'	5
Owasco	N 42° 50.670'	W 76° 30.960'	50
Skaneateles	N 42° 53.590'	W 76° 24.240'	60
Otisco	N 42° 52.040'	W 76° 17.570'	19

Field measurements include: (1) Secchi Disk depth; and (2) vertical water column profiles. Secchi Disk depth, a common measurement of water clarity, is measured using a 20 cm (~ 8 inch) diameter black and white disk. The Secchi disk is attached to a calibrated line and is slowly lowered into the water to the depth at which it disappears. The disk is then lifted until it reappears. An average of the two depths is then

recorded. Vertical water column profiles are taken with a Hydrolab® Surveyor IV probe, and parameters include temperature, dissolved oxygen, pH, and conductivity.

Water samples are collected from both the epilimnion and hypolimnion at each site. Sample depths are determined as follows: (1) epilimnetic samples are collected at the measured Secchi Disk depth; and (2) hypolimnion samples are collected at 2/3rd station depth. Exceptions to this procedure are during non-stratified conditions and/or at monitoring locations with depths less than 10 meters. In these instances, a single water column sample is collected from the Secchi Disk depth.

Sample parameters have varied during the investigation due to funding constraints, etc. However, basic analytes include total phosphorus, ammonia nitrogen, nitrate+nitrite nitrogen, total Kjeldahl nitrogen, total organic carbon, major ions and trace metals, reactive silica, chlorophyll *a* and alkalinity. Table 4.2 provides a summary of analytical methods, and Table 4.3 describes processing and preservation methods.

Table 4.2: Analytical procedures for sample parameters and field measurements

PARAMETERS	METHOD
Phosphorus (all forms)	APHA 4500-PF
Ammonia nitrogen	USEPA 350.1
Nitrate (+ nitrite) nitrogen	USEPA 353.2
Total nitrogen	USEPA 351.2
Total organic carbon	USEPA 415.2
Dissolved organic carbon	USEPA 415.2
Dissolved inorganic carbon	APHA 4500-CO_2
Chloride	APHA 4500-Cl^- E
Reactive silica	USEPA 370.1
Metals (Fe, Ca, Mg, Na, K)	USEPA 200.7
Alkalinity	USEPA 310.1
pH	Hydrolab (1991)
Dissolved oxygen, in situ	Hydrolab (1991)
Temperature, in situ	Hydrolab (1991)
Specific conductance, in situ	Hydrolab (1991)

Table 4.3: Summary of processing, preservation, and sample containers

Parameter	Processing	Preservation	Hold Time (days)
Ortho-phosphorus	a	A	2
Total phosphorus	b	B	28
Ammonia nitrogen	b	A	28
Nitrate (+ nitrite) nitrogen	b	B	28
Total Kjeldahl nitrogen	b	A	28
Total organic carbon	b	B	28
Dissolved inorganic carbon	b	A	28
Dissolved organic carbon	b	A	28
Metals (Fe, Ca, Mg, Na, K, Pb)	b	C	182
Reactive silica	b	A	28
Total chlorides	b	A	28
SO_4	b	A	28
Chlorophyll a	a	D	30
Alkalinity	b	A	14

Processing: a - filtration through 0.45 μ cellulose nitrate filter
b - whole sample

Preservation: A - no addition, sample held at 4° C
B - 0.2 ml 5N H_2SO_4/20 ml of sample
C - 0.1 ml 1+1 HNO_3/20 ml of sample
D - $MgCO_3$, wrapped in aluminum foil, and frozen

In addition to the above measurements and analyses, intensive optics measurements were conducted at each of the primary sampling sites during the first two field seasons. The results of these investigations are available within a separate report (Effler, et al., 2000).