FINAL

ONONDAGA LAKE AMBIENT MONITORING PROGRAM

2004 Annual Report
Appendices 1-12

October 2005

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APPENDIX 1: 2003 SENECA RIVER CONDITIONS

(by QEA, LLC)

A1-1 WATER QUALITY ISSUES

In 2004, OCDWEP completed two full water quality surveys of the Seneca River. The analyses were designed to assess current water quality status with respect to ambient water quality standards and support the river modeling effort being carried out by Quantitative Environmental Analysis, LLC (QEA). The AMP calls for annual water quality monitoring at Buoy 316; this sampling and analysis was incorporated into the full river surveys. The study area for these water quality surveys is shown in Figure A1-1. A summary of sampling locations and numbers of samples collected in 2004 is shown in Table A1-1.

River sampling events in 2004 occurred on August 11th and September 29th. During each survey, grab samples of bottom and top waters (1m above the bottom and 1m below the surface) were collected and analyzed for a large number of water quality parameters. Grab samples of mid-depth waters (center location between the top and bottom of the water column) were also collected and analyzed at Buoy 269 (1 km downstream of Onondaga Lake outlet) to help characterize the extent of stratification of the water column and examine variations in water quality with depth. A depth profile of field parameters (DO, salinity, redox, pH, and temperature) was collected at each station. In addition, YSI data sondes were deployed between May and September 2004 at three locations within the river: Cross Lake (Buoy 409), Buoy-316, and Onondaga Lake Outlet at station LO1 (Figure A1-1). The purpose of these sondes was to evaluate changes in water quality conditions over the course of a day, as suggested by river modeling peer review panel. In situ parameters measured by the sondes (temperature DO, salinity, and chlorophyll at select locations) were recorded every 15 minutes for top and bottom depths at each location.

The year 2004 was a relatively wet year, with high flow rates throughout the spring and few low-flow periods in the summer. The flow rates in the Seneca River on the two dates of the full water quality surveys were 2,790 and 6,160 cfs, respectively. The flow rates were high as compared with flows recorded for the survey days in previous years. The 2004 average flow rates from July to September were 4,549 cfs in the Seneca River and 2,537 cfs in the Oneida River (Figure A1-2), as compared to 2,065 cfs and 1,162 cfs, respectively, in 2003. There were only 13 days in 2004 where the flow rates were below 1,000 cfs in the Seneca River. The minimum flow rate in the Seneca River in 2004 was 425 cfs, which is above the 7Q10 value of 350 cfs (QEA, 2000).

As in past years, the quality of Seneca River water in 2004 can be understood in light of several major factors: the loading of algal biomass from Cross Lake, flow rates, time of year, phytoplankton and zebra mussel activity, and effects of inflow from the more saline and eutrophic Onondaga Lake.

During both 2004 river sampling events, DO concentrations were about 8-10 mg/L just downstream of Cross Lake (Figure A1-3). DO concentrations decreased as the water moved downstream to Baldwinsville, as a result of zebra mussel respiration and sediment oxygen demand. DO levels in the vicinity of Baldwinsville were lower in the August event, slightly above 6 mg/L, than the September event, around 8-9 mg/L. DO concentrations in 2004 were generally higher than those measured in 2003, likely as a result of the high flow rates observed during the 2004 sampling events.

The influence of photosynthesis and respiration of phytoplankton and macrophytes can be observed in the diurnal DO variations recorded by the data sondes deployed at Buoy-316 (Figure A1-4). DO is produced via photosynthesis during day time and gradually reaches its peak concentration around late afternoon. DO is consumed at night, and reaches its minimum concentration before sun rise. The magnitude of the diurnal DO fluctuations at 2004 was around 1 to 3 mg/L during July to September (see Figure A1-4), which was comparable with diurnal observations of DO in previous years (0.5-2 mg/L; 1998 AMP, 2000 AMP, 2001 AMP).

Spatial profiles of other water quality constituents (i.e., organic and inorganic forms of nitrogen, phosphorus, and carbon, as well as solids, chlorophyll, salinity, and temperature) measured during the 2004 river surveys are included in Figures A1-3 through A1-14. Two salient water quality features of the river system are the influence of zebra mussel activity and the impacts of Onondaga Lake on the river:

- Zebra mussel filtration led to a decrease in chlorophyll-*a*; concentrations of approximately 10 µg/L at Cross Lake decreased to less than 2 µg/L at Baldwinsville (Figure A1-13). Nutrient release by the mussels led to the increases in NH3-N and SRP concentrations in the river.
- Elevated salinity and slightly lower temperature were observed downstream of the lake outlet, probably reflecting the influx of lake water: the salinity and temperature of the bottom waters of the river were similar to data collected in the bottom waters of the lake outlet (Figures A1-12 and A1-14). Dissolved oxygen levels in the bottom waters downstream of the outlet also appeared to be influenced by Onondaga Lake, where concentrations were lower than the Seneca River during the sampling events in 2004 (Figure A1-3). However, the extent and magnitude of the concentration differences for salinity, temperature and dissolved oxygen between top and bottom waters was smaller and weaker in 2004, as compared to measurements from previous years. These patterns suggest that the high flow rates observed in 2004 led to increased mixing of Onondaga Lake waters with the Seneca River waters as well as less influence from groundwater recharge in the vicinity of the "deep hole" (downstream of the lake outlet). The river became well-mixed at about Buoy 255 (5 km downstream of the outlet) in both sampling events.

In summary, the river water quality in 2004 was comparable to data collected from 1994 to 2003, although the observed extent of stratification near the lake outlet was less in 2004 due to the relatively high flow rates. The introduction of zebra mussels in the early 1990s resulted in dramatic changes in water quality in the river; since then, the dominant patterns and mechanisms do not appear to have changed significantly.

A1-2 REGULATORY ISSUES

In 2004, DO concentrations during the two river surveys were in compliance with the NYSDEC daily average and instantaneous standards of 5 mg/L and 4 mg/L, respectively (Figure A1-3). This is likely due to relatively high flow in 2004. However, the high frequency data from the YSI sonde at Buoy 316 exhibited short periods during which DO was violated, in July in mid-July (top and bottom waters) and mid-September (bottom waters only), as shown on Figure A1-4. There were no violations detected for ammonia during the 2004 river surveys, as NH3 concentrations at all locations were below 0.2 mgN/L during both surveys (Figure A1-5), while the NYSDEC NH3 standard, which varies as a function of water temperature and pH, was in the range of 0.6 to 1.7 mgN/L for the river conditions measured in 2004. Violations of ambient water quality standards for nitrite were detected at two locations in the river during the September 29th survey. Nitrite concentrations equaled the regulatory limit (0.1 mg/L) at sampling locations LO1 and Buoy 182 (Figure A1-5).

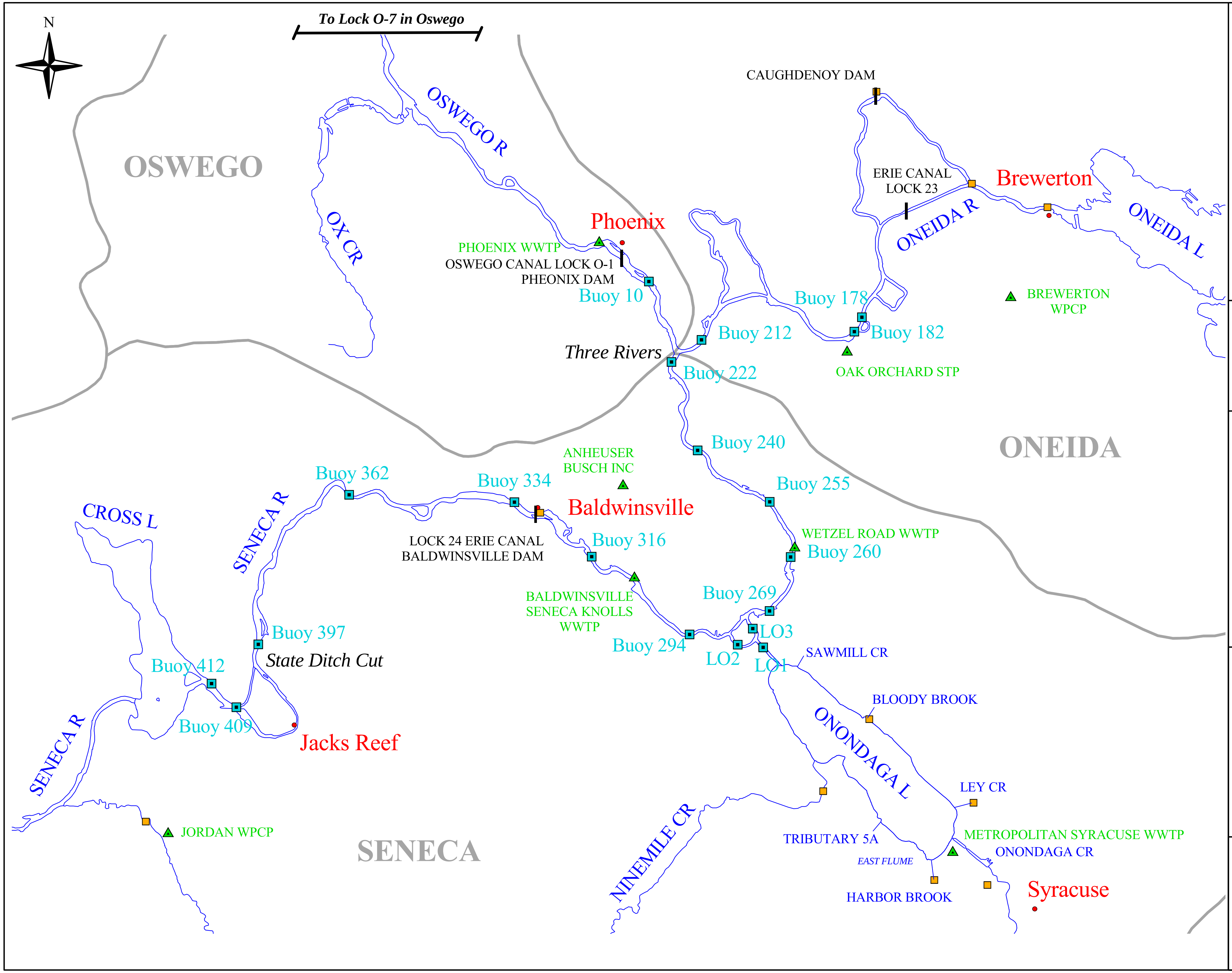

Figure A1-1.
Three Rivers System study area.

QEA
Quantitative Environmental Analysis, LLC

ONOamp 430 May 2005

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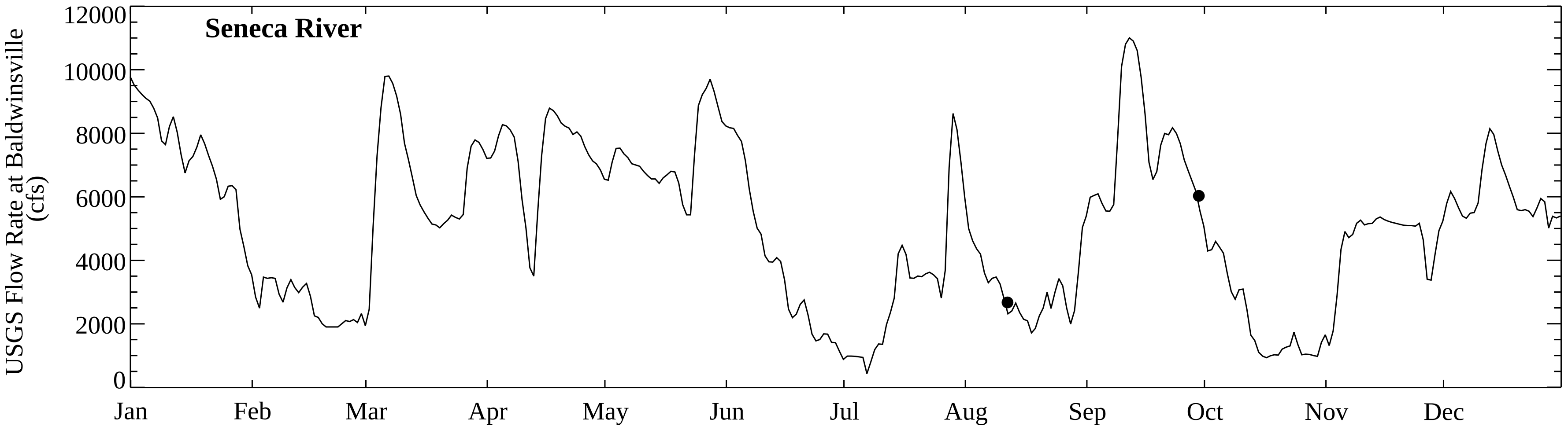

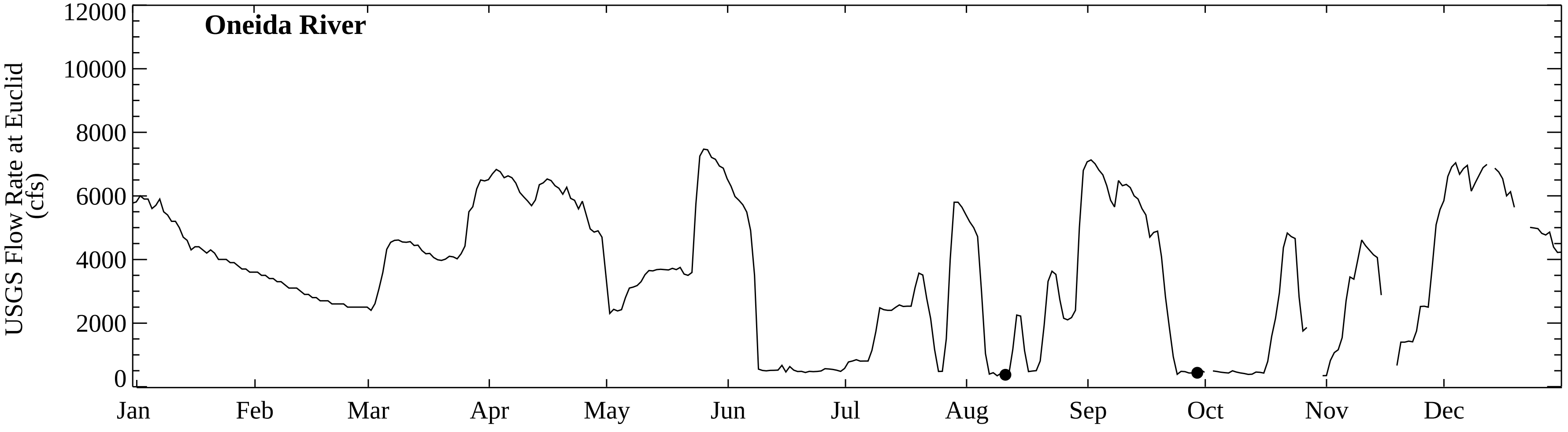

Figure A1-2. USGS flow rate and OCDWEP AMP sampling dates for year 2004.

Note: Points represent OCDWEP water quality sampling dates.

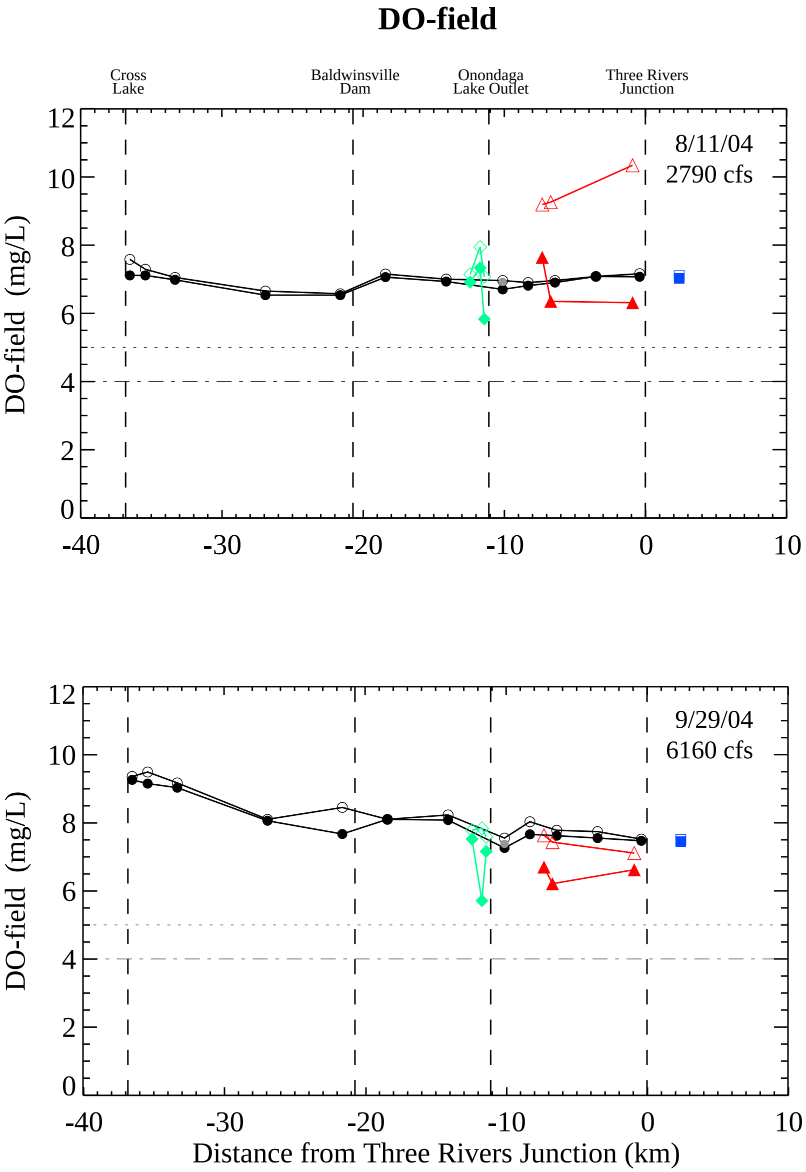

Figure A1-3. Spatial profiles of water quality parameters in year 2004.

Notes: (1)River km measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego; (2)Open symbols represent surface samples, filled symbols represent bottom samples, gray circles represent mid-depth samples, and open symbols with dots represent composite samples; (3)Baldwinsville flow on sampling dates shown in each panel.

● Seneca River
▲ Oneida River
■ Oswego River
◆ Onondaga Lake Outlet
······ Minimum Daily Average Standard
–·–·– Instantaneous Minimum Standard

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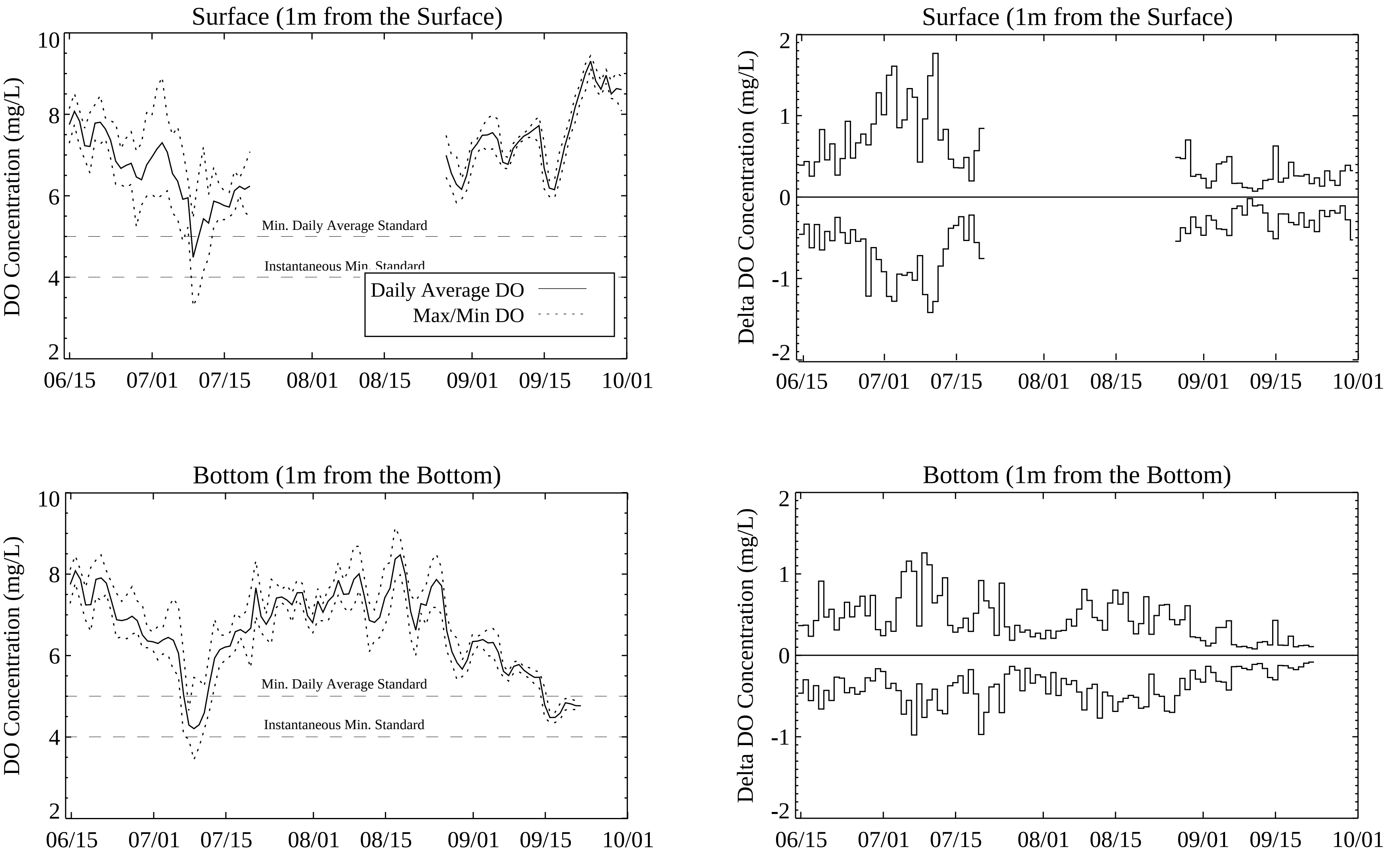

Figure A1-4. Temporal profiles of dissolved oxygen concentrations and variations from YSI data sonde at Buoy 316 in 2004.

Note: No data for July 21 to August 26 for top sonde due to equipment malfunction.

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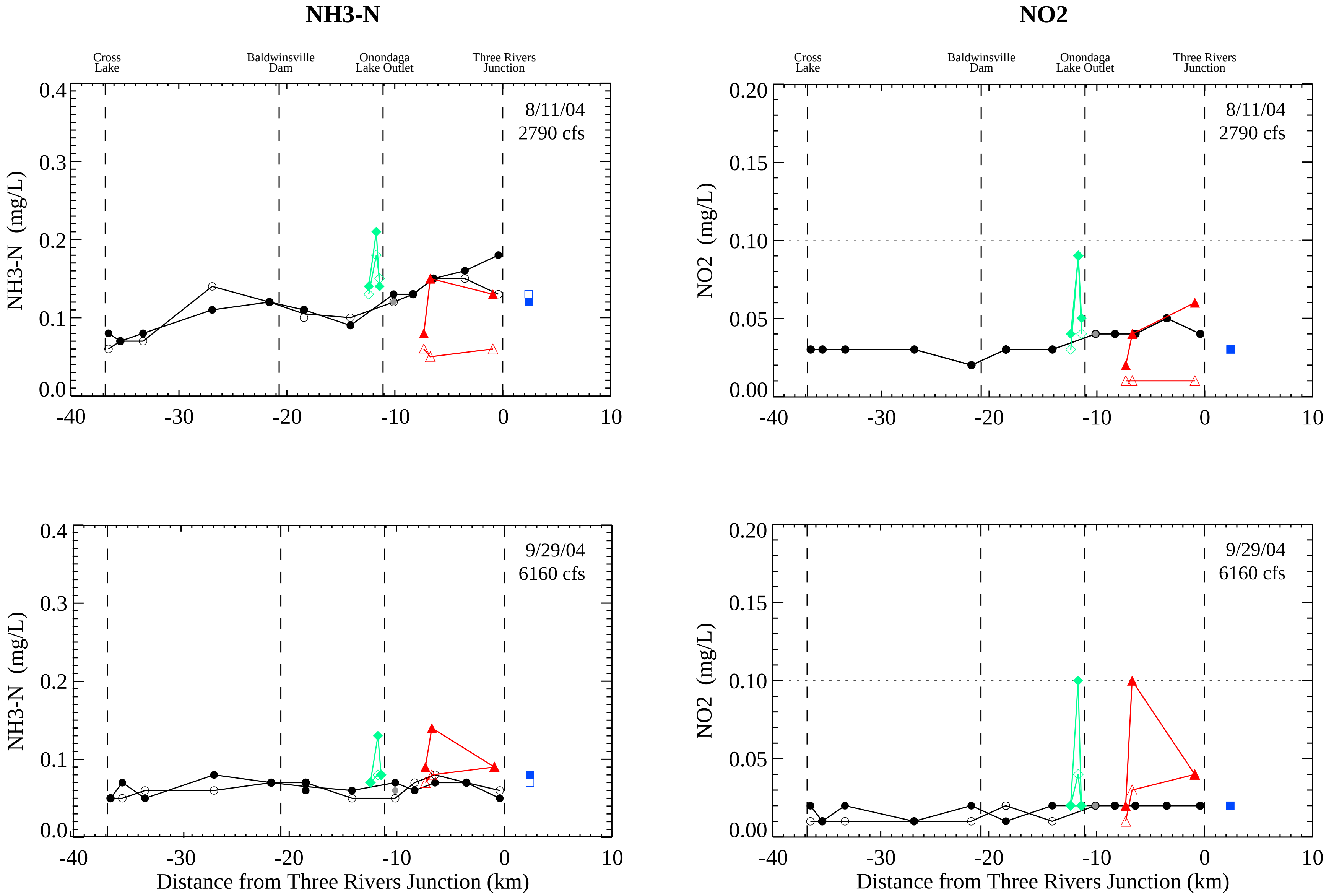

Figure A1-5. Spatial profiles of water quality parameters in year 2004.

Notes: (1)River km measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego; (2)Open symbols represent surface samples, filled symbols represent bottom samples, gray circles represent mid-depth samples, and open symbols with dots represent composite samples; (3)Baldwinsville flow on sampling dates shown in each panel.

● Seneca River
▲ Oneida River
■ Oswego River
◆ Onondaga Lake Outlet

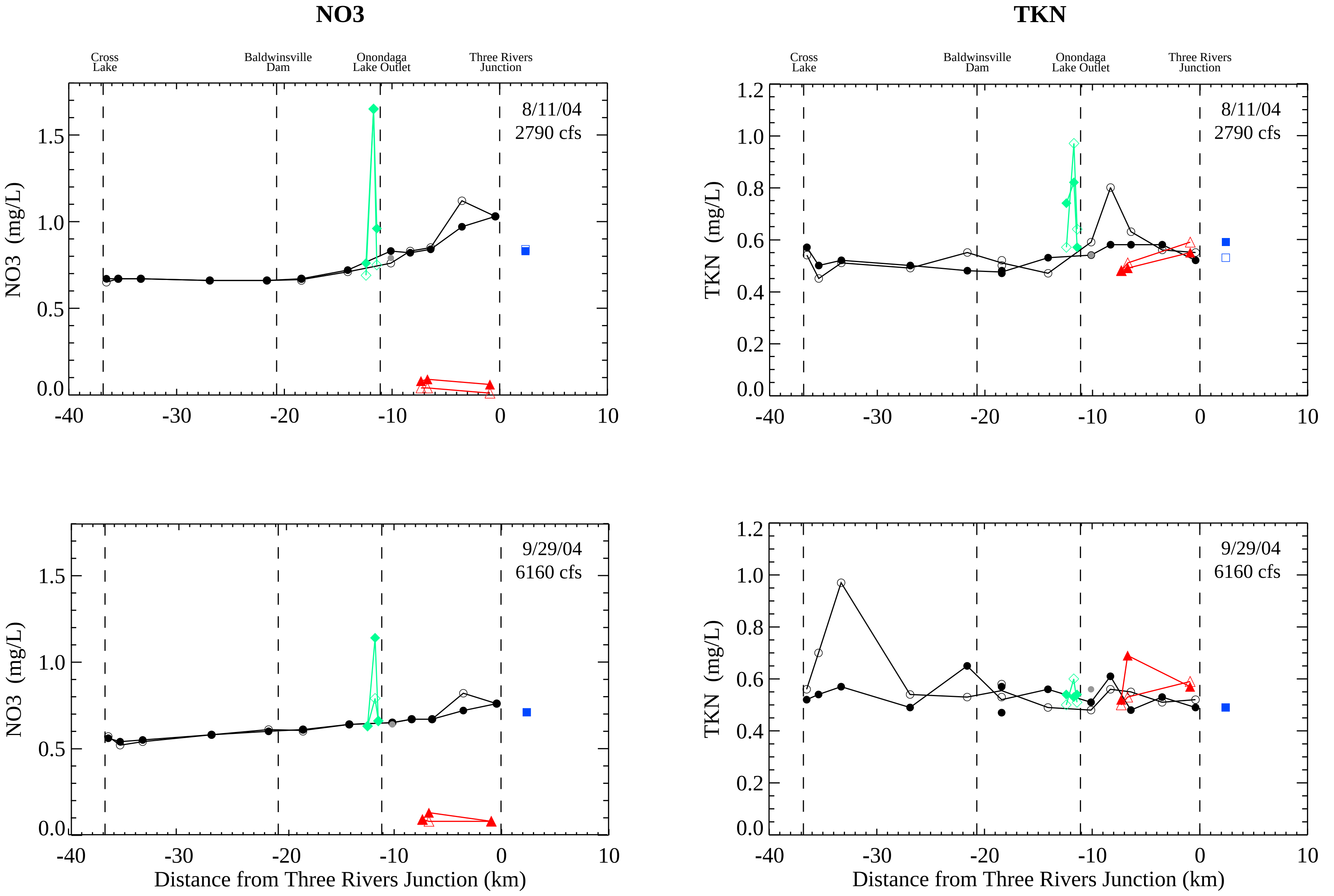

Figure A1-6. Spatial profiles of water quality parameters in year 2004.

Notes: (1)River km measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego; (2)Open symbols represent surface samples, filled symbols represent bottom samples, gray circles represent mid-depth samples, and open symbols with dots represent composite samples; (3)Baldwinsville flow on sampling dates shown in each panel.

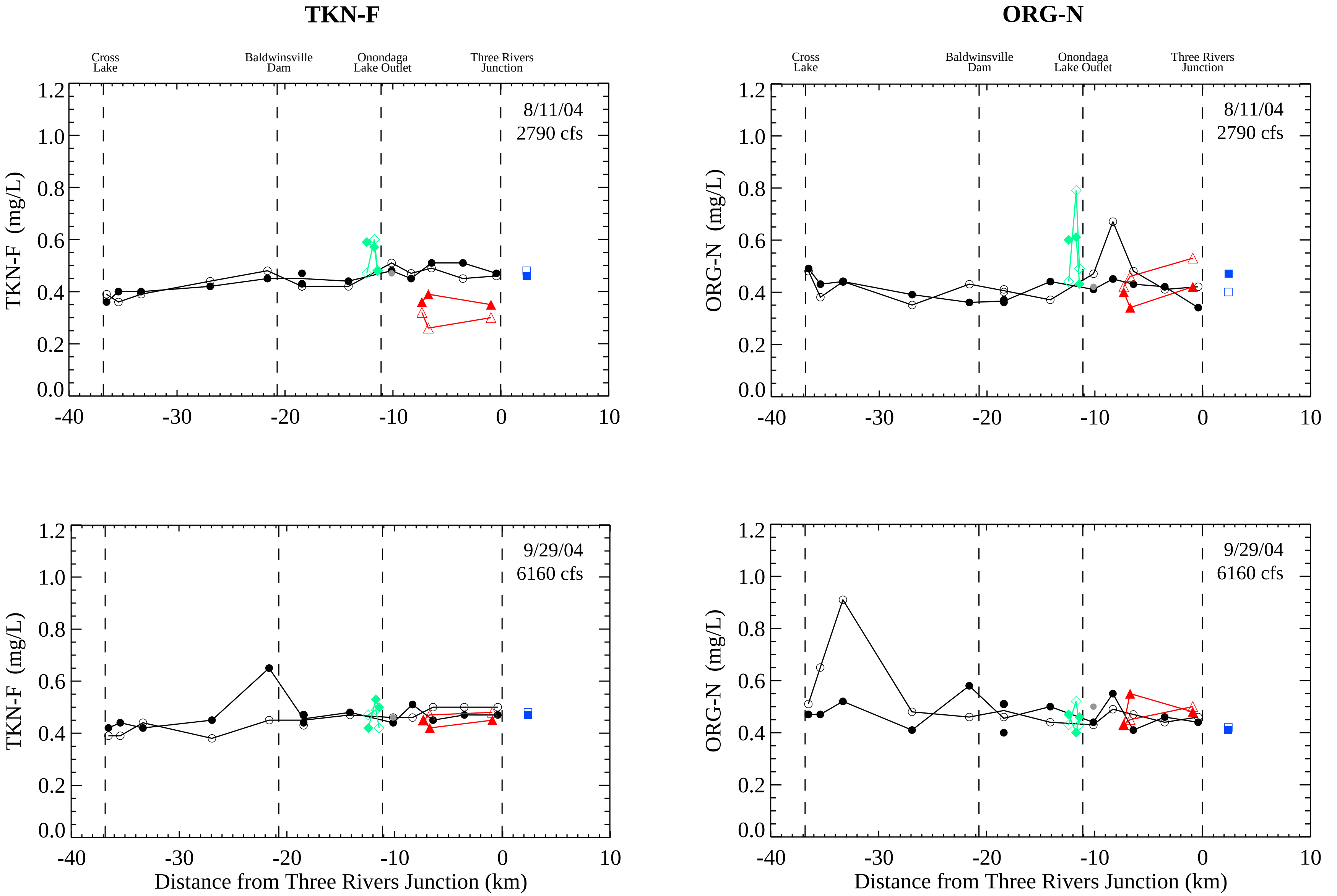

Figure A1-7. Spatial profiles of water quality parameters in year 2004.

Notes: (1)River km measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego; (2)Open symbols represent surface samples, filled symbols represent bottom samples, gray circles represent mid-depth samples, and open symbols with dots represent composite samples; (3)Baldwinsville flow on sampling dates shown in each panel.

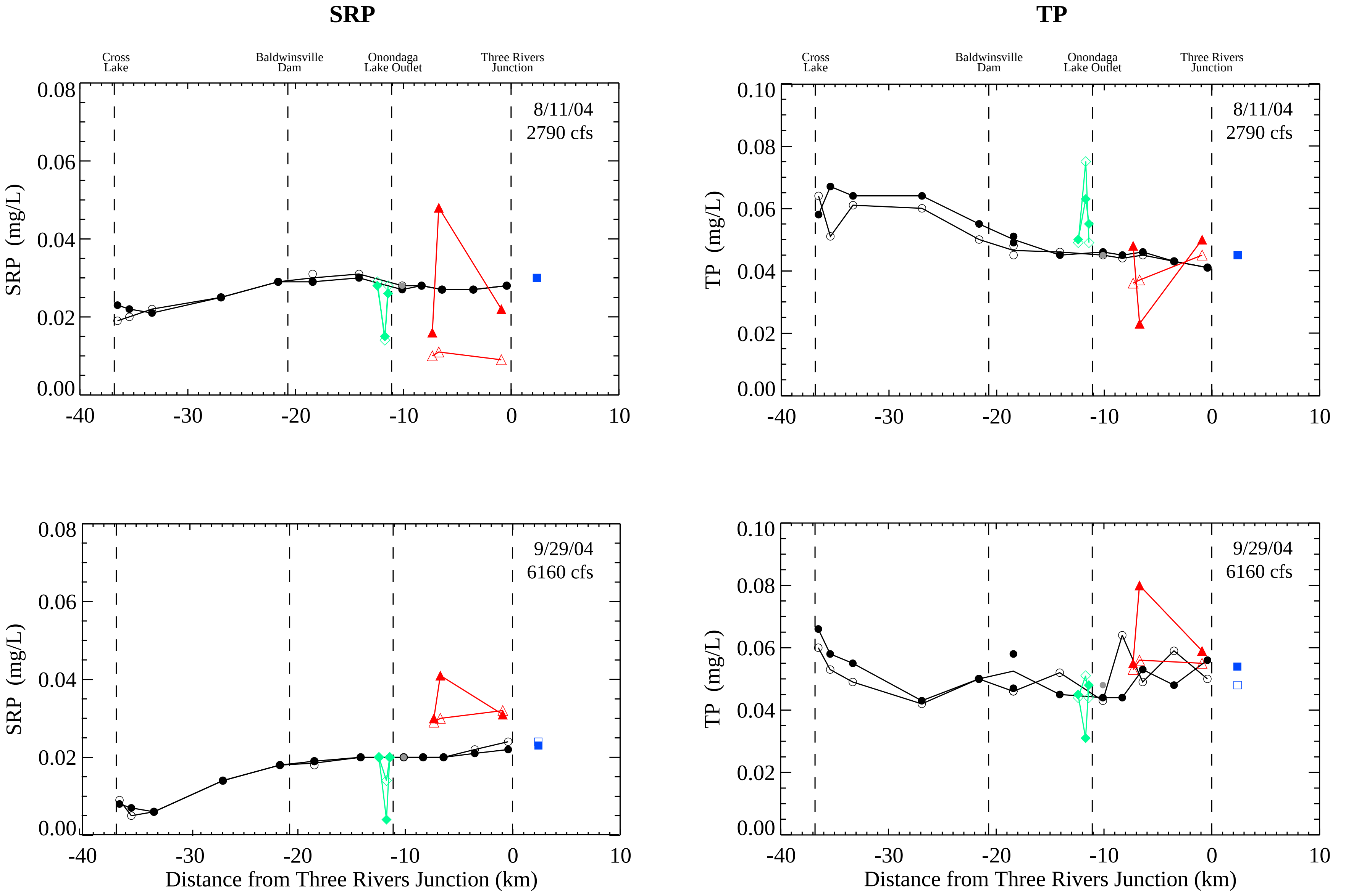

Figure A1-8. Spatial profiles of water quality parameters in year 2004.

Notes: (1)River km measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego; (2)Open symbols represent surface samples, filled symbols represent bottom samples, gray circles represent mid-depth samples, and open symbols with dots represent composite samples; (3)Baldwinsville flow on sampling dates shown in each panel.

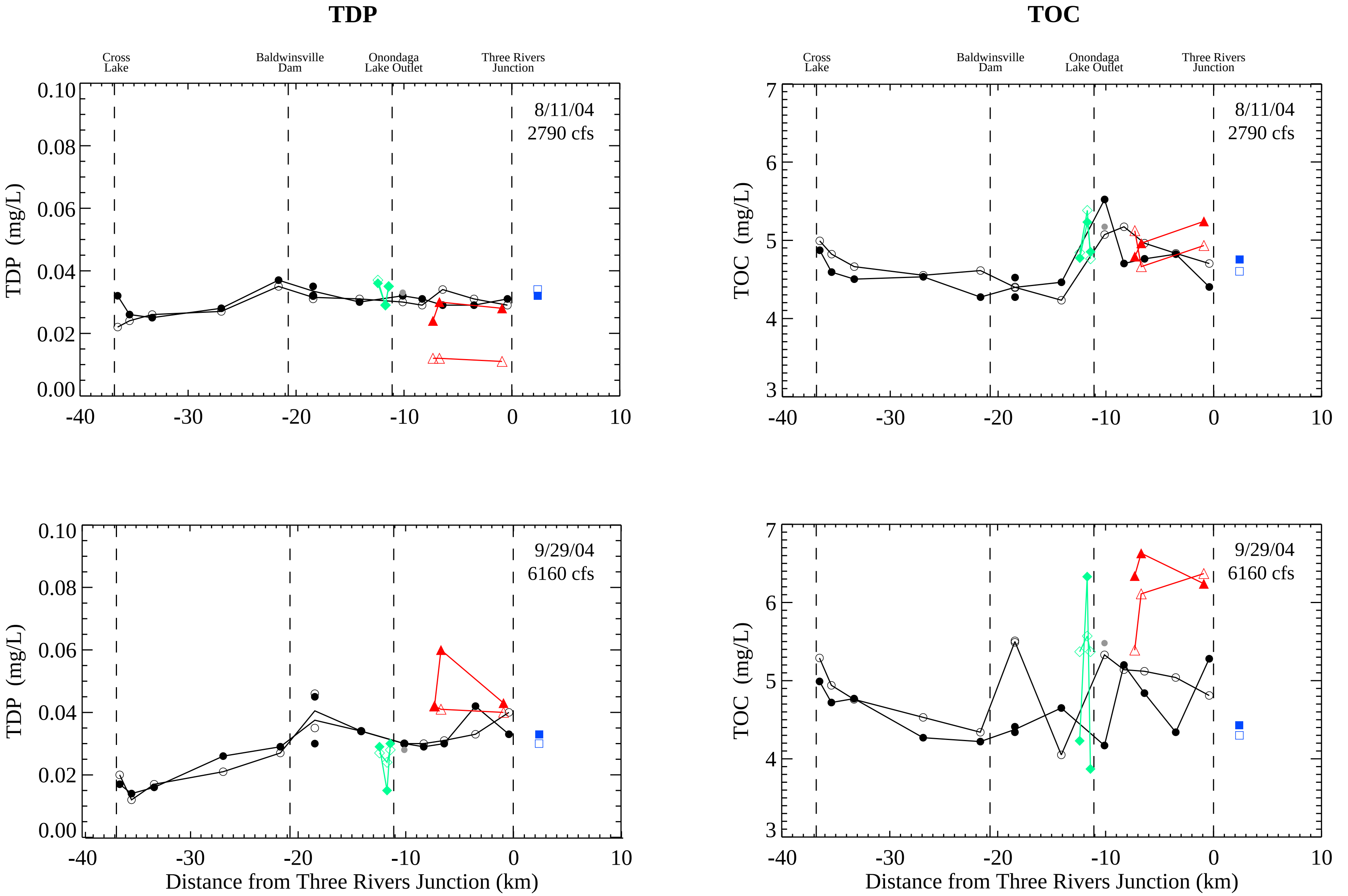

Figure A1-9. Spatial profiles of water quality parameters in year 2004.

Notes: (1)River km measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego; (2)Open symbols represent surface samples, filled symbols represent bottom samples, gray circles represent mid-depth samples, and open symbols with dots represent composite samples; (3)Baldwinsville flow on sampling dates shown in each panel.

● Seneca River
▲ Oneida River
■ Oswego River
◆ Onondaga Lake Outlet

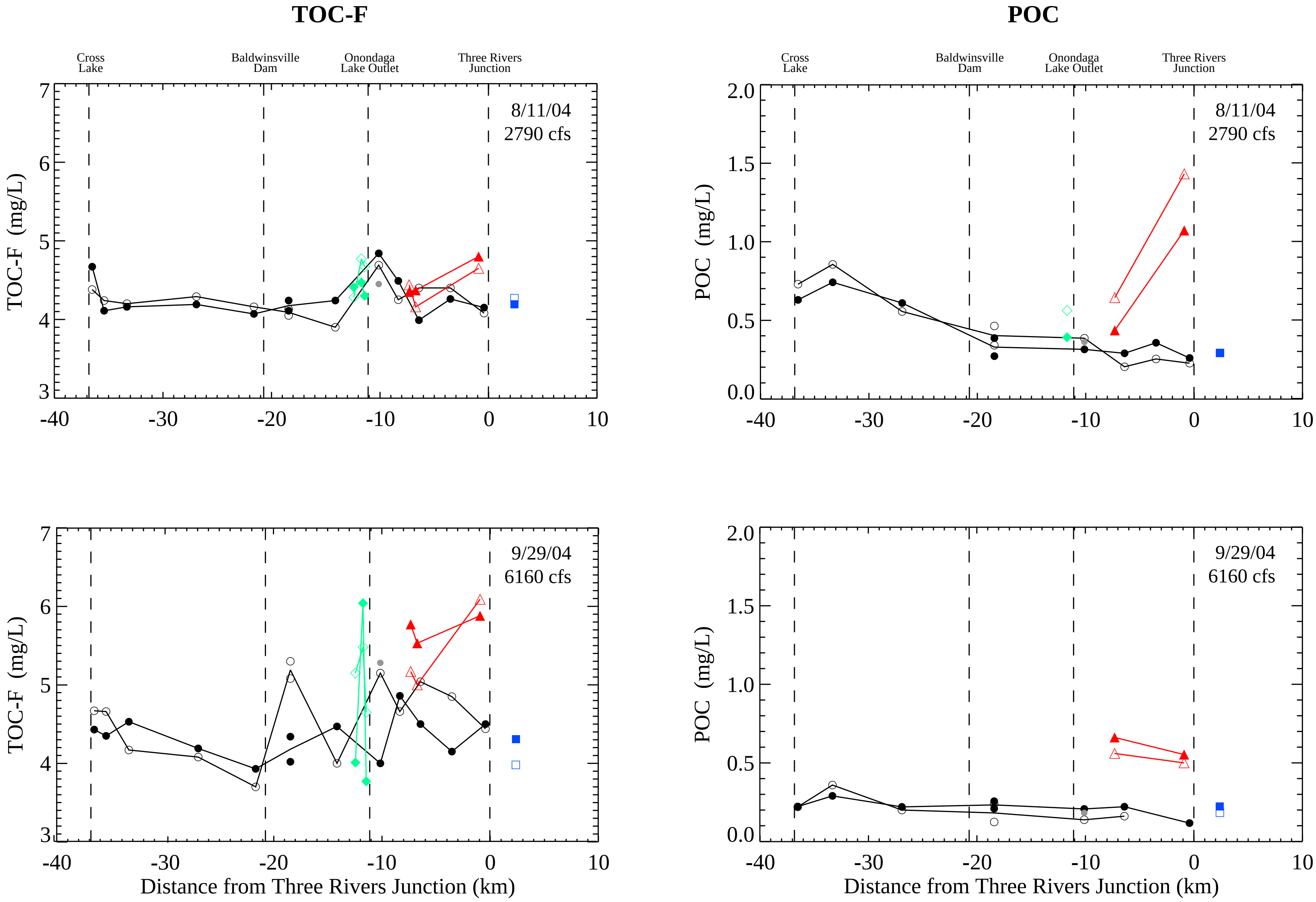

Figure A1-10. Spatial profiles of water quality parameters in year 2004.

Notes: (1)River km measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego; (2)Open symbols represent surface samples, filled symbols represent bottom samples, gray circles represent mid-depth samples, and open symbols with dots represent composite samples; (3)Baldwinsville flow on sampling dates shown in each panel.

● Seneca River
▲ Oneida River
■ Oswego River
◆ Onondaga Lake Outlet

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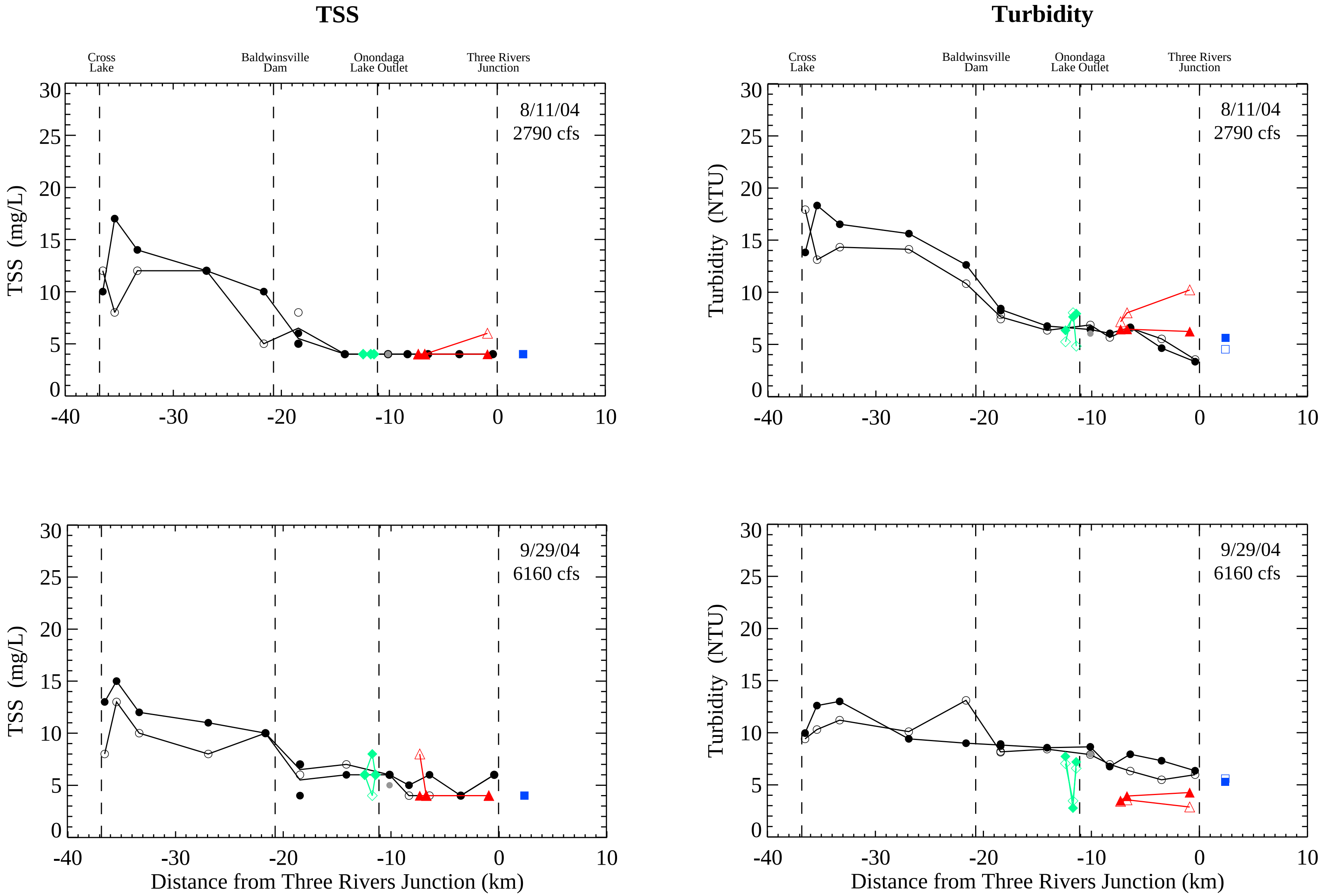

Figure A1-11. Spatial profiles of water quality parameters in year 2004.

Notes: (1)River km measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego; (2)Open symbols represent surface samples, filled symbols represent bottom samples, gray circles represent mid-depth samples, and open symbols with dots represent composite samples; (3)Baldwinsville flow on sampling dates shown in each panel.

●	Seneca River
▲	Oneida River
■	Oswego River
◆	Onondaga Lake Outlet

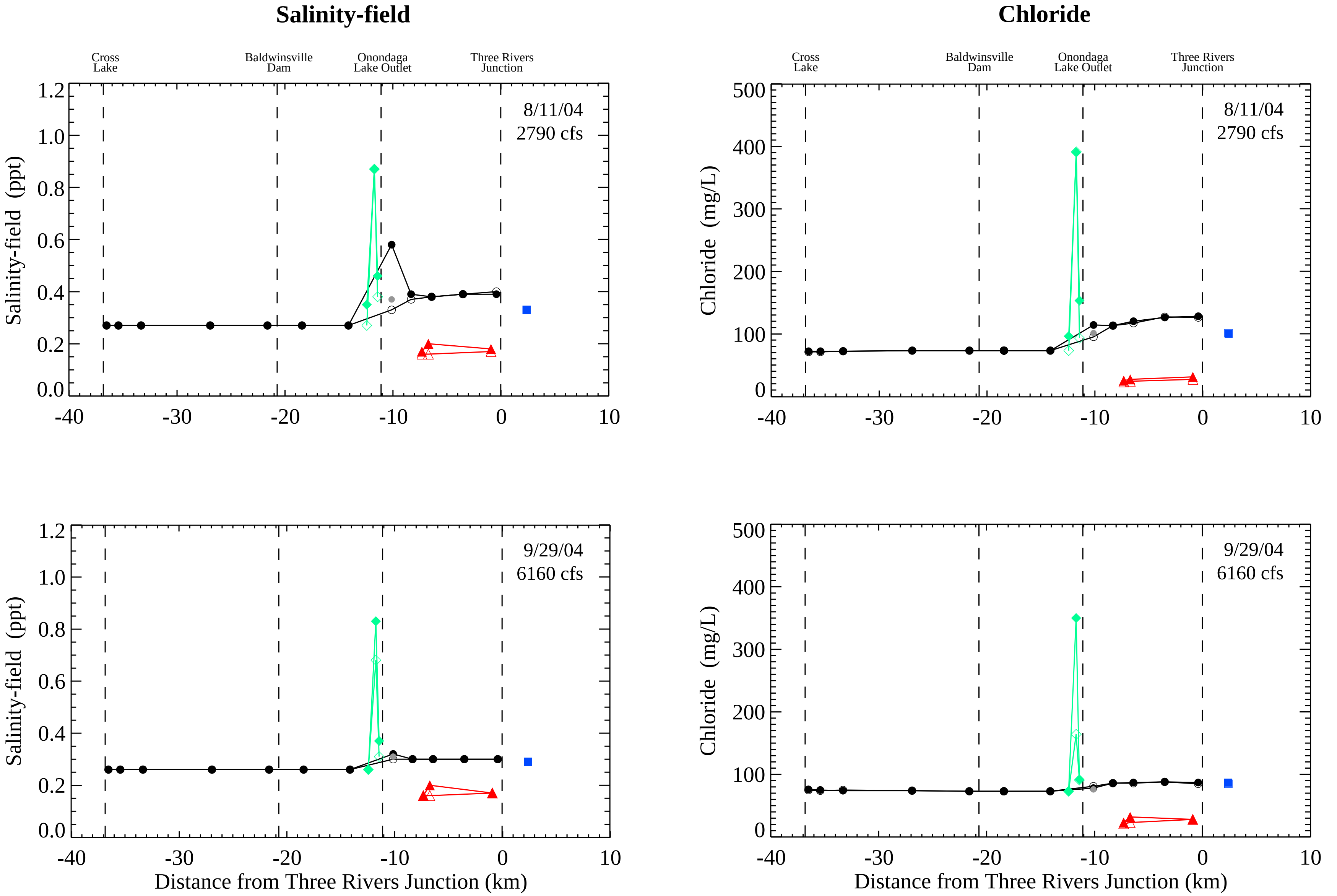

Figure A1-12. Spatial profiles of water quality parameters in year 2004.

Notes: (1)River km measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego; (2)Open symbols represent surface samples, filled symbols represent bottom samples, gray circles represent mid-depth samples, and open symbols with dots represent composite samples; (3)Baldwinsville flow on sampling dates shown in each panel.

● Seneca River
▲ Oneida River
■ Oswego River
◆ Onondaga Lake Outlet

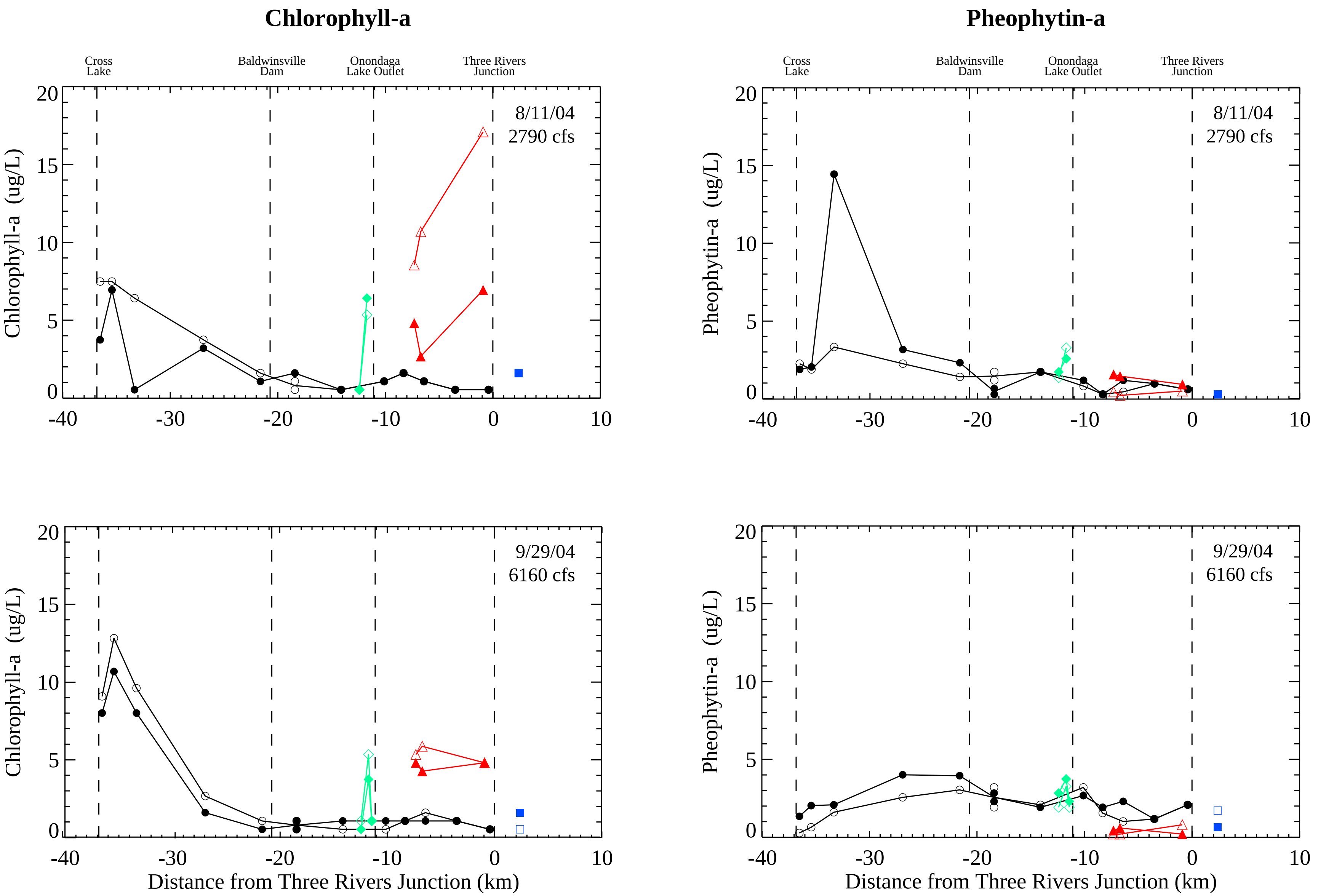

Figure A1-13. Spatial profiles of water quality parameters in year 2004.

Notes: (1)River km measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego; (2)Open symbols represent surface samples, filled symbols represent bottom samples, gray circles represent mid-depth samples, and open symbols with dots represent composite samples; (3)Baldwinsville flow on sampling dates shown in each panel.

● Seneca River
▲ Oneida River
■ Oswego River
◆ Onondaga Lake Outlet

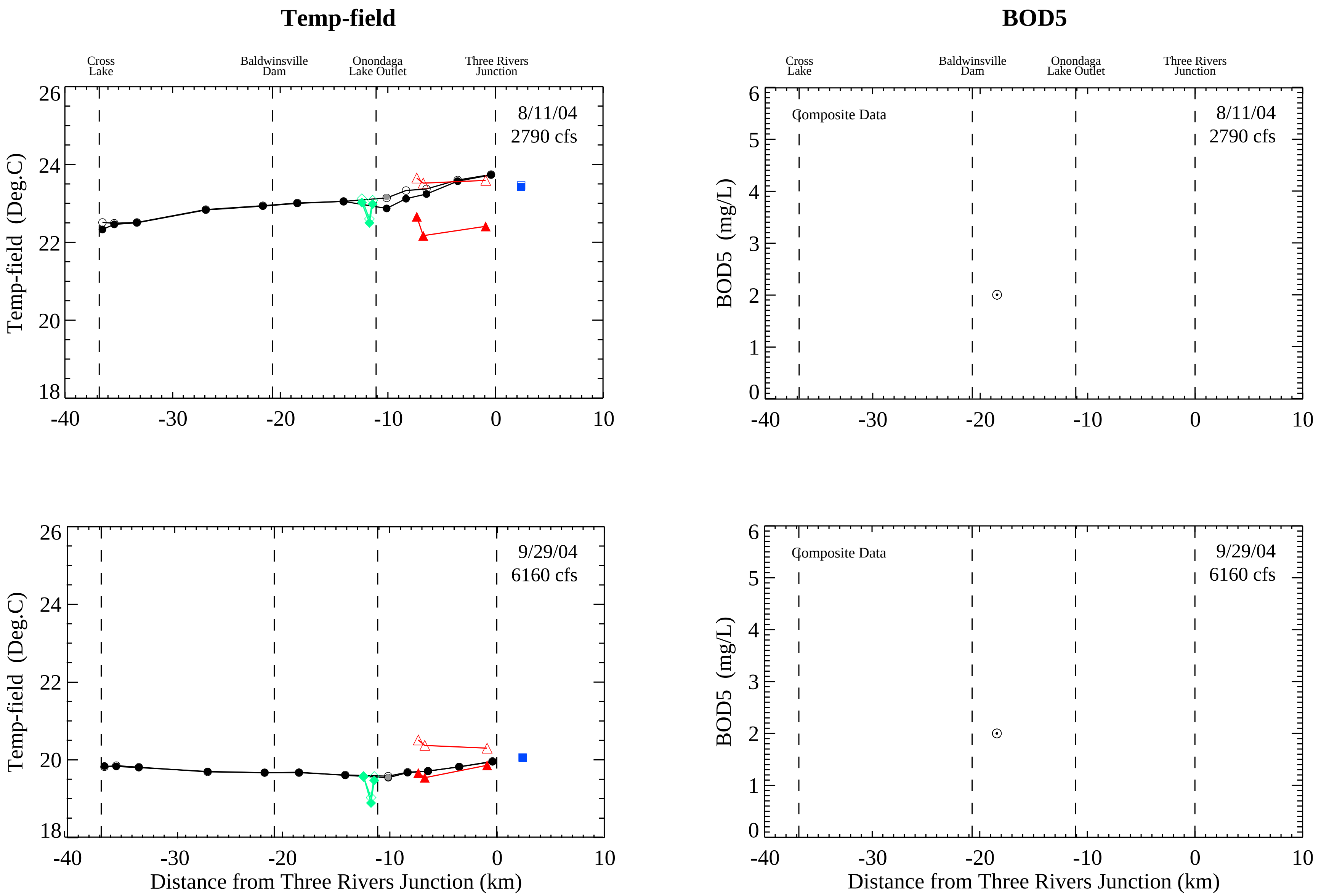

Figure A1-14. Spatial profiles of water quality parameters in year 2004.

Notes: (1)River km measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego; (2)Open symbols represent surface samples, filled symbols represent bottom samples, gray circles represent mid-depth samples, and open symbols with dots represent composite samples; (3)Baldwinsville flow on sampling dates shown in each panel.

Table A1-1. Summary of AMP river sampling locations and total numbers of samples collected in 2004.

Buoy	River	Kilometer[1]	DO-field	Chlorophyll-a	Pheophytin-a	TOC	TOC-F	POC	BOD10	BOD5	CBOD10	CBOD5	NH3-N	NO2	NO3	ORG-N
BUOY-10	Oswego River	2.4	4	4	4	4	4	4					4	4	4	4
BUOY-178	Oneida River	-7.3	4	4	4	4	4	4					4	4	4	4
BUOY-182	Oneida River	-6.7	4	4	4	4	4						4	4	4	4
BUOY-212	Oneida River	-0.9	4	4	4	4	4	4					4	4	4	4
BUOY-222	Seneca River	-0.4	4	4	4	4	4	4					4	4	4	4
BUOY-240	Seneca River	-3.5	4	4	4	4	4	2	4		4		4	4	4	4
BUOY-255	Seneca River	-6.4	4	4	4	4	4	4					4	4	4	4
BUOY-260	Seneca River	-8.3	4	4	4	4	4						4	4	4	4
BUOY-269	Seneca River	-10.1	6	4	4	6	6	6					6	6	6	6
BUOY-294	Seneca River	-14.1	4	4	4	4	4						4	4	4	4
BUOY-316	Seneca River	-18.4	4	8	8	8	8	8	8	4	8	2	8	8	8	8
BUOY-334	Seneca River	-21.6	4	4	4	4	4						4	4	4	4
BUOY-362	Seneca River	-26.9	4	4	4	4	4	4					4	4	4	4
BUOY-397	Seneca River	-33.3	4	4	4	4	4	4					4	4	4	4
BUOY-409	Seneca River	-35.4	4	4	4	4	4						4	4	4	4
BUOY-412	Seneca River	-36.5	4	4	4	4	4	4	4		4		4	4	4	4
LO1	Onondaga Lake Outlet	-11.7	4	4	4	4	4	2	4		4		4	4	4	4
LO2	Onondaga Lake Outlet	-12.4	4	4	4	4	4						4	4	4	4
LO3	Onondaga Lake Outlet	-11.4	4	2	2	4	4						4	4	4	4

Table A1-1 (Continued). Summary of AMP river sampling locations and total numbers of samples collected in 2004.

Buoy	River	Kilometer[1]	TKN	TKN-F	TP	SRP	TDP	Chloride	COND-field	Salinity -field	Temp -field	pH -field	Turbidity	TSS	VSS
BUOY-10	Oswego River	2.4	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-178	Oneida River	-7.3	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-182	Oneida River	-6.7	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-212	Oneida River	-0.9	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-222	Seneca River	-0.4	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-240	Seneca River	-3.5	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-255	Seneca River	-6.4	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-260	Seneca River	-8.3	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-269	Seneca River	-10.1	6	6	6	6	6	6	6	6	6	6	6	6	6
BUOY-294	Seneca River	-14.1	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-316	Seneca River	-18.4	8	8	8	8	8	8	4	4	4	4	8	8	8
BUOY-334	Seneca River	-21.6	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-362	Seneca River	-26.9	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-397	Seneca River	-33.3	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-409	Seneca River	-35.4	4	4	4	4	4	4	4	4	4	4	4	4	4
BUOY-412	Seneca River	-36.5	4	4	4	4	4	4	4	4	4	4	4	4	4
LO1	Onondaga Lake Outlet	-11.7	4	4	4	4	4	4	4	4	4	4	4	4	4
LO2	Onondaga Lake Outlet	-12.4	4	4	4	4	4	4	4	4	4	4	4	4	4
LO3	Onondaga Lake Outlet	-11.4	4	4	4	4	4	4	4	4	4	4	4	4	4

Note:

[1] *River kilometers measured from Three Rivers Junction, upstream (-) for Seneca and Oneida / downstream (+) for Oswego.*

APPENDIX 2:
PHYTOPLANKTON & ZOOPLANKTON COMMUNITY STRUCTURE

FINAL
October 2005

Appendix 2

Assessing Community Structure of Lower Trophic Levels In Onondaga Lake, New York in 2004

2004 Annual Report

Prepared by

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Introduction

Onondaga Lake is a well-studied urban lake in which detailed limnological investigations have documented water quality changes over the past several decades (Murphy 1978; Effler 1996; Stearns & Wheler 1996, Stearns & Wheler 1997, EcoLogic 2000, 2001, 2002, and 2003). The lake (19.5 m maximum depth) is a eutrophic body of water located at the northern edge of the City of Syracuse in central New York State. Onondaga Lake is a relatively steep-sided lake with two basins - a northern one at 18 m in depth and a southern one at 19.5 m in depth - that are separated by a slightly shallower 17 m deep "saddle". Since the 1960s, summer blooms of planktonic algae have been associated with the eutrophic conditions of the lake. Recent studies have shown that overall phytoplankton abundance has been low compared to values prior to 1988, and that there has been a change in the composition of the algal community (Stearns & Wheler 1996).

The contributions to the phytoplankton community made by cyanobacteria, commonly known as blue green algae, decreased in the mid-1970s, associated with a state-wide ban of phosphates in detergents (Effler 1996). Prior to the phosphorus ban (1968 - 1971), Aphanizomenon flos-aquae formed dense summer blooms in Onondaga Lake. From 1972 – 1989, A. flos-aquae was only sporadically detected, but has made a substantial reappearance since 1990 (Effler 1996). A. flos-aquae typically dominated cyanobacteria blooms from 1996 through 1998, although the duration of the blooms declined each year (Mills and Keats 1998). Interestingly, in 1999 the dominant cyanobacteria in algal blooms shifted to Oscillatoria limnetica (biomass) and Microcystis aeruginosa (density) (Mills et al. 1999). In more recent years (2000 – 2001) Aphanizomenon flos-aquae was again the most prevalent of the cyanobacteria in terms of density and biomass. In 2002 and 2003, A. flos-aquae remained the dominant species in terms of biomass (2002) and density (2003). However, Oscillatoria amphibia reached the greatest density for cyanobacteria in 2002 and Aphanizomenon issatschenkoi the greatest biomass in 2003. The 2004 cyanobacterial blooms were significantly reduced compared to 2002 and 2003, dominated by a Synechocystis sp. (density) and Anabaena crassa (biomass) (This report).

The composition of the zooplankton community has been documented since the late 1960s (Waterman 1971; Auer et al. 1990; Siegfried et al. 1994; Makarewicz et al. 1995; Hairston et al. 1999). Daphnia were present in 1969, very rare in 1978, absent from the catch in 1979-1981 and appeared again in 1986-1989. The exotic Daphnia exilis invaded the lake in the 1920s and 1930s and persisted until the late 1970s. Daphnia exilis has not been observed in Onondaga Lake since the early 1980s (Hairston et al. 1999). The introduction of this species, its successful colonization, and subsequent disappearance corresponded with distinct events in the history of industrial activity in Onondaga Lake. The return of large numbers of Daphnia pulicaria and Daphnia mendotae in the late 1980s was accompanied by substantial increases in water clarity (Auer et al. 1990) in accordance with the "trophic cascade" hypothesis (e.g. Carpenter and Kitchell 1993; Gulati et al. 1990).

After initial appearance in 2000, the exotic zooplankter Cercopagis pengoi has again been detected in Onondaga Lake in 2003 and 2004. This Ponto-Caspian invader has been established in Lake Ontario since 1998 and has subsequently spread to many of the Finger Lakes (Makarewicz et al. 2001). Other temporal patterns in Onondaga Lake zooplankton have been the continued presence of the cladocerans Ceriodaphnia quadrangula and Bosmina longirostris, the copepods Acanthocyclops vernalis and Diacyclops thomasi and a variety of rotifers. A few zooplankton species have only appeared recently: Diaphanosoma birgei, Chydorus sphaericus and Diaptomus sicilis (previously Leptodiaptomus siciloides and Diaptomus siciloides) (Siegfried et al. 1994).

The objective of this report is to present data on phytoplankton community structure, biomass, and abundance in Onondaga Lake in 2004 and to make comparisons with the data from previous years. We also present 2004 data on species composition, biomass, and size structure of the crustacean zooplankton community.

Methods

Phytoplankton samples were collected March through December in 2004 and preserved in Lugol's Iodine solution. The phytoplankton sample for each date and sampling site is comprised of an integrated tube sample of the upper mixed layer (UML) of the water column. The UML depth is the same depth as the epilimnion depth when a thermocline is present, or is a default of 6 meters when there is no thermocline. This protocol differs from previous years, in which integrated samples were taken of both the epilimnion and the photic zone (twice the Secchi depth) of the water column. The data reported for March 30th, 2004 includes both an epilimnion sample and a photic zone sample as it predated this change in protocol. All subsequent 2004 data consists of UML values only. Integrated water samples were collected using a 2 cm i.d. Tygon tube.

Phytoplankton samples were processed by Ann St. Amand at PhycoTech, Inc. (620 Broad St., Ste. 100, St. Joseph, MI 49085). Raw water samples were run through filtration towers and the filters from these towers were then made into slides. The method used in counting the phytoplankton depended on the relative importance of soft algae and diatoms in the samples as well as alga size. Phytoplankton were identified to species when possible and density and biovolume estimates were made. Individual phytoplankton species were converted to biomass, based on estimates of biovolume and density. In this study, biomass is reported in µg/L. PhycoTech reported biomass as total biovolume (μm^3/mL). Total biovolume (μm^3/mL) was converted to total biomass (µg/L) by multiplying total biovolume by 1×10^{-3}.

Calculations of zooplankton density, species composition, size structure, and biomass were based on vertical hauls using a 0.50 m diameter net with 80 micron nylon mesh. Vertical tows were taken from the UML when the lake was thermally stratified or from a depth of six meters when no thermocline was present. In addition, a second sample was collected with a vertical tow to a depth of 15 meters. Zooplankton samples were collected at the South Deep site throughout the year (on a bi-weekly basis during the ice-free period) and at the North Deep site on four dates. Samples were preserved in 95% ethyl alcohol; this preservative comprised at least 70% of each final sample volume. Vertical tow depths and a flow meter (Digital Pygmy) were used to calculate the volume of water strained in each haul.

A compound microscope (40X-200X magnification) was used to identify zooplankton to species when possible and a dry weight conversion was used to estimate biomass. For each sample, one to three 1-mL subsamples were withdrawn with a Henson-Stemple pipette from a known volume of sample, until at least 100 individual zooplankton were counted. Zooplankton length was measured using a compound scope equipped with a drawing tube and a digitizing pad interfaced with a computer.

Results and Discussion

Phytoplankton Community Structure.

The raw phytoplankton data from the analyses completed by PhycoTech, Inc. for 2004 are presented in Appendix A of this report. The phytoplankton community of Onondaga Lake is comprised of Bacillariophyta, Chlorophyta, Chrysophyta, Cryptophyta, Cyanophyta (cyanobacteria), Pyrrhophyta, and "miscellaneous microflagellates". Euglenophyta and Xanthophyta were present briefly in June 2002 but absent in both 2003 and 2004. The two dominant cyanobacteria found in the 2004 algal blooms were *Synechocystis sp.* (density) and *Anabaena crassa* (biomass). The most frequently occurring algal species of other taxonomic groups, determined by the highest average abundance and / or biomass were: *Cyclotella sp#1* (density) and *Stephanodiscus medius* (biomass) (Bacillariophyta)*; Monoraphidium capricornutum* (density) and *Closterium sp*. (biomass) (Chlorophyta); *Erkenia subaequiciliata (*density) and an unidentified chrysophyte (biomass) (Chrysophyta); *Rhodomonas minuta* (density) and *Cryptomonas erosa* (biomass) (Cryptophyta); and *Gymnodinium sp.#2* (density) and *Peridinium umbonatum* (biomass) (Pyrrhophyta).

Phytoplankton Abundance and biomass.

The abundance and biomass of phytoplankton in Onondaga Lake for 2004 are summarized in Appendix B. Seasonal trends in abundance of algal groups in 2003 and 2004 are displayed in Figures A2-1 and A2-2, respectively [note: these files are best viewed at 100% magnification or higher to discern the patterns]. The 2004 season again saw two peaks in algal abundance, the highest peak occurring in early June, (dominated by cryptophytes), with a second peak in mid-July (dominated by chlorophytes). The 2004 early summer peak in algal abundance (1.38 x 10^7 per liter) occurred at approximately the same time as the first peak seen in 2003 (early to mid-June), however the 2003 algal abundance peak (1.27 x 10^8 per liter) was more than nine times greater than that seen in the first peak of 2004. The 2004 mid-July peak in algal abundance also occurred within just a few weeks of the time that this peak occurred in 2003. The second algal abundance peak of 2004 (1.24 x 10^7 per liter) was also less than half the corresponding peak seen in 2003 (2.89 x 10^7 per liter). Overall, algal abundance in 2004 (yearly average 5.0 x 10^6 per liter) was significantly less than that seen in 2003 (yearly average 1.13 x 10^7 per liter), but densities remained slightly higher than that seen in either the 2001 or 2002 season (yearly averages of 2.9 x 10^6 per liter and 4.42 x 10^6 per liter respectively).

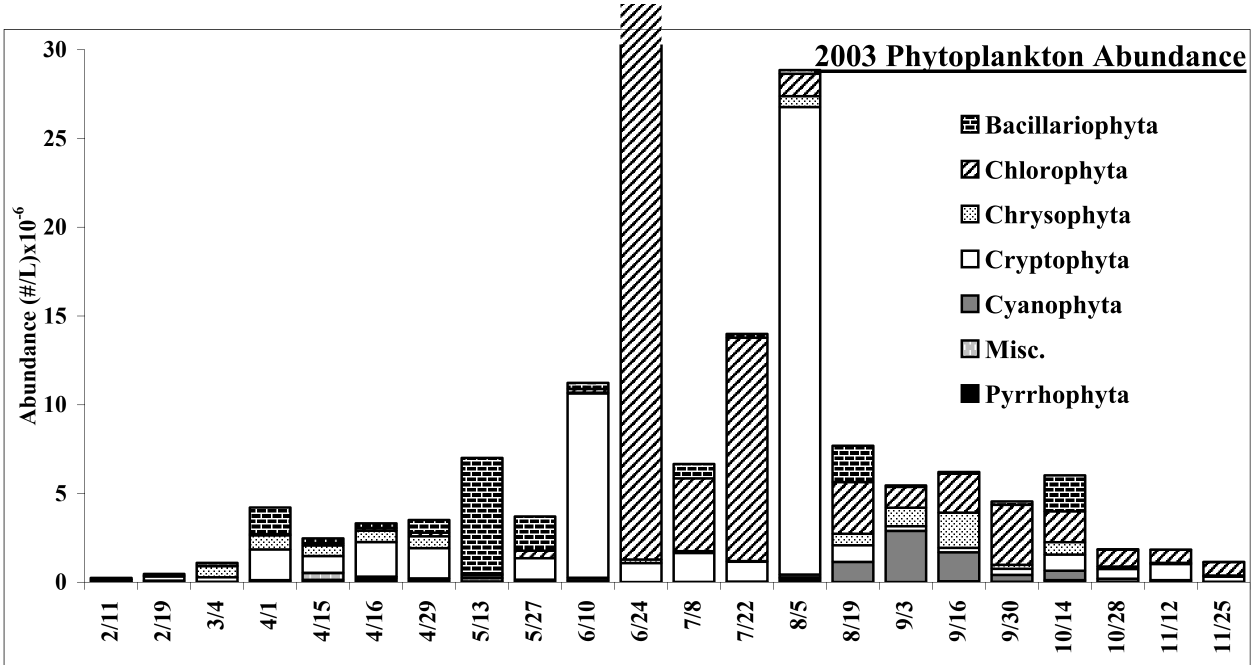


Figure A2-1. Abundance (#/L) x 10^6 of nine major groups of phytoplankton collected from Onondaga Lake, 2/11/03 - 11/25/03. Data are averages of integrated epilimnetic and integrated photic zone samples. An asterisk indicates "North" station samples were taken in addition to "South" station samples.

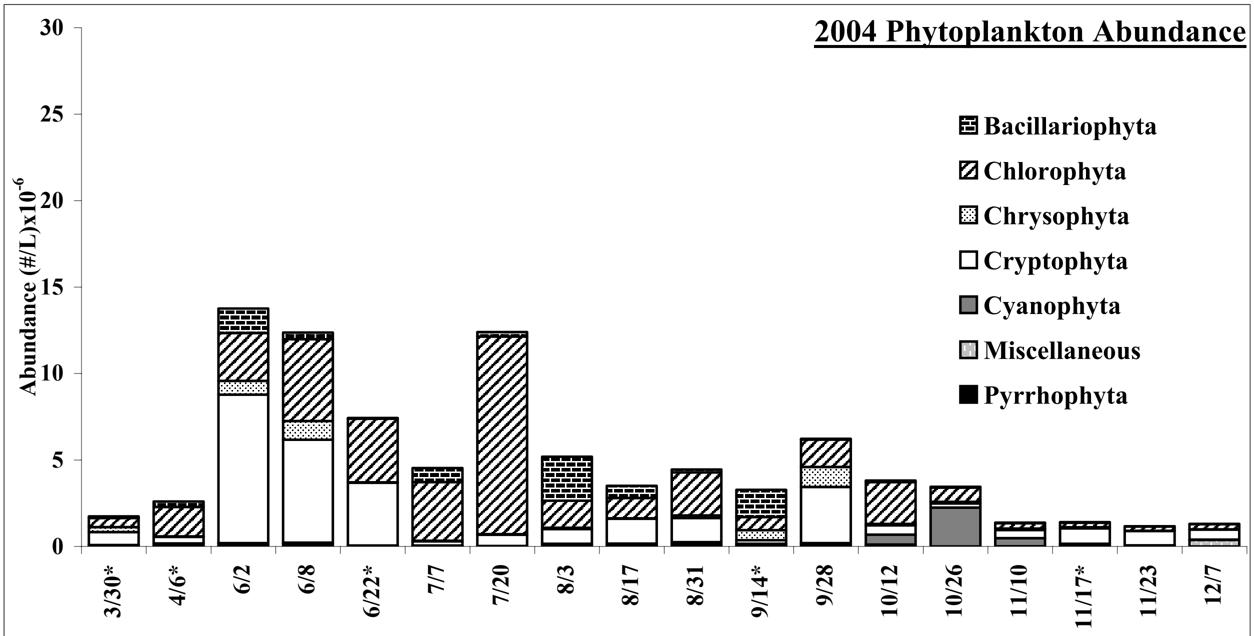


Figure A2-2. Abundance (#/L) x 10^{-6} of nine major groups of phytoplankton collected from Onondaga Lake, 3/30/04 - 12/07/04. Data are averages of integrated upper mixed layer samples (UML). An asterisk indicates "North" station samples were taken in addition to "South" station samples.

The comparison of 2003 and 2004 algal biomass data shows significantly different temporal patterns in peak algal biomass (Figures A2-3 and A2-4, respectively). In both 2003 and 2004, spring blooms in Onondaga Lake were dominated by bacillariophytes. The spring biomass peak in 2003 (9,506 µg/L) occurred in mid-May compared to mid-June (3,705 µg/L) in 2004. However, no samples were collected between April 10th and June 2nd (when sampling was temporarily suspended during the laboratory move) and it is likely that the actual spring peak occurred in mid to late May. Consequently, the magnitude of the spring bloom was presumably higher in 2004 than the data show. Chlorophytes had a significantly lower biomass peak (955 µg/L) in 2004 than was observed in either the 2003 (8,295 µg/L) or 2002 (1,948 µg/L). In all three years, the chlorophytes peak occurred in early to mid August. In addition to these differences in seasonal algal biomass trends, overall algal biomass in 2004 (31,620 µg/L) was almost 2.5 times lower than in 2003 or 2002 (78,135 µg/L and 76,083 µg/L respectively).

We compared the temporal pattern of biomass of each division of phytoplankton observed in Onondaga Lake in 2003 and 2004 for the UML samples (Figure A2-5A – 5G). Maximum biomass of Bacillariophyta was greater in 2003 than in 2004 (Figure A2-5A). Both maximum biomass and overall seasonal biomass were higher for Chlorophyta in 2003 than in 2004, with almost all 2004 measures being significantly less from July through September. Maximum Chlorophyta biomass was over 2.9 times greater in 2003 than in 2004 (5,160 µg/L compared to 14,964 µg/L). (Figure A2-5B). Similar to the trend seen in 2003, Chrysophyta biomass in 2004 had two peaks. In 2004 the highest spring and summer biomass peaks were 93.4 µg/L and 34.8 µg/L respectively (compared to peaks of 51µg/L and 72µg/L respectively, in 2003) (Figure A2-5C). Cryptophyta mean annual biomass in 2004 (7,815µg/L) was approximately 71% of the corresponding value in 2003 (11,017 µg/L). Both 2004 and 2003 had large Cryptophyta peaks in June (3,377 µg/L and 1,141 µg/L respectively), however 2003 had an even greater Cryptophyta biomass peak in early August, reaching a concentration of 5,348 µg/L. (Figure A2-5D). 2004 Cyanophyta biomass (4,112 µg/L) was almost 2.8 times less than the overall Cyanophyta biomass seen in 2003 (11,841 µg/L). Cyanophyta biomass peaked in the late summer of both years, but the 2004 early August peak of 1,741µg/L was approximately half the early September peak (3,444 µg/L) seen in 2003 (Figure A2-5E). In 2004, the biomass of the "Miscellaneous flagellates" had only one minor biomass peak of 11µg/L in early December. The spring peak

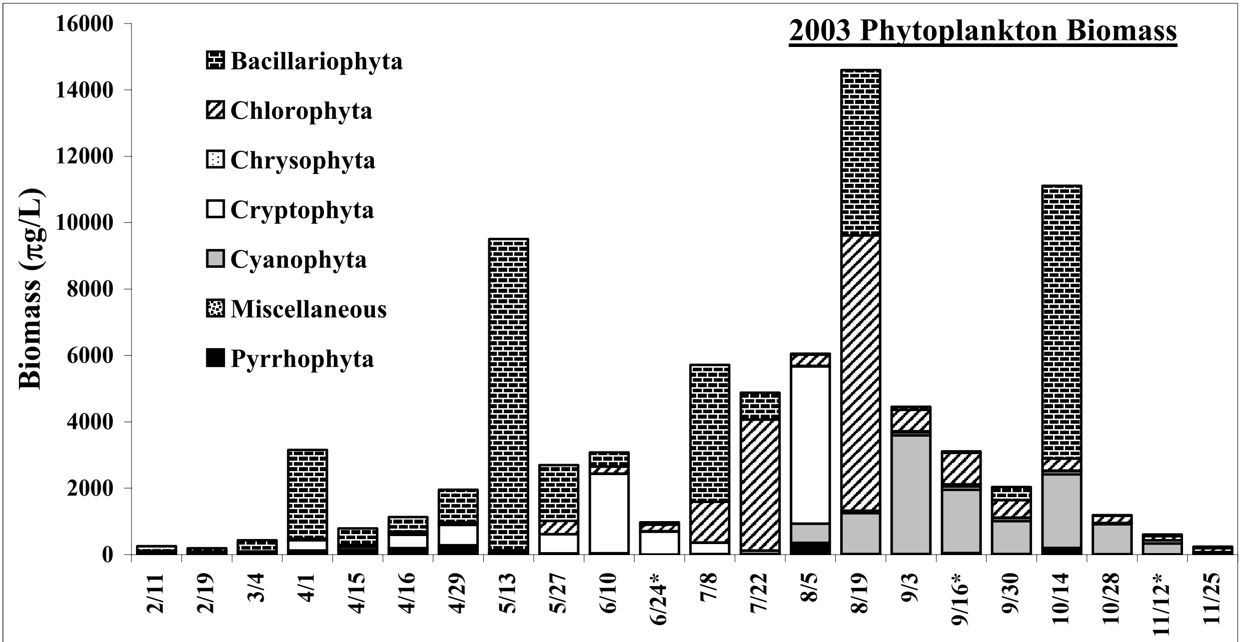


Figure A2-3. Biomass (πg/L) of eight major groups of phytoplankton collected from Onondaga Lake, 2/11/03 - 11/25/03. Data are averages of integrated epilimnetic and integrated photic samples. An asterisk indicates "North" station samples were taken in addition to "South" station samples.

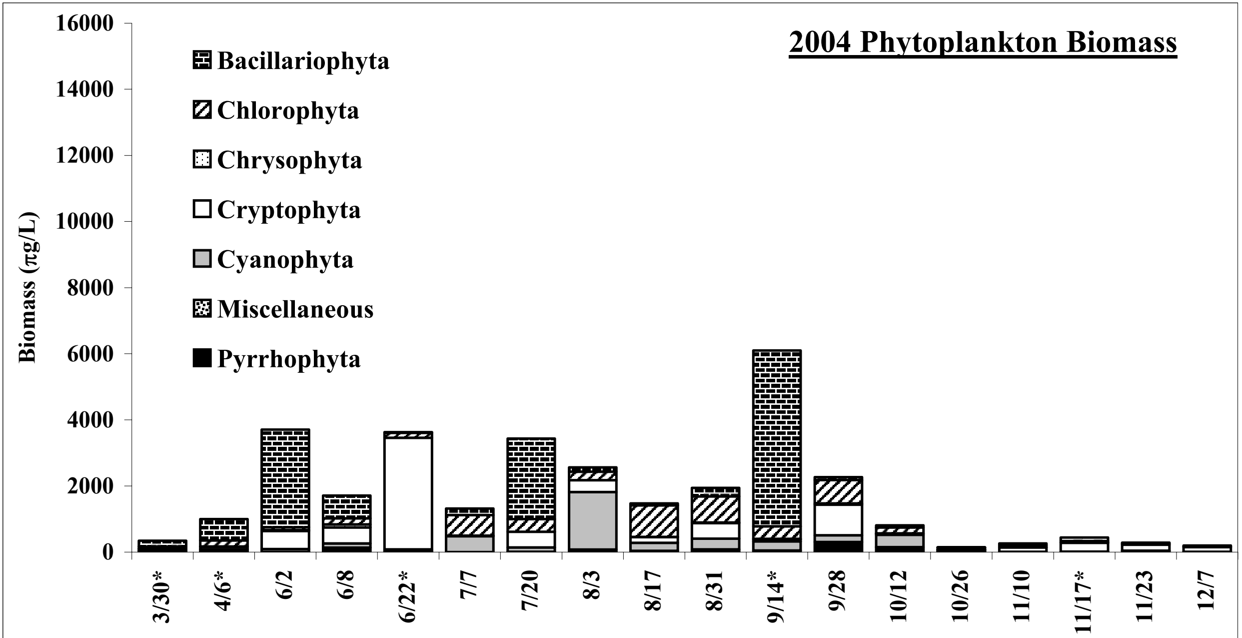


Figure A2-4. Biomass (πg/L) of eight major groups of phytoplankton collected from Onondaga Lake, 3/30/04 - 12/07/04. Data are averages of integrated upper mixed layer samples (UML). An asterisk indicates "North" station samples were taken in addition to "South" station samples.

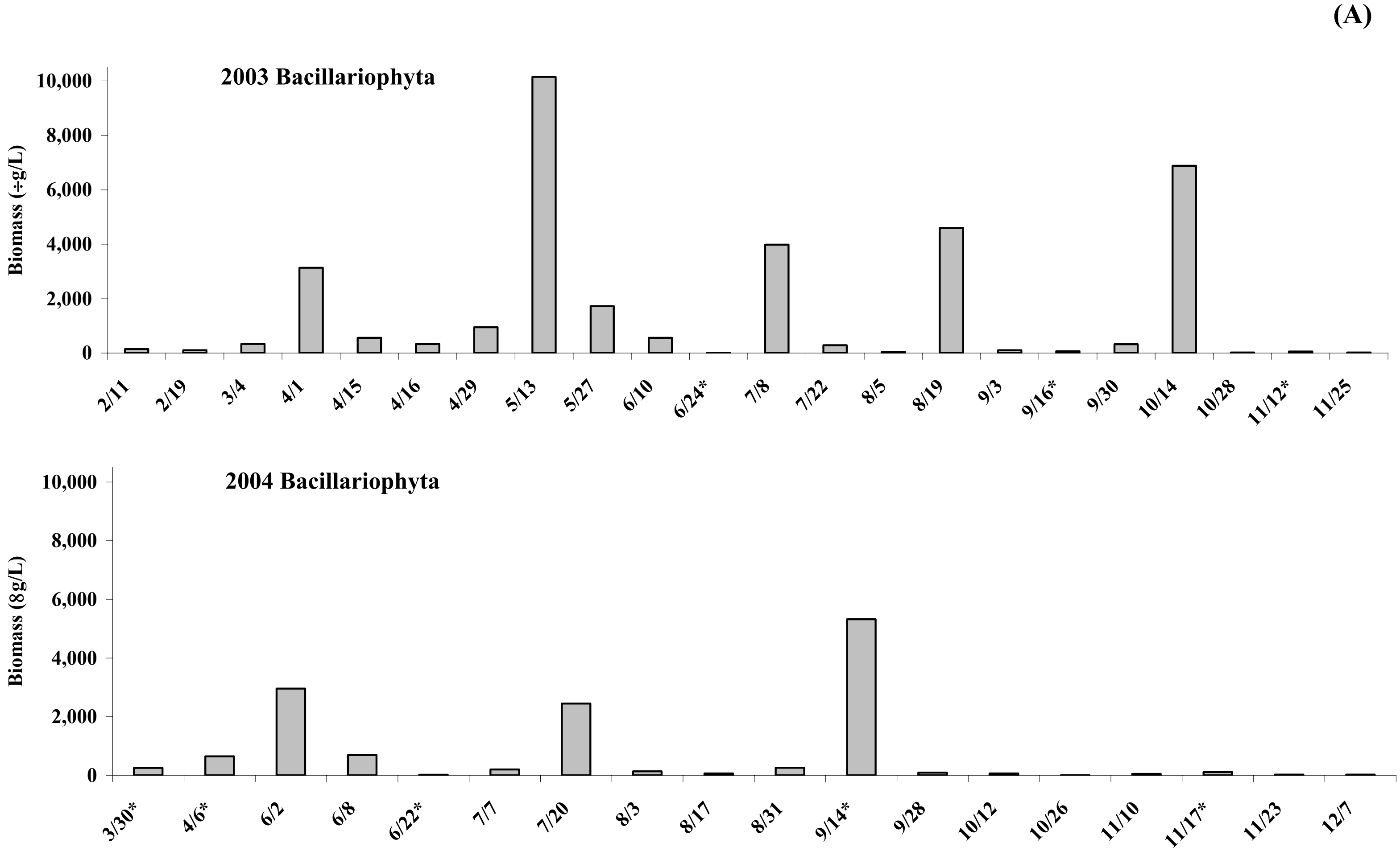
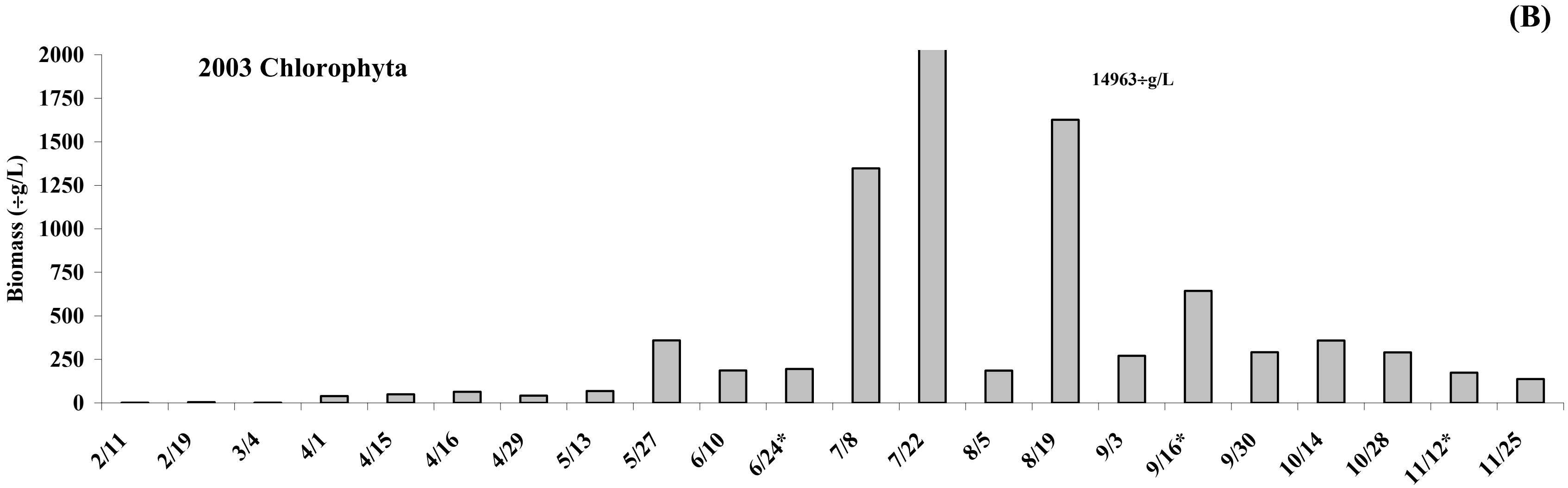
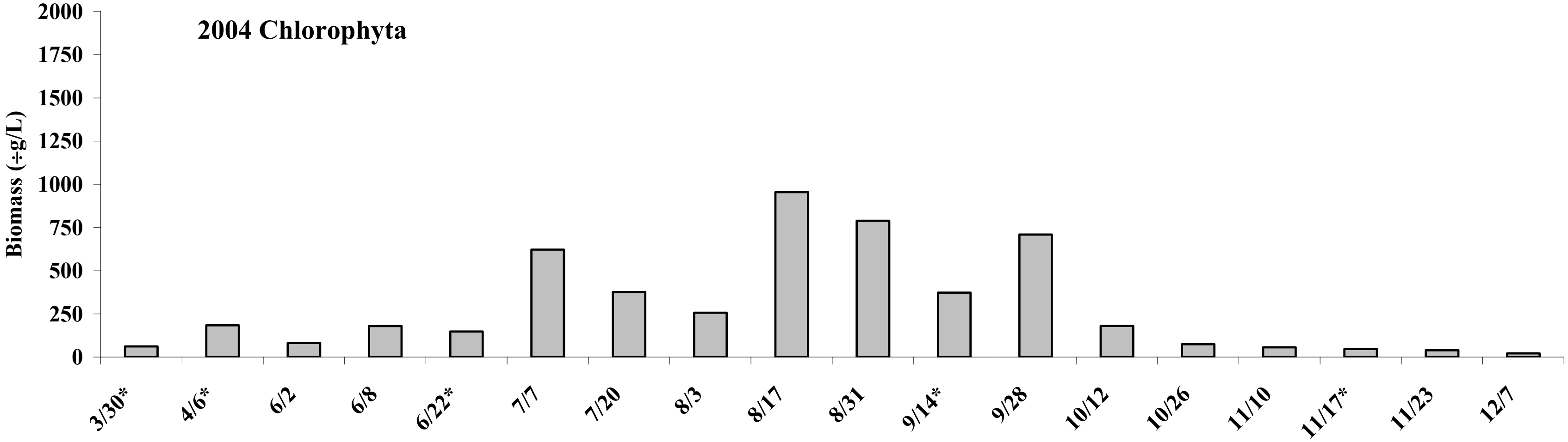


Figure A2-5A-G. Biomass (÷g/L) of (A) Bacillariophyta 2003-2004, (B) Chlorophyta 2003-2004, (C) Chrysophyta 2003-2004, (D) Cryptophyta 2003-2004, (E) Cyanophyta 2003-2004, (F) Miscellaneous Microflagellates 2003-2004, (G) Pyrrhophyta 2003-2004; from integrated upper mixed layer (UML) samples from Onondaga Lake "South" sampling station. The dates with an asterisk ("*") indicates that the sample is an average of "North" and "South" site collections.





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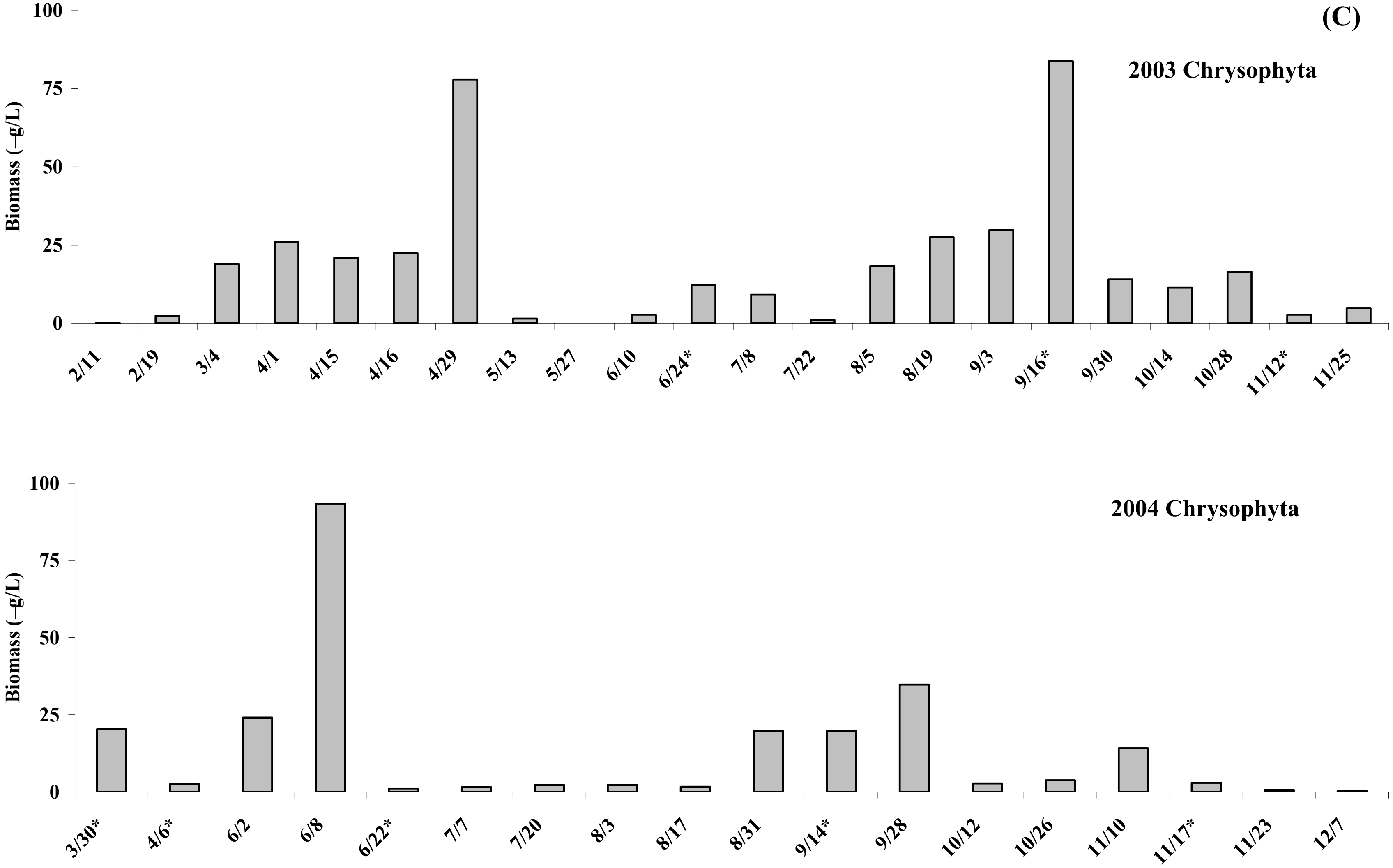

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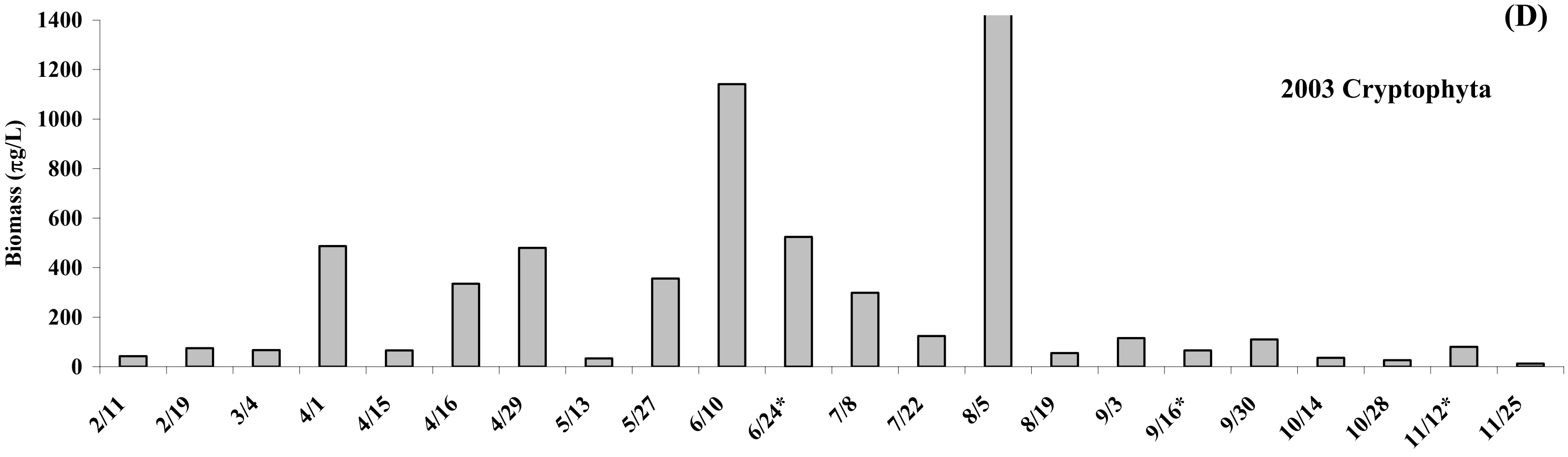

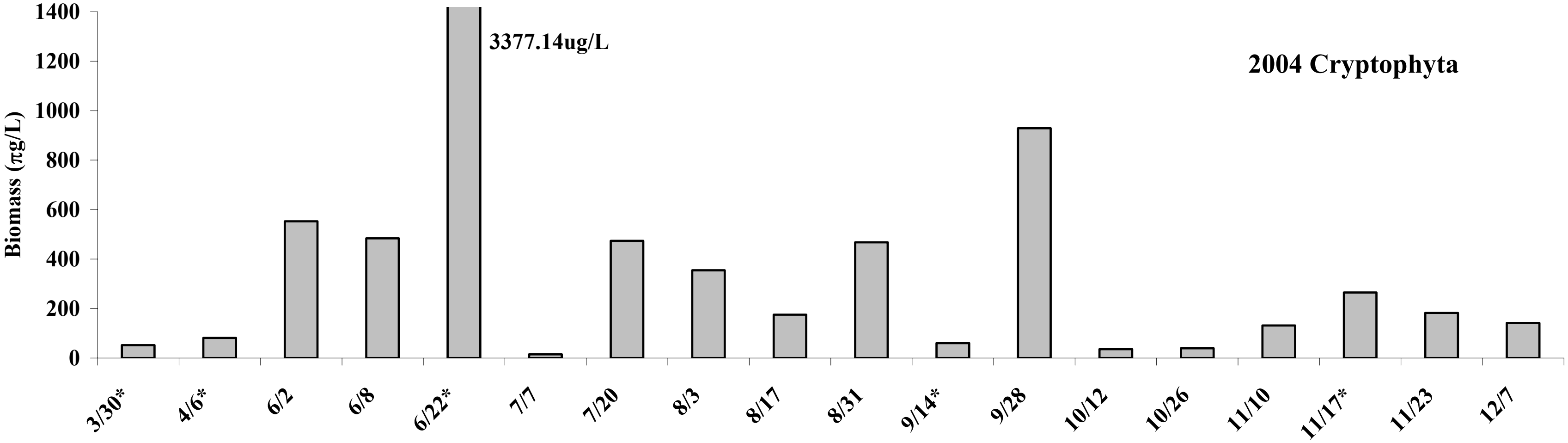

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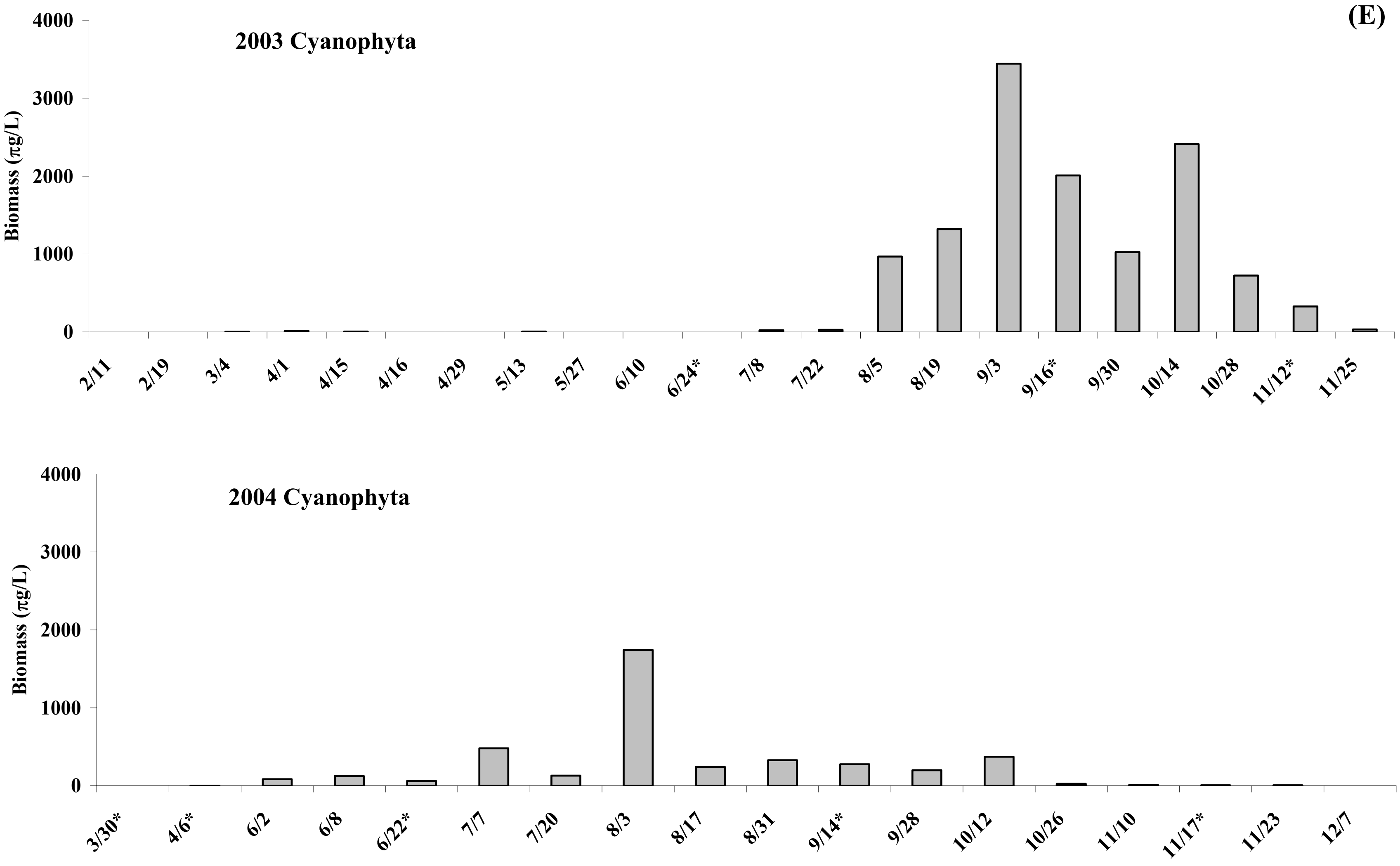

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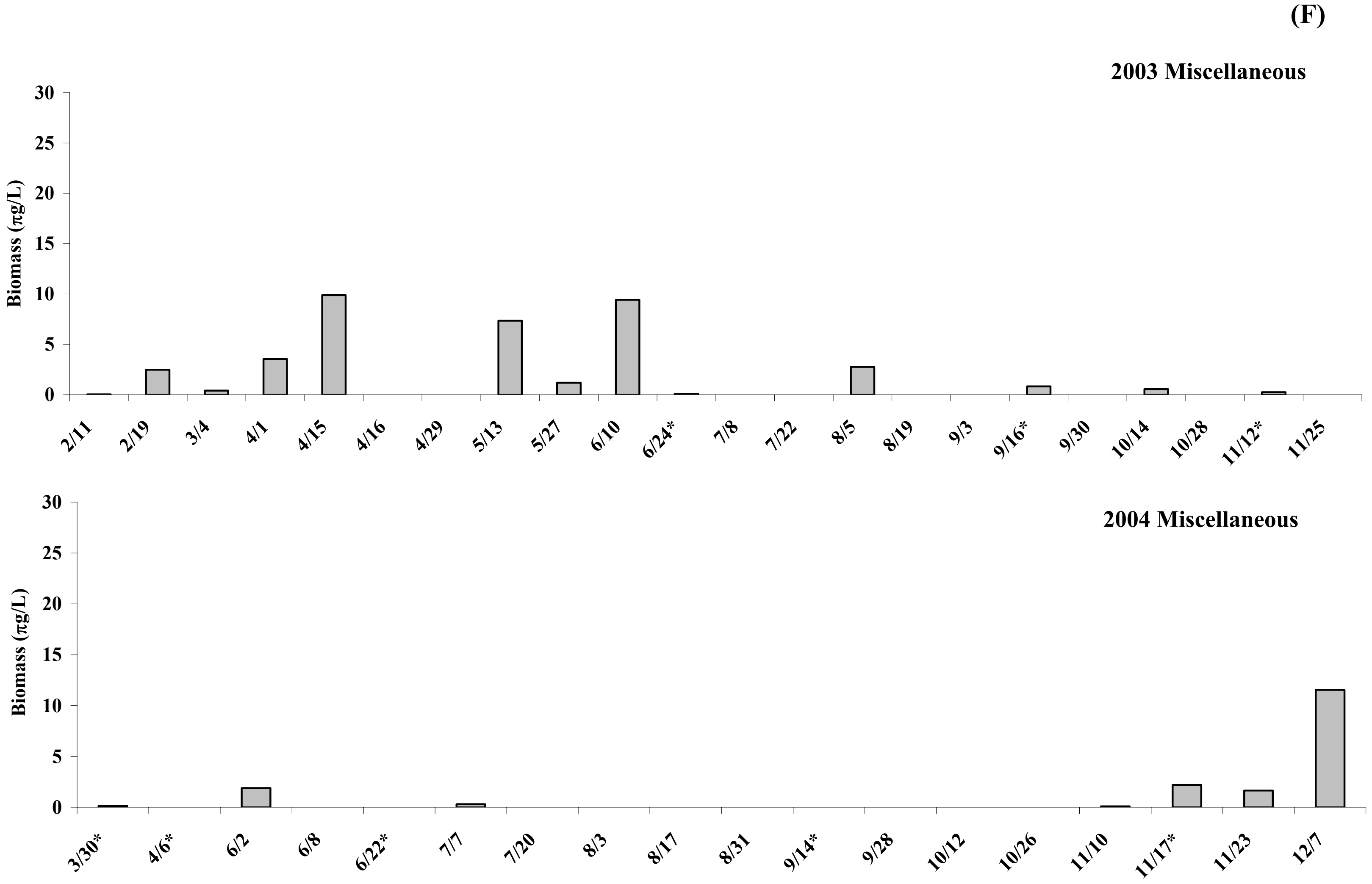

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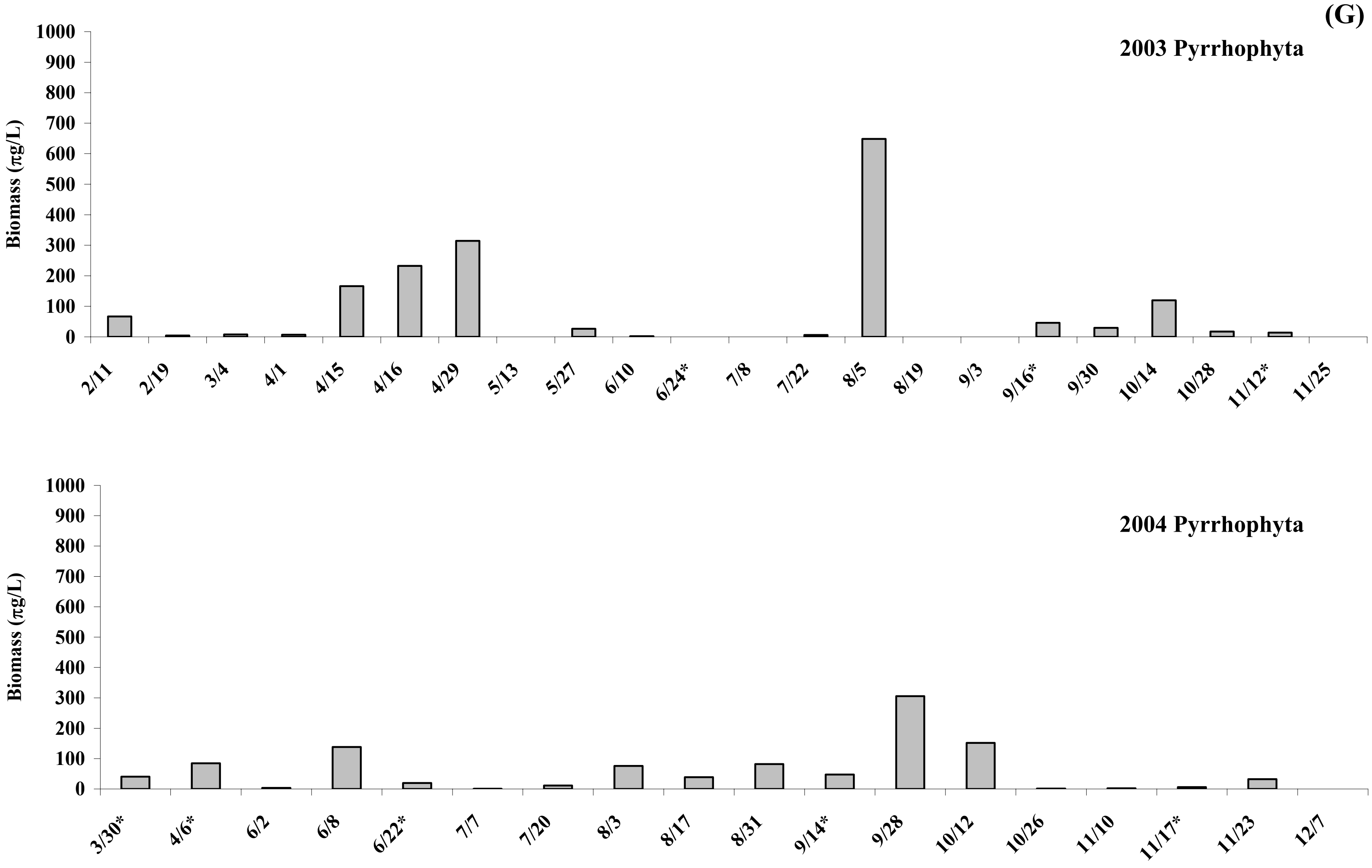

Figure A2-5. Continued

seen in 2003 was not present in 2004, but this may be due to a lack of sampling during the period the spring peak likely occurred (Figure A2-6F). Overall Pyrrhophyta biomass in 2004 (1,026 µg/L) was slightly lower than in 2003 (1,555µg/L), but exhibited similar seasonal trends (Figure A2-5G).

Seasonal changes in phytoplankton size were examined by dividing the phytoplankton into two functional groups based on cell or colony size. Netplankton were categorized as phytoplankton greater than 50 µm in length and nannoplankton were less than 50 µm in length. Nannoplankton abundance reached a much greater maximum (1.23 x 10^7 per liter) than that seen for netplankton (3.08 x 10^5. per liter). Nannoplankton abundance peaked twice, once in early June and once in mid to late July, while the netplankton had no significant abundance peaks (Figure A2-6A). Overall nannoplankton biomass (25,151µg/L) was almost 4 times the overall biomass of the netplankton (6,467µg/L) Nannoplankton biomass had four peaks (6/2, 6/22, 7/20, and 9/14) of at least 3,000 µg/L during the year, while only once (8/3) did the netplankton exceed the biomass of the nannoplankton with a value of 1,790µg/L (Figure A2-6A).

Zooplankton Community Structure.

A summary of the zooplankton community in Onondaga Lake from March 30 to December 7, 2004 is presented in Appendix C. A total of 13 species, as well as nauplii and copepodites, were identified in Onondaga Lake in 2004. The dominant cladoceran was *Bosmina longirostris*. Other cladocerans present included *Diaphanosoma birgei*, *Ceriodaphnia quadrangula*, *Alona* sp., *Daphnia mendotae*, *Daphnia pulicaria*, *Leptodora kindti*, and *Cercopagis pengoi*. The dominant copepods during the year were *Diacyclops thomasi, Acanthocyclops vernalis,* and nauplii. Copepod species appearing less frequently were *Mesocyclops edax*, *Diaptomus sicilis*, and *Diaptomus minutus*. Copepod abundance was low, contributing less than 20% of zooplankton biomass in the summer and fall of 2004. Adult cyclopoid copepods were detected throughout the year, but mature calanoid copepods were rare, having been detected only several instances throughout the entire season.

Zooplankton Abundance and Biomass.

A summary of seasonal changes in the biomass, average size and abundance of the total zooplankton community, cladocerans, copepods, and individual species is presented in Table A2-1. Total zooplankton density and biomass were much higher during late spring and early summer

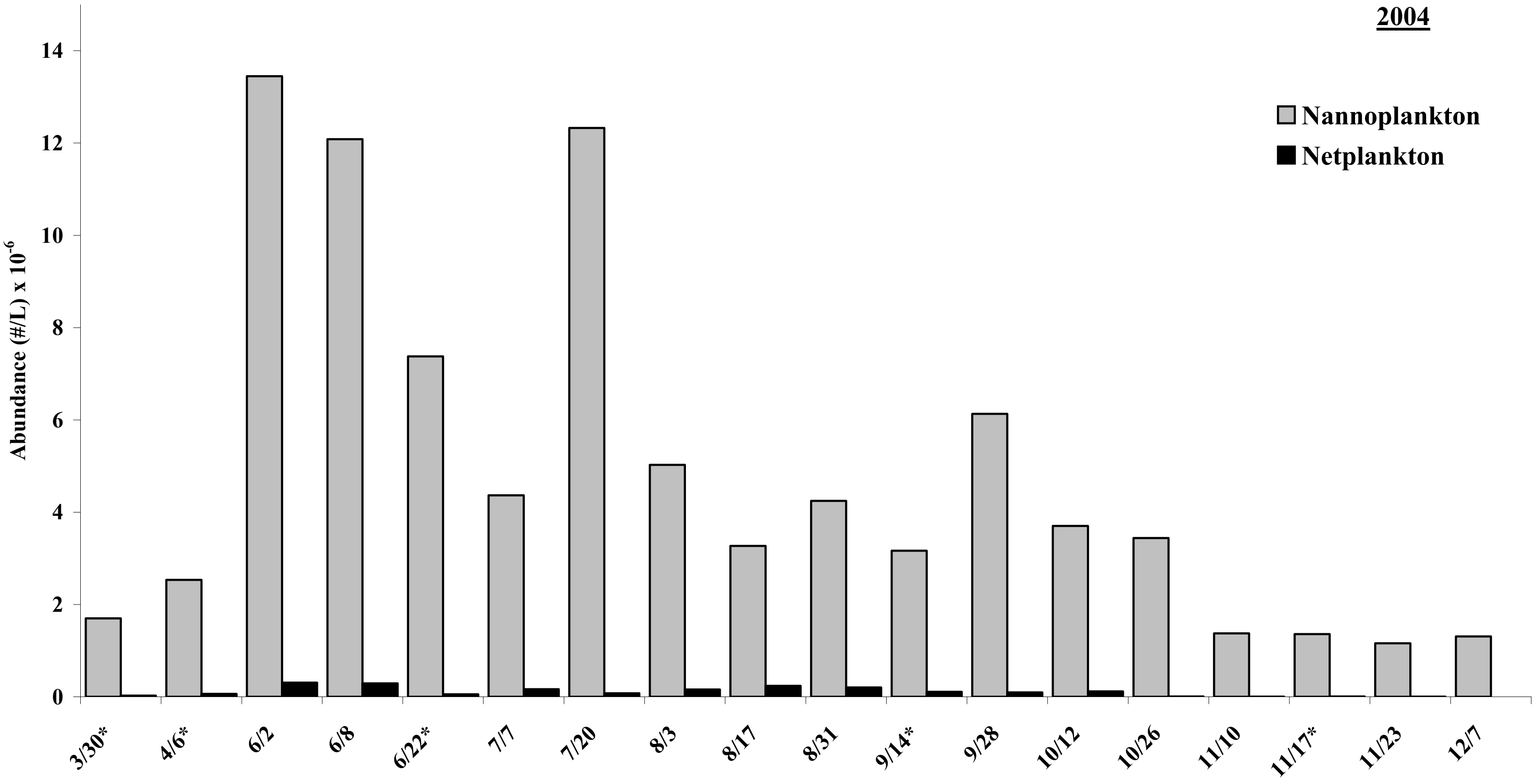

Figure A2-6A. Abundance (8/L) x 10^{-6} of Nannoplankton (<50mm) and Netplankton (>50mm) collected from Onondage Lake durring 2004. Data are averages of intergrated upper mixed layer samples 3/30/04 - 12/7/04. An asterisk indicates "North" station samples were taken in addition to "South" station samples.

than at any other time in 2004 (Table A2-1). Zooplankton densities were lowest in late March and were highest in late June (Figure A2-7A). Total zooplankton biomass followed a similar pattern, reaching a low in early April (21.1 µg/L), and peaking in late June (1508.2 µg/L) (Figure A2-7B). Total biomass exceeded 100 µg/L on only four sampling dates: June 22 (peak biomass of 1508.2 µg/L), July 7 (859.3 µg/L), July 20 (111.3 µg/L), and October 26 (161.3 µg/L) (Figure A2-7A, A2-7B).

We analyzed the zooplankton community by assessing the relative proportion in density and biomass by taxa and by species. By taxa, cladoceran proportion abundance was high from early June through November, with copepod proportion abundance only dominating in March and April (Figure A2-8A). The proportion of zooplankton biomass occupied by cladocerans and copepods mirrored their relative abundance (Figure A2-8B). The cladoceran zooplankton community was proportionally dominated by *Bosmina longirostris* for nearly the entire season, only reaching a low of 53% in mid-August (Figure A2-9A). *Cercopagis pengoi* was a significant contributor to cladoceran biomass in mid-September and early October, with a peak contribution of 11% in late September. During the August through October reduction in *B. longirostris* biomass, *Diaphanosoma birgei, Daphnia mendotae, C. pengoi, Ceriodaphnia quadrangula, Leptodora kindti, D. pulicaria,* and *Alona* sp. rounded out the cladoceran biomass contribution. The importance of *Bosmina longirostris* was consistent with our observations from 1996 through 2003. Although *D. mendotae* was detected more frequently than in 2003, it was only found between August and November, and was then a minor contributor to zooplankton biomass. The copepod community was largely dominated by *D. thomasi* for the majority of the season, although *A. vernalis* was also a significant contributor from March to September. Declines in *D. thomasi* and *A. vernalis* relative abundance were mostly filled out by *Mesocyclops edax*, nauplii, and diaptomids (Figure A2-9B). *Bosmina longirostris* and *D. thomasi* were by far the dominant species in the zooplankton community throughout the year (Figure A2-10).

Zooplankton Community Size Structure.

A summary of mean size of the crustacean zooplankton community is shown in Table A2-1. The mean size of the crustacean community was 0.35 mm in each of the spring, summer, and fall, with a March through December average of 0.35 mm. The highest mean size of zooplankton (0.68 mm) was observed on a single date (3/30), while average body lengths ranged from 0.26 to 0.45 mm for the remainder of 2004.

Table A2-1. Zooplankton data collected from Onondaga Lake, March 30 through December 7, 2004.

Taxon		Spring (n = 5) 3/30, 4/6*, 6/2, 6/8, 6/22*			Summer (n = 6) 7/7, 7/20, 8/3, 8/17, 8/31, 9/14*		
		Density (animals/L)	*Ave. Size (mm)*	*Biomass (µg/L)*	*Density (animals/L)*	*Ave. Size (mm)*	*Biomass (µg/L)*
Total Community	mean	617.37	0.35	457.06	198.70	0.35	177.24
	SE	327.07	0.03	234.17	102.11	0.01	86.32
Cladocerans	mean	426.03		308.89	211.06		184.66
	SE	408.03		295.41	154.33		133.15
Copepods	mean	20.05		25.13	8.57		10.03
	SE	4.62		2.92	2.28		2.39
Bosmina longirostris	mean	598.33	0.32	433.63	182.89	0.29	156.86
	SE	329.02	0.02	236.21	101.50	0.00	87.16
Daphnia mendotae	mean	0.00	0.00	0.00	2.30	0.48	2.84
	SE	0.00	0.00	0.00	0.63	0.13	0.73
Diacyclops thomasi	mean	7.68	0.67	19.52	4.02	0.58	5.93
	SE	1.53	0.07	3.59	0.82	0.07	0.98
Mesocyclops edax	mean	0.00	0.00	0.00	0.04	0.08	0.39
	SE	0.00	0.00	0.00	0.04	0.08	0.39
Nauplii and Copepodites	mean	10.58	0.18	1.06	3.66	0.36	0.83
	SE	2.73	0.04	0.26	1.15	0.10	0.37
Diaptomids	mean	0.00	0.00	0.00	0.03	0.21	0.14
	SE	0.00	0.00	0.00	0.03	0.15	0.14
Cercopagis pengoi	mean	0.00	0.00	0.00	0.61	0.72	1.97
	SE	0.00	0.00	0.00	0.43	0.13	0.83

Notes:

Density (animals/L), average size (mm), and biomass (µg/L) of the total zooplankton community, cladocerans, copepods, and individual taxa collected from Onondaga Lake, NY, 3/30/04-12/7/04.

Data are grouped by season into Spring (n=5), Summer (n=6), and Fall (n=7). Yearly averages (n=18) are also listed. An asterisk ("*") indicates that the sample is an average of "North" and "South" site collections. All averages are generated from UML and 15m tows. Data are mean and standard errors (SE).

Table A2-1. *continued*

Taxon		**Fall (n = 7) 9/28, 10/12, 10/26, 11/10, 11/17*, 11/23, 12/7**			**Year (n = 18)**		
		Density (animals/L)	*Ave. Size (mm)*	*Biomass (µg/L)*	*Density (animals/L)*	*Ave. Size (mm)*	*Biomass (µg/L)*
Total Community	mean	80.67	0.35	67.30	228.41	0.35	183.64
	SE	15.48	0.01	12.57	120.22	0.01	90.05
Cladocerans	mean	59.72		52.09	211.92		167.61
	SE	19.85		16.98	120.62		90.10
Copepods	mean	20.74		14.68	16.49		16.04
	SE	3.47		2.02	2.33		1.94
Bosmina longirostris	mean	58.10	0.30	49.58	209.17	0.30	163.81
	SE	14.68	0.01	11.99	120.85	0.01	90.40
Daphnia mendotae	mean	0.69	0.41	1.11	0.99	0.32	1.31
	SE	0.23	0.10	0.42	0.39	0.09	0.46
Diacyclops thomasi	mean	16.48	0.47	14.52	9.90	0.55	13.30
	SE	1.86	0.01	1.63	1.64	0.04	1.90
Mesocyclops edax	mean	0.00	0.00	0.00	0.02	0.03	0.15
	SE	0.00	0.00	0.00	0.02	0.03	0.15
Nauplii and Copepodites	mean	4.69	0.33	0.79	6.13	0.31	0.87
	SE	1.82	0.07	0.49	1.49	0.06	0.24
Diaptomids	mean	0.00	0.00	0.00	0.01	0.07	0.03
	SE	0.00	0.00	0.00	0.01	0.06	0.03
Cercopagis pengoi	mean	0.07	0.20	0.37	0.24	0.31	0.71
	SE	0.04	0.11	0.23	0.17	0.11	0.33

Notes:

Density (animals/L), average size (mm), and biomass (µg/L) of the total zooplankton community, cladocerans, copepods, and individual taxa collected from Onondaga Lake, NY, 3/30/04-12/7/04.

Data are grouped by season into Spring (n=5), Summer (n=6), and Fall (n=7). Yearly averages (n=18) are also listed. An asterisk ("*") indicates that the sample is an average of "North" and "South" site collections. All averages are generated from UML and 15m tows. Data are mean and standard errors (SE).

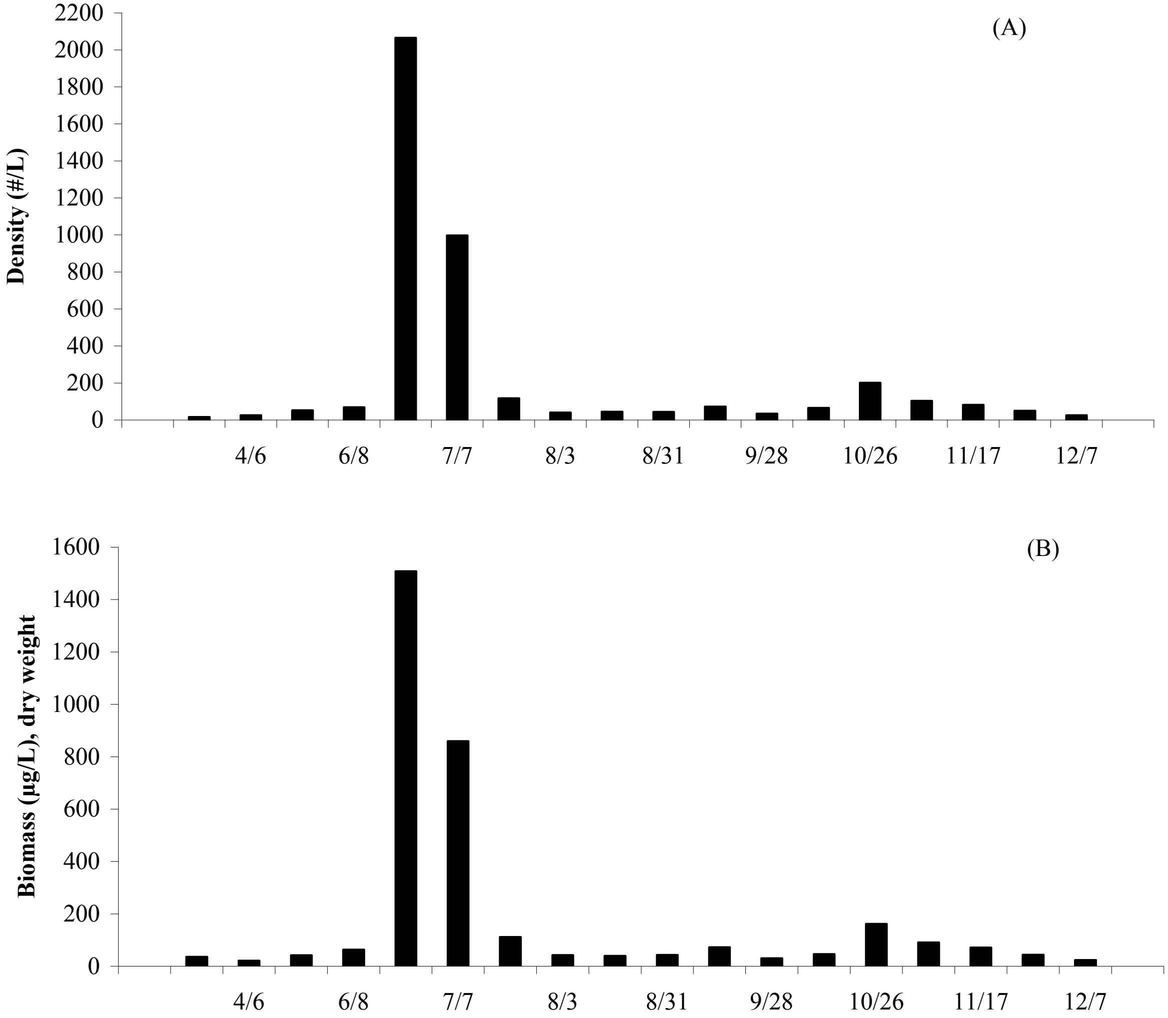

Figure A2-7. (A) Density (#/L) and (B) dry weight biomass (µg/L) of zooplankton community in Onondaga Lake South Station, March-December 2004.

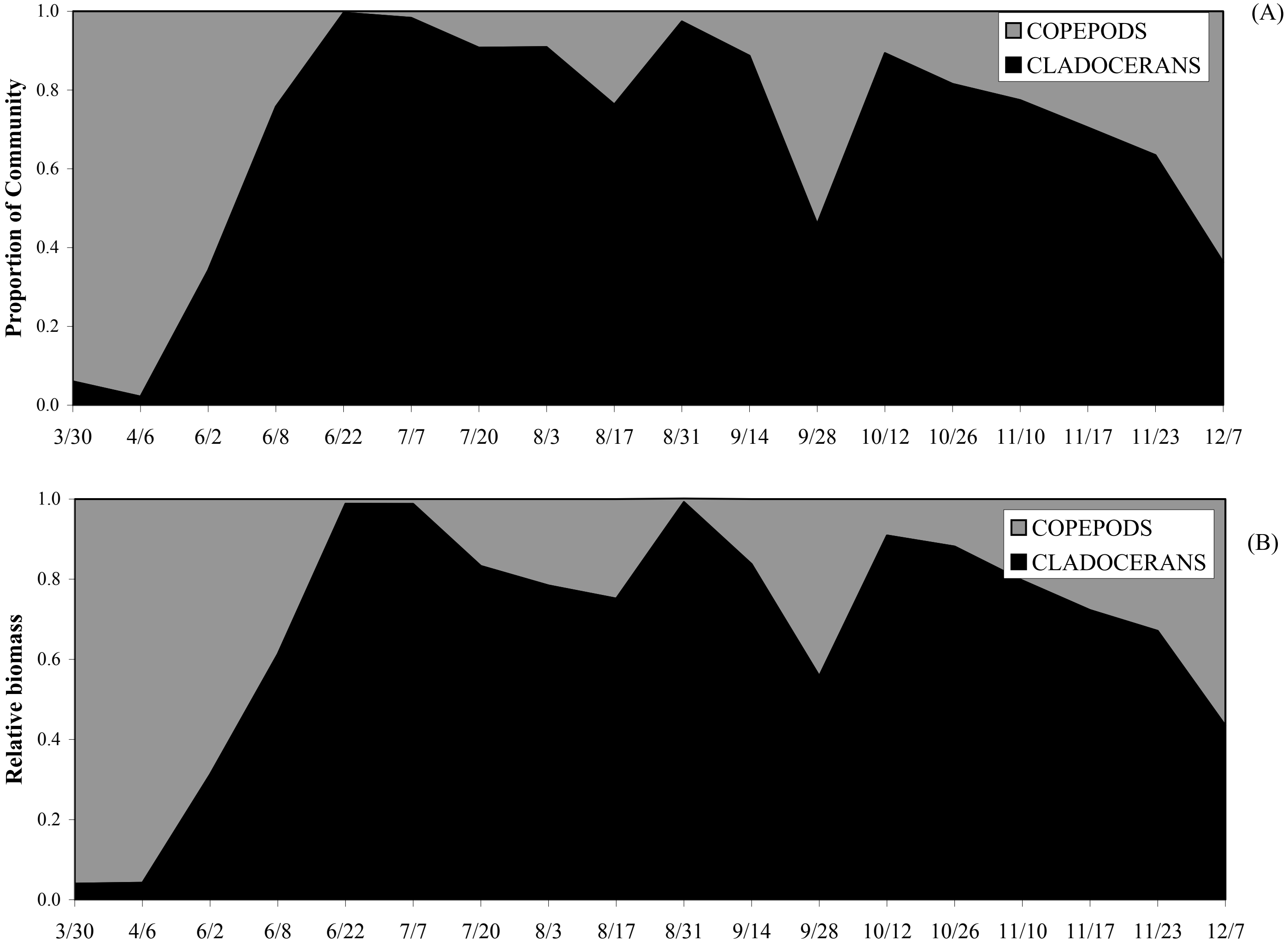

Figure A2-8. (A) Relative abundance and (B) relative biomass of cladocerans and copepods in Onondaga Lake during 2004.

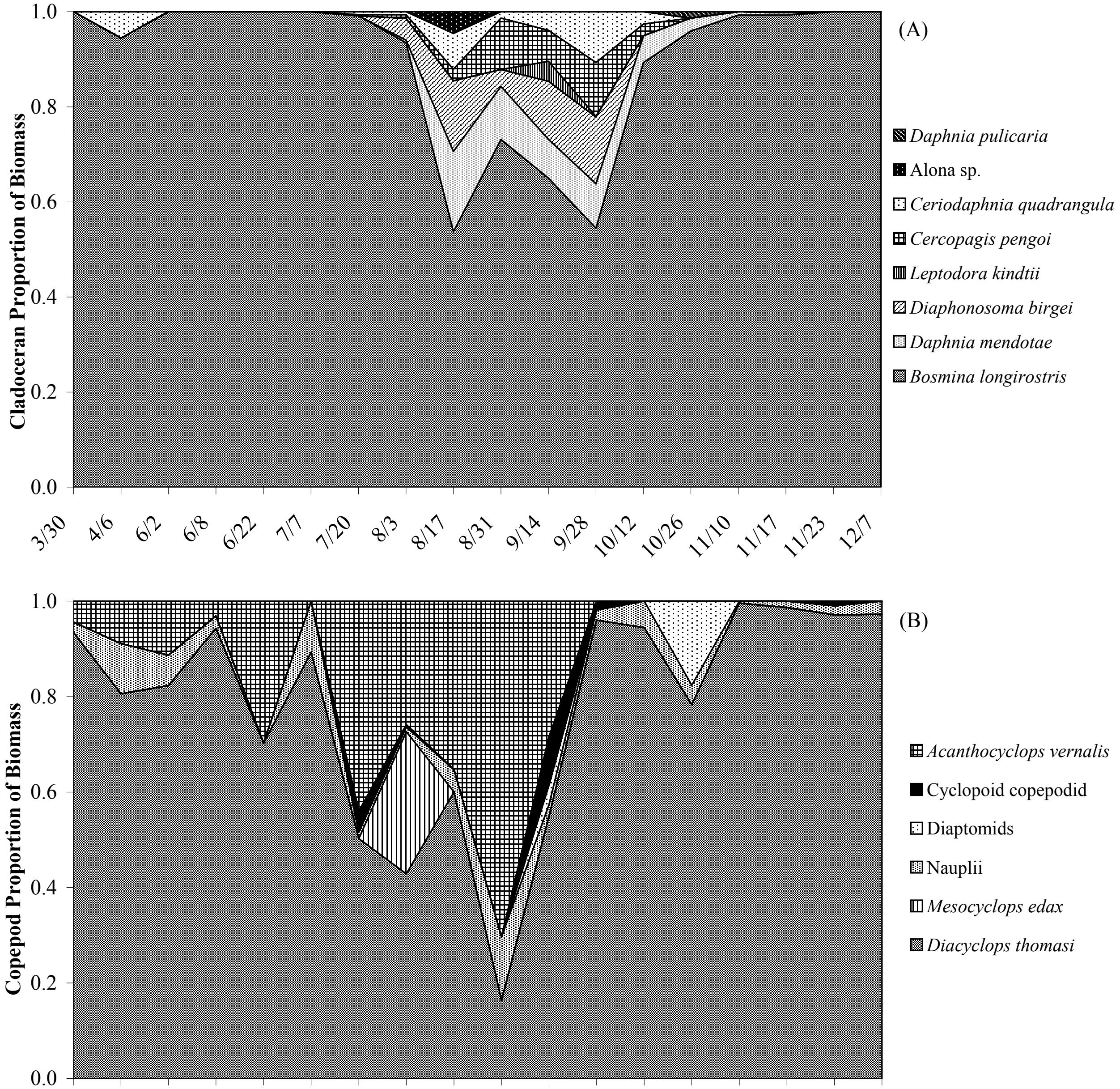

Figure A2-9. (A) Contributions to the total cladoceran biomass by each species in the Onondaga Lake cladoceran community from March to December 2004. (B) Proportion of total copepod biomass contributed by each copepod species during this same time period in Onondaga Lake.

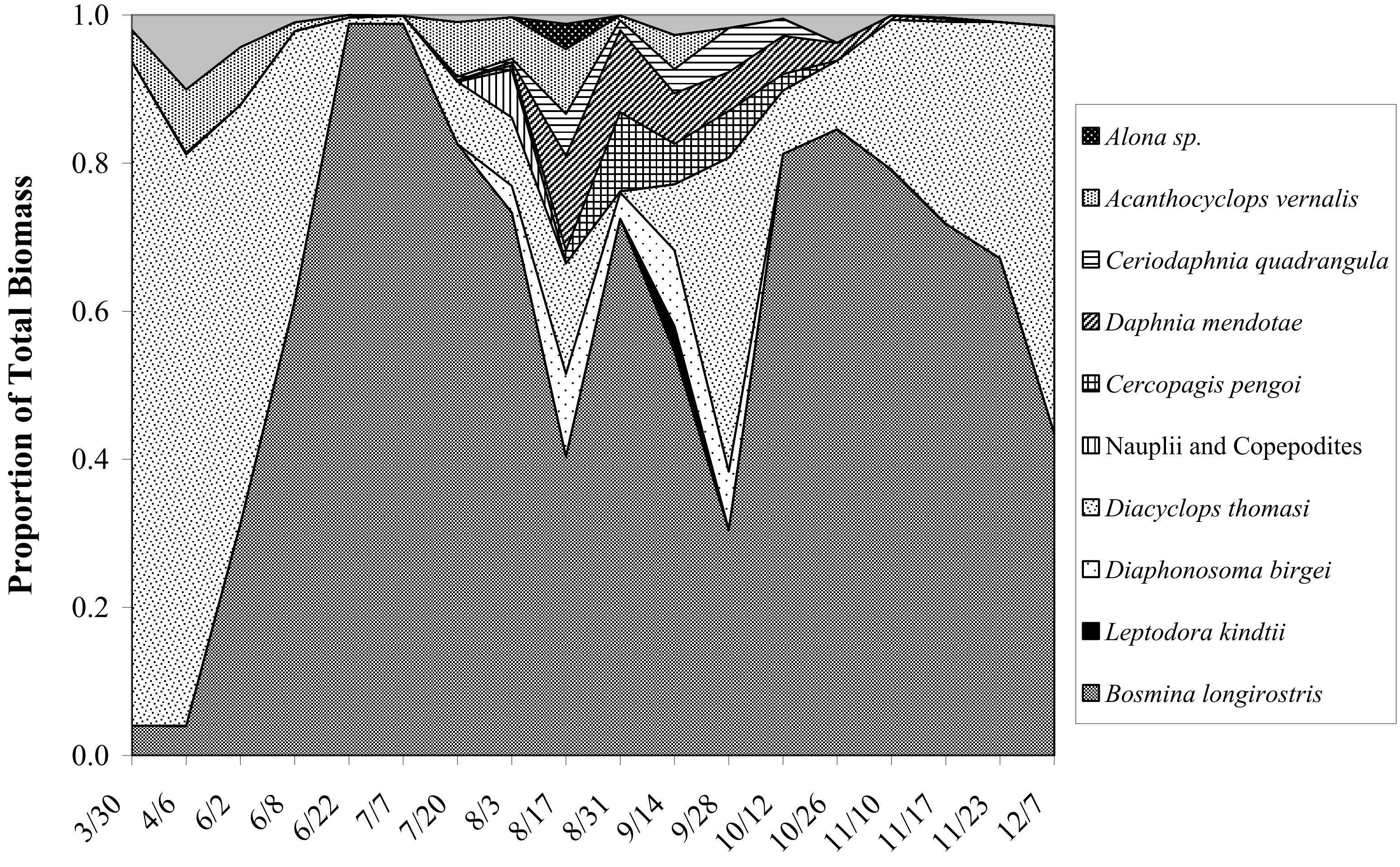

Figure A2-10. Relative biomass of major zooplankton species in Onondaga Lake in 2004.

We compared mean adjusted zooplankton size found at the Shackelton Point site of Oneida Lake (February - November 2004) with mean adjusted zooplankton size for the entire season in Onondaga Lake. The 80-micron mesh net used to collect zooplankton samples in Onondaga Lake is nearly half the mesh size (153 micron) Mills and Schiavone (1982) used in their studies and in Oneida Lake. Consequently, the average size of Onondaga Lake zooplankton would be expected to be lower compared to samples collected with a 153 micron net because of the likelihood of retaining higher numbers of small zooplankton such as nauplii. To compensate for the differing mesh sizes, we adjusted the mean zooplankton size by excluding nauplii from the average zooplankton lengths that were calculated after analyzing samples from both lakes. Our results indicated that temporal patterns in zooplankton size were dissimilar between the two lakes, with average adjusted zooplankton size in Oneida being larger than in Onondaga for corresponding dates for nearly the entire season, and by a large margin from May to early August (Figure A2-11). For Oneida Lake, average adjusted zooplankton size was largest in the late spring (1.48 mm) and smallest in late September (0.38 mm). In Onondaga Lake, average adjusted zooplankton size was largest in the late March (0.96 mm), and then declined to its smallest value in mid-June (0.28 mm), remaining low for the duration of the year (Figure A2-11).

Cercopagis pengoi.

The exotic zooplankton *Cercopagis pengoi* was observed in 2004 as it has been in 2000, 2002, and 2003. It was found in samples collected on seven dates (7/20, 8/3, 8/17, 8/31, 9/14, 9/28, and 10/12), spanning from mid-summer to mid-fall. While the biomass of the species is relatively small (maximum value of 4.62 μg/L), it did reach proportions of roughly 10% of the total biomass in the late summer of 2004, thus possessing great potential to impact the zooplankton community through predation (Ojaveer et al. 2000).

Significant Findings

Onondaga Lake remains a productive aquatic system as evidenced by its high levels of algal biomass. The duration of the cyanobacteria blooms in Onondaga Lake declined from 1996-2000. For example, cyanobacteria blooms (typically dominated by *Aphanizomenon flos-aquae*) that historically occurred July through October (1996) decreased in duration (middle to late July through August) from 1997 to 2000. In 2001 there was no significant cyanobacterial bloom

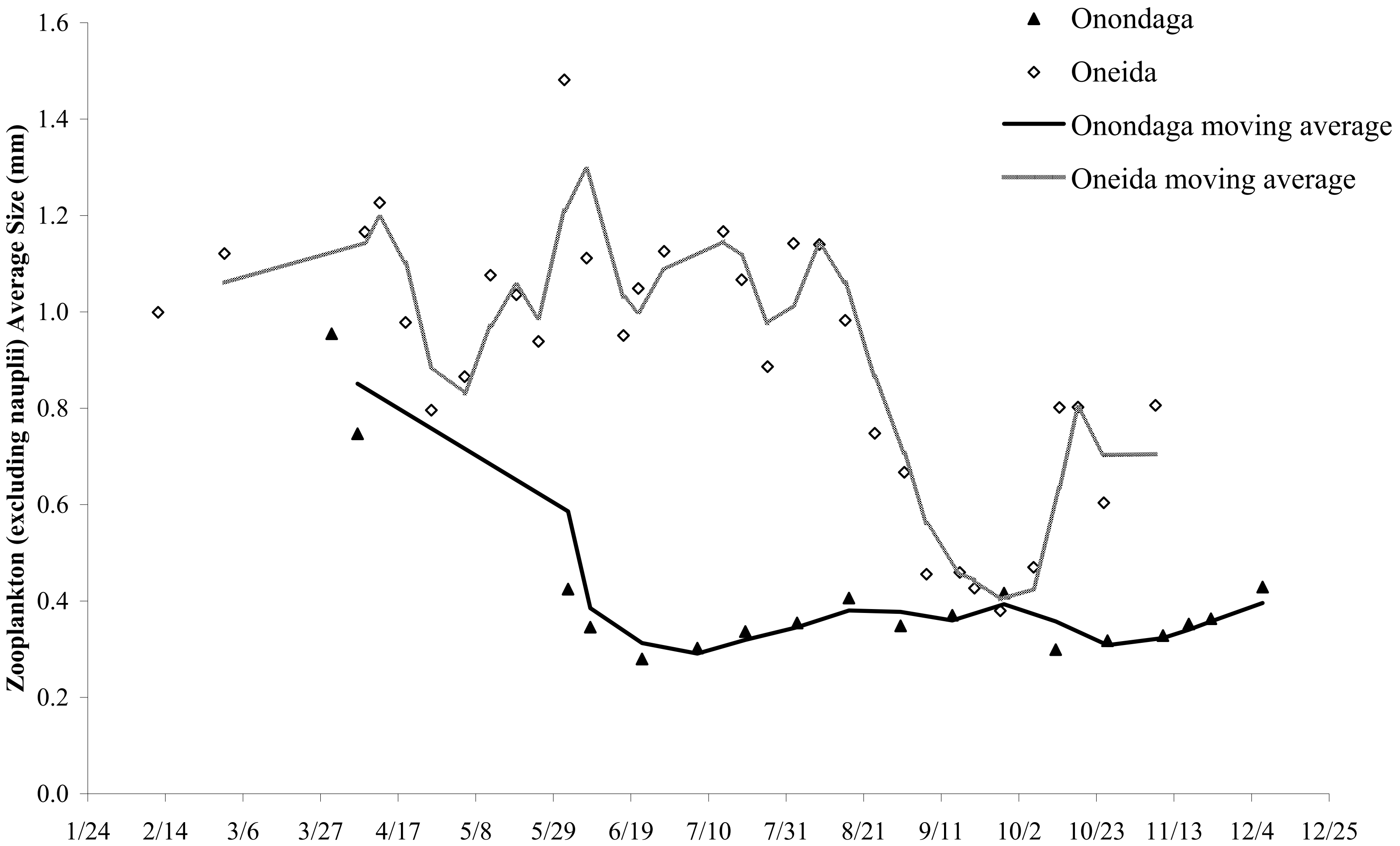

Figure A2-11. Adjusted average zooplankton (excluding nauplii) lengths (mm) in both Oneida (February - November 2004) and Onondaga Lake (March - December 2004). Averages represent a composite of all samples for each date. Trend lines reflect averages between two adjacent data points.

documented. The 2002 sampling season saw a reversal of this declining trend however, with cyanobacteria blooms of greater magnitude, lasting from late June through mid-September. A similar resurgence of cyanobacteria was again seen in 2003, but the onset of the bloom did not occur until mid-August, and remained in significant quantity through the end of October. During the 2004 sampling season only one minor peak was seen in early August (1741µg/L) with no lengthy period of late season dominance like that seen in either 2002 or 2003. The resurgence of cyanobacteria seen in 2002 and 2003 may still reflect changes in the food web that favors blooms of cyanobacteria, but the limited cyanobacteria productivity observed in 2004 could signal an overall improvement of water quality.

Average total zooplankton biomass in nearby Oneida Lake (Cornell Biological Field Station unpublished data) was 235 µg/L for a single deep site (February - November 2004), while it averaged 184 µg/L in all of Onondaga Lake for the same time period. 2004 was the first year since 1996 that average total zooplankton biomass was greater in Oneida Lake than Onondaga Lake.

During both 1996 and 2004, small zooplankton dominated Onondaga Lake while larger species, especially *Daphnia pulicaria*, led to high average total zooplankton biomass in Oneida Lake. Onondaga Lake zooplankton biomass was moderate during most of the 2004 season (between 21 and 161 µg/L), but skyrocketed to 1508 µg/L in late June and 859 µg/L in early July. In contrast, Oneida Lake zooplankton biomass was more consistent, remaining above 100 µg/L on all sampling dates between May and November. Temporal patterns in average zooplankton size showed little similarity between the two lakes (Figure A2-11). The consistently small average size of the total zooplankton community in Onondaga Lake throughout the seasons in 2004 (0.35 mm year-round) is similar to 2003. In contrast, during 2002 average size showed more variation, changing from 0.92 mm in winter to 0.27 mm in fall. Associated with this change in size structure is the dominance of the small cladoceran *B. longirostris*, but also a much-reduced *Daphnia* population and few mature calanoid copepods throughout the 2004 season. These findings suggest intense planktivory by plankton-eating fish in 2004.

Populations of *Daphnia* have a tremendous capability to exert strong influence on the phytoplankton community (Mills *et al*. 1987). The low number of *Daphnia* individuals in Onondaga Lake in 2004 was likely linked to the increased density/biomass and drastically different composition of the phytoplankton community in 2004 when compared to previous years other than 2003. The potential significance of alewife grazing pressure is unknown; these fish were prolific in 2003 and 2004. *Cercopagis pengoi* again appeared in the lake in the 2004 season. Interestingly, the periods of *Cercopagis* detection in the lake also represent periods of decreased dominance by *Bosmina longirostris* (Figure A2-10) and a late-summer to early-fall season rise in average adjusted size (Figure A2-11), suggesting that *Cercopagis* predation may be structuring the zooplankton community.

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APPENDIX 2A

Job ID	Lake	Date	Site	Station	Sample Type	Depth	Depth Note	Taxa Code	Division	Genus	Species	GALD	Concentration (natural unit/ml)	Relative Concentration (%)	Biovolume (um3/unit)	Total Biovolume (um3/ml)	Relative Total Biovolume (%)
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	1178	Bacillariophyta	Achnanthes	exigua	20	4.3275	0.00206348	502.6548	2175.2255	0.00508413
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	9141	Bacillariophyta	Anomoeoneis	vitrea	24	4.3275	0.00206348	603.1858	2610.2708	0.00610095
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	1021	Bacillariophyta	Asterionella	formosa	88	3.135	0.00149486	3168	9931.5331	0.02321285
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	1076	Bacillariophyta	Cyclotella	meneghiniana	16	4.3275	0.00206348	1608.4954	6960.7218	0.01626921
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	1862	Bacillariophyta	Cymbella	affinis	30	4.3275	0.00206348	720	3115.7812	0.00728248
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	9397	Bacillariophyta	Fragilaria	capucina	64	3.135	0.00149486	5428.6721	17018.6353	0.03977745
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	9687	Bacillariophyta	Navicula	viridula	44	6.2699	0.00298967	2488.1414	15600.4158	0.03646266
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	9818	Bacillariophyta	Stephanodiscus	medius	22.6667	38.9473	0.01857118	4666.3123	181740.1011	0.42477893
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	1298	Bacillariophyta	Stephanodiscus	parvus	8	34.6198	0.01650771	201.0619	6960.721	0.01626921
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	1477	Bacillariophyta	Synedra	filiformis	92	4.3275	0.00206348	828	3583.1484	0.00837485
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	9504	Bacillariophyta	Synedra	tenera	80	4.3275	0.00206348	720	3115.7812	0.00728248
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	2683	Chlorophyta	.	.	6	12.9824	0.00619038	113.0973	1468.2768	0.00343179
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	2080	Chlorophyta	Chlamydomonas	.	7.5	238.0111	0.11349047	143.6964	34201.3329	0.07993836
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	2082	Chlorophyta	Chlamydomonas	globosa	7.3333	86.5495	0.04126927	216.4208	18731.1072	0.04377999
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	2085	Chlorophyta	Chlamydomonas	platystigma	6	4.3275	0.00206348	50.2655	217.5226	0.00050841
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	2501	Chlorophyta	Selenastrum	minutum	6	4.3275	0.00206348	32.0285	138.6025	0.00032395
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	7.3333	69.2396	0.03301541	98.698	6833.8083	0.01597258
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	7111	Chrysophyta	Gonyostomum	semen	24	3.135	0.00149486	904.7787	2836.4393	0.00662958
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	1180	Chrysophyta	Mallomonas	.	12	4.3275	0.00206348	402.1239	1740.1807	0.0040673
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	1631	Chrysophyta	Uroglena	.	4	519.2969	0.24761556	30.2431	15705.147	0.03670745
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	3015	Cryptophyta	Cryptomonas	erosa	12.6667	38.9473	0.01857118	347.6696	13540.78	0.0316487
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	3018	Cryptophyta	Cryptomonas	lucens	10	8.6549	0.0041269	167.5516	1450.1503	0.00338942
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	3043	Cryptophyta	Rhodomonas	minuta	7.3333	778.9453	0.37142332	25.6563	19984.8542	0.04671036
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	3041	Cryptophyta	Rhodomonas	minuta	12	116.8418	0.0557135	147.6549	17252.2635	0.04032351
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	4285	Cyanophyta	Synechocystis	.	2.6667	8.6549	0.0041269	10.821	93.6552	0.0002189
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	7140	Miscellaneous	.	.	3	21.6374	0.01031733	6.2832	135.9519	0.00031776
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	6060	Pyrrhophyta	Amphidinium	.	12	12.9824	0.00619038	201.0619	2610.2704	0.00610095
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	6032	Pyrrhophyta	Gymnodinium	sp. 1	24	12.9824	0.00619038	1451.4158	18842.8919	0.04404126
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	30.2923	0.01444423	603.1858	18271.8955	0.04270668
060	Onondaga	3/30/2004	2401141	South	Grab	Epi	0-6m	6034	Pyrrhophyta	Gymnodinium	sp. 3	8	12.9824	0.00619038	75.3982	978.8512	0.00228786
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	1021	Bacillariophyta	Asterionella	formosa	63.3333	13.6315	0.0100508	750	10223.657	0.04012614
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	1109	Bacillariophyta	Diatoma	tenuis	50	4.5438	0.00335024	1413.7167	6423.7132	0.025212
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	10355	Bacillariophyta	Navicula	pelliculosa	12	4.5438	0.00335024	169.646	770.8456	0.00302544
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	9687	Bacillariophyta	Navicula	viridula	50	9.0877	0.00670056	2827.4334	25694.8527	0.10084799
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	9818	Bacillariophyta	Stephanodiscus	medius	22	9.0877	0.00670056	4285.1324	38941.9769	0.15284073
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	1298	Bacillariophyta	Stephanodiscus	parvus	8	22.7192	0.01675135	201.0619	4567.9731	0.01792853
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	9504	Bacillariophyta	Synedra	tenera	80	4.5438	0.00335024	720	3271.5702	0.01284036
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	2683	Chlorophyta	.	.	6	9.0877	0.00670056	113.0973	1027.7938	0.00403392
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	2080	Chlorophyta	Chlamydomonas	.	6	436.2094	0.32162651	89.2152	38916.5059	0.15274076
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	2082	Chlorophyta	Chlamydomonas	globosa	5.8333	163.5785	0.12060992	117.7225	19256.8714	0.07557999
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	2083	Chlorophyta	Chlamydomonas	incerta	13	4.5438	0.00335024	1150.3465	5226.9991	0.0205151
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	2331	Chlorophyta	Micractinium	pusillum	20	4.5438	0.00335024	30.2431	137.42	0.00053935
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	7.3333	22.7192	0.01675135	98.698	2242.3433	0.00880082
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	1631	Chrysophyta	Uroglena	.	4	31.8069	0.02345191	30.2431	961.9403	0.00377545
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	3015	Cryptophyta	Cryptomonas	erosa	18	18.1754	0.01340111	552.9203	10049.5422	0.03944277
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	3018	Cryptophyta	Cryptomonas	lucens	10	9.0877	0.00670056	167.5516	1522.6579	0.00597618
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	3041	Cryptophyta	Rhodomonas	minuta	12.6667	109.0523	0.08040659	165.4572	18043.4951	0.07081769
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	3043	Cryptophyta	Rhodomonas	minuta	7	436.2094	0.32162651	29.3215	12790.3129	0.05019983
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	4041	Cyanophyta	Aphanizomenon	flos-aquae	140	2.1945	0.00161805	1759.2919	3860.709	0.01515264
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	4183	Cyanophyta	Oscillatoria	agardhii	680	4.5438	0.00335024	8545.132	38827.7772	0.15239252
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	6033	Pyrrhophyta	Gymnodinium	sp. 2	13	27.2631	0.02010167	385.3687	10506.3398	0.04123562
060	Onondaga	3/30/2004	2401142	South	Grab	Photic	0-3.8m	6034	Pyrrhophyta	Gymnodinium	sp. 3	10	9.0877	0.00670056	167.5516	1522.6579	0.00597618
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	1013	Bacillariophyta	Achnanthes	minutissima	14.6667	19.4736	0.00798559	128.8053	2508.3071	0.00283902
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	1021	Bacillariophyta	Asterionella	formosa	80	19.4736	0.00798559	953.3333	18564.8623	0.02101257
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	1071	Bacillariophyta	Cyclotella	sp. 1	5	6.4912	0.00266186	49.0874	318.6367	0.00036065
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	1109	Bacillariophyta	Diatoma	tenuis	50	6.4912	0.00266186	628.3185	4078.5478	0.00461629
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	1160	Bacillariophyta	Gomphonema	.	16	6.4912	0.00266186	108.1298	701.8933	0.00079444
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	9687	Bacillariophyta	Navicula	viridula	44	19.4736	0.00798559	1727.876	33648.0221	0.03808438
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	9118	Bacillariophyta	Nitzschia	linearis	144	2.1945	0.0008999	7238.2295	15884.0597	0.01797831
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	9818	Bacillariophyta	Stephanodiscus	medius	23	77.8945	0.03194239	4856.9022	378326.1127	0.42820695
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	1298	Bacillariophyta	Stephanodiscus	parvus	8	103.8594	0.04258989	201.0619	20882.1629	0.0236354
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	9504	Bacillariophyta	Synedra	tenera	94.6667	32.4561	0.01330936	1038.6667	33711.0226	0.03815569
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	2683	Chlorophyta	.	.	6	6.4912	0.00266186	113.0973	734.1384	0.00083093
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	2080	Chlorophyta	Chlamydomonas	.	7.1111	798.4189	0.32740966	175.9106	140450.3529	0.15896819
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	2082	Chlorophyta	Chlamydomonas	globosa	5.3333	759.4717	0.31143848	86.5683	65746.1709	0.07441455
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	2884	Chlorophyta	Scenedesmus	quadricauda	24	2.1945	0.0008999	134.0413	294.1493	0.00033293
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	2501	Chlorophyta	Selenastrum	minutum	6	12.9824	0.00532373	21.1595	274.7016	0.00031092
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	8	58.4209	0.02395681	152.9063	8932.9232	0.01011069
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	1653	Chrysophyta	.	.	6	6.4912	0.00266186	105.6832	686.0119	0.00077646
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	9511	Chrysophyta	Polygoniochloris	circularis	8	12.9824	0.00532373	158.067	2052.0924	0.00232265

Job ID	Lake	Date	Site	Station	Sample Type	Depth	Depth Note	Taxa Code	Division	Genus	Species	GALD	Concentration (natural unit/ml)	Relative Concentration (%)	Biovolume (um3/unit)	Total Biovolume (um3/ml)	Relative Total Biovolume (%)
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	1631	Chrysophyta	Uroglena	.	4	6.4912	0.00266186	30.2431	196.3143	0.0002222
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	3015	Cryptophyta	Cryptomonas	erosa	19	45.4385	0.01863308	735.1327	33403.3093	0.03780741
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	3018	Cryptophyta	Cryptomonas	lucens	10	12.9824	0.00532373	167.5516	2175.2255	0.00246202
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	3043	Cryptophyta	Rhodomonas	minuta	8	142.8066	0.05856106	33.5103	4785.4933	0.00541644
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	3041	Cryptophyta	Rhodomonas	minuta	10	90.877	0.03726616	147.6549	13418.4272	0.01518759
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	4172	Cyanophyta	Oscillatoria	limnetica	80	6.4912	0.00266186	141.3717	917.6735	0.00103867
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	6032	Pyrrhophyta	Gymnodinium	sp. 1	22	38.9473	0.01597122	1474.4542	57425.9582	0.06499735
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	6033	Pyrrhophyta	Gymnodinium	sp. 2	13.3333	97.3682	0.03992802	410.5014	39969.7669	0.04523963
060	Onondaga	4/6/2004	2405500	North	Grab	Upper Mixed	0-6m	6034	Pyrrhophyta	Gymnodinium	sp. 3	8	45.4385	0.01863308	75.3982	3425.9793	0.00387768
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	1010	Bacillariophyta	Achnanthes	.	24	7.2125	0.00261575	942.4778	6797.5801	0.00612367
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	1021	Bacillariophyta	Asterionella	formosa	72	21.6374	0.00784723	648	14021.0153	0.01263098
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	1119	Bacillariophyta	Cymbella	sinuata	24	7.2125	0.00261575	864	6231.5624	0.00561377
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	4272	Bacillariophyta	Diatoma	vulgaris	28	2.4383	0.0008843	351.8584	857.9354	0.00077288
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	1210	Bacillariophyta	Navicula	.	16	7.2125	0.00261575	226.1947	1631.4194	0.00146968
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	9101	Bacillariophyta	Navicula	subminuscula	10	7.2125	0.00261575	141.3717	1019.6372	0.00091855
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	9687	Bacillariophyta	Navicula	viridula	60	7.2125	0.00261575	3392.9201	24471.2885	0.02204521
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	1222	Bacillariophyta	Nitzschia	gracilis	70	2.4383	0.0008843	1759.2919	4289.6766	0.0038644
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	9126	Bacillariophyta	Nitzschia	subacicularis	50	7.2125	0.00261575	314.1593	2265.8603	0.00204122
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	9818	Bacillariophyta	Stephanodiscus	medius	23.5	129.8242	0.04708329	5225.254	678364.5049	0.61111163
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	1298	Bacillariophyta	Stephanodiscus	parvus	5	108.1868	0.03923606	49.0874	5310.611	0.00478412
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	9317	Bacillariophyta	Surirella	brebissonii	34	7.2125	0.00261575	2631.9289	18982.6726	0.01710074
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	9504	Bacillariophyta	Synedra	tenera	70	21.6374	0.00784723	630	13631.5427	0.01228012
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	2683	Chlorophyta	.	.	6	21.6374	0.00784723	150.7964	3262.8374	0.00293936
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	2031	Chlorophyta	Ankistrodesmus	falcatus	20	7.2125	0.00261575	25.6641	185.1012	0.00016675
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	2080	Chlorophyta	Chlamydomonas	.	6.2857	1495.6832	0.54243878	76.7446	114785.6056	0.10340579
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	2082	Chlorophyta	Chlamydomonas	globosa	6	189.327	0.06866314	113.0973	21412.3705	0.01928955
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	2083	Chlorophyta	Chlamydomonas	incerta	12	7.2125	0.00261575	904.7787	6525.677	0.00587872
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	8471	Chlorophyta	Nephroselmis	.	8	7.2125	0.00261575	145.7699	1051.3591	0.00094713
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	8303	Chlorophyta	Scenedesmus	opoliensis	30	7.2125	0.00261575	235.6194	1699.3947	0.00153092
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	11	21.6374	0.00784723	157.0444	3398.0277	0.00306115
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	9511	Chrysophyta	Polygoniochloris	circularis	8	7.2125	0.00261575	158.067	1140.0514	0.00102703
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	1631	Chrysophyta	Uroglena	.	4	28.8498	0.01046294	30.2431	872.5082	0.00078601
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	3015	Cryptophyta	Cryptomonas	erosa	22.6667	36.0623	0.0130787	1237.0894	44612.2671	0.04018942
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	3061	Cryptophyta	Cryptomonas	ovata	16	14.4249	0.00523147	603.1858	8700.9026	0.0078383
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	3069	Cryptophyta	Cryptomonas	rostratiformis	28	14.4249	0.00523147	1876.578	27069.4742	0.02438581
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	3041	Cryptophyta	Rhodomonas	minuta	10	173.099	0.06277774	147.6549	25558.9089	0.02302501
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	3043	Cryptophyta	Rhodomonas	minuta	6	230.7986	0.08370363	14.1372	3262.8461	0.00293937
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	6032	Pyrrhophyta	Gymnodinium	sp. 1	19	43.2747	0.01569442	1132.0206	48987.8957	0.04413125
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	6033	Pyrrhophyta	Gymnodinium	sp. 2	12	64.9121	0.02354164	201.0619	13051.3518	0.01175744
060	Onondaga	4/6/2004	2405484	South	Grab	Upper Mixed	0-6m	6034	Pyrrhophyta	Gymnodinium	sp. 3	8	50.4872	0.01831017	130.6903	6598.1867	0.00594404
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	1076	Bacillariophyta	Cyclotella	meneghiniana	10	113.5962	0.00825834	416.261	47285.6633	0.01276133
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	1109	Bacillariophyta	Diatoma	tenuis	66	181.7539	0.01321334	829.3805	150743.1427	0.04068215
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	1221	Bacillariophyta	Nitzschia	acicularis	70	22.7192	0.00165166	343.6117	7806.5959	0.00210682
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	1296	Bacillariophyta	Stephanodiscus	hantzschii	20	45.4385	0.00330334	3141.5927	142749.1835	0.03852476
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	9818	Bacillariophyta	Stephanodiscus	medius	19	817.8926	0.05946002	2758.3183	2256008.021	0.60884534
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	1298	Bacillariophyta	Stephanodiscus	parvus	7	136.3154	0.00991	142.9425	19485.2679	0.00525863
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	9504	Bacillariophyta	Synedra	tenera	80	45.4385	0.00330334	720	32715.7025	0.00882923
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	1315	Bacillariophyta	Synedra	ulna	184	45.4385	0.00330334	6624	300984.4628	0.08122887
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	2683	Chlorophyta	.	.	4	113.5962	0.00825834	33.5103	3806.6424	0.00102733
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	2031	Chlorophyta	Ankistrodesmus	falcatus	20	4.1146	0.00029913	583.208	2399.6832	0.00064762
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	2082	Chlorophyta	Chlamydomonas	globosa	6	22.7192	0.00165166	113.0973	2569.4845	0.00069345
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	1000012	Chlorophyta	Closterium	.	140	4.1146	0.00029913	938.289	3860.7089	0.00104192
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	2861	Chlorophyta	Monomastix	astigmata	4	22.7192	0.00165166	15.9174	361.6312	0.0000976
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	8041	Chlorophyta	Monoraphidium	capricornutum	4	2453.6777	0.17838006	7.8108	19165.1857	0.00517225
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	2381	Chlorophyta	Pediastrum	.	48	4.1146	0.00029913	2754.7047	11334.5814	0.00305895
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	102793	Chlorophyta	Scenedesmus	acutus	40	12.3439	0.00089739	1675.5161	20682.3696	0.0055817
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	2488	Chlorophyta	Scenedesmus	denticulatus	20	22.7192	0.00165166	201.0619	4567.9731	0.00123279
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	8303	Chlorophyta	Scenedesmus	opoliensis	20	68.1577	0.004955	134.0413	9135.9485	0.00246559
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	2501	Chlorophyta	Selenastrum	minutum	6	22.7192	0.00165166	21.1595	480.7277	0.00012974
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	12	22.7192	0.00165166	120.3356	2733.9331	0.00073783
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	1731	Chrysophyta	Erkenia	subaequiciliata	4	749.7348	0.05450501	30.2431	22674.306	0.00611928
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	1631	Chrysophyta	Uroglena	.	4	45.4385	0.00330334	30.2431	1374.2004	0.00037087
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	3015	Cryptophyta	Cryptomonas	erosa	18	477.104	0.03468501	678.584	323755.137	0.08737416
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	3061	Cryptophyta	Cryptomonas	ovata	16	22.7192	0.00165166	603.1858	13703.9216	0.00369838
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	3041	Cryptophyta	Rhodomonas	minuta	12	45.4385	0.00330334	201.0619	9135.9463	0.00246558
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	3043	Cryptophyta	Rhodomonas	minuta	6.8571	8042.6102	0.58469019	25.5815	205742.0326	0.0555251
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	4041	Cyanophyta	Aphanizomenon	flos-aquae	200	4.1146	0.00029913	2513.2741	10341.1846	0.00279085
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	4183	Cyanophyta	Oscillatoria	agardhii	640	4.1146	0.00029913	18095.5737	74456.5297	0.02009413
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	7140	Miscellaneous	.	.	3	136.3154	0.00991	13.9493	1901.5048	0.00051317
060	Onondaga	6/2/2004	2406644	South	Grab	Upper Mixed	0-6m	6034	Pyrrhophyta	Gymnodinium	sp. 3	8	45.4385	0.00330334	75.3982	3425.9793	0.00092459

Job ID	Lake	Date	Site	Station	Sample Type	Depth	Depth Note	Taxa Code	Division	Genus	Species	GALD	Concentration (natural unit/ml)	Relative Concentration (%)	Biovolume (um3/unit)	Total Biovolume (um3/ml)	Relative Total Biovolume (%)
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	1431	Bacillariophyta	Aulacoseira	ambigua	64	30.2923	0.0024475	7238.2295	219262.7433	0.1282624
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	1109	Bacillariophyta	Diatoma	tenuis	38	60.5846	0.004895	477.5221	28930.5018	0.01692351
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	1296	Bacillariophyta	Stephanodiscus	hantzschii	16	60.5846	0.004895	1608.4954	97450.1055	0.05700551
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	9818	Bacillariophyta	Stephanodiscus	medius	20	90.877	0.00734252	3141.5927	285498.3669	0.16700834
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	9504	Bacillariophyta	Synedra	tenera	95	151.4616	0.01223752	380	57555.4025	0.03366826
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	2683	Chlorophyta	.	.	4	121.1693	0.00979002	33.5103	4060.4185	0.00237523
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	1000031	Chlorophyta	Ankistrodesmus	falcatus	100	30.2923	0.0024475	261.7994	7930.5104	0.00463912
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	1000012	Chlorophyta	Closterium	.	120	30.2923	0.0024475	804.2477	24362.5264	0.01425138
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	2162	Chlorophyta	Closterium	moniliferum	160	4.3889	0.00035461	586.1835	2572.7213	0.00150497
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	8041	Chlorophyta	Monoraphidium	capricornutum	4	4180.3398	0.33775553	7.8108	32651.7978	0.01910036
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	2371	Chlorophyta	Pandorina	morum	40	30.2923	0.0024475	2038.768	61759.0068	0.03612724
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	2484	Chlorophyta	Scenedesmus	abundans	20	30.2923	0.0024475	75.3982	2283.9862	0.00133607
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	102793	Chlorophyta	Scenedesmus	acutus	60	4.3889	0.00035461	4289.3212	18825.5523	0.01101241
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	8303	Chlorophyta	Scenedesmus	opoliensis	16	90.877	0.00734252	71.2094	6471.2932	0.00378552
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	2884	Chlorophyta	Scenedesmus	quadricauda	20	121.1693	0.00979002	71.2094	8628.3909	0.00504736
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	16	90.877	0.00734252	120.3356	10935.7325	0.00639709
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	1000035	Chrysophyta	.	.	5.6	954.208	0.07709637	94.0383	89732.0971	0.0524907
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	1631	Chrysophyta	Uroglena	.	4	121.1693	0.00979002	30.2431	3664.5343	0.00214365
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	3015	Cryptophyta	Cryptomonas	erosa	24	272.6309	0.02202754	1105.8406	301486.2672	0.1763608
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	3043	Cryptophyta	Rhodomonas	minuta	7.3333	5679.8095	0.45890697	32.1141	182401.9689	0.10669991
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	4041	Cyanophyta	Aphanizomenon	flos-aquae	200	8.7779	0.00070922	2513.2741	22061.1938	0.01290516
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	4174	Cyanophyta	Oscillatoria	tenuis	720	30.2923	0.0024475	3392.9201	102779.4116	0.060123
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	6032	Pyrrhophyta	Gymnodinium	sp. 1	17.3333	90.877	0.00734252	1093.2742	99353.4263	0.0581189
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	60.5846	0.004895	603.1858	36543.7911	0.02137707
060	Onondaga	6/8/2004	2407031	South	Grab	Upper Mixed	0-6m	6034	Pyrrhophyta	Gymnodinium	sp. 3	8	30.2923	0.0024475	75.3982	2283.9862	0.00133607
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	1298	Bacillariophyta	Stephanodiscus	parvus	6	67.3163	0.00626533	84.823	5709.9671	0.0015781
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	2683	Chlorophyta	.	.	4	16.8291	0.00156633	33.5103	563.947	0.00015586
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	1000012	Chlorophyta	Closterium	.	280	16.8291	0.00156633	1876.578	31581.0533	0.00872823
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	2175	Chlorophyta	Coelastrum	pseudomicroporum	20	16.8291	0.00156633	628.3185	10574.0129	0.0029224
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	8041	Chlorophyta	Monoraphidium	capricornutum	4	4139.95	0.38531742	7.8108	32336.3215	0.00893697
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	4640	Chlorophyta	Nannochloris	.	1.5	2221.4366	0.20675569	0.7854	1744.7163	0.0004822
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	2363	Chlorophyta	Oocystis	parva	4	16.8291	0.00156633	18.8496	317.2211	0.00008767
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	2381	Chlorophyta	Pediastrum	.	48	2.4383	0.00022694	2630.2821	6413.4097	0.00177251
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	2884	Chlorophyta	Scenedesmus	quadricauda	20	16.8291	0.00156633	134.0413	2255.7898	0.00062345
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	2501	Chlorophyta	Selenastrum	minutum	6	16.8291	0.00156633	9.2986	156.4867	0.00004325
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	2641	Chlorophyta	Sphaerocystis	schroeteri	20	16.8291	0.00156633	523.5988	8811.6783	0.00243533
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	1000035	Chrysophyta	.	.	5	16.8291	0.00156633	65.4498	1101.4589	0.00030442
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	3015	Cryptophyta	Cryptomonas	erosa	20.8	3736.0524	0.34772547	907.8365	3391724.774	0.93739017
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	3018	Cryptophyta	Cryptomonas	lucens	9	50.4872	0.00469899	84.823	4282.4754	0.00118357
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	3069	Cryptophyta	Cryptomonas	rostratiformis	32	2.4383	0.00022694	2144.6606	5229.3201	0.00144526
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	3043	Cryptophyta	Rhodomonas	minuta	6	319.7522	0.02976028	14.1372	4520.4013	0.00124933
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	10222	Cyanophyta	Anabaena	crassa	56	2.4383	0.00022694	5428.6721	13236.7164	0.00365831
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	4041	Cyanophyta	Aphanizomenon	flos-aquae	280	16.8291	0.00156633	3518.5838	59214.4757	0.01636544
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	4649	Cyanophyta	Lyngbya	.	24	16.8291	0.00156633	75.3982	1268.8812	0.00035069
060	Onondaga	6/22/2004	2407522	North	Grab	Upper Mixed	0-5m	6032	Pyrrhophyta	Gymnodinium	sp. 1	20	33.6581	0.00313266	1105.8406	37220.5268	0.01028685
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	1109	Bacillariophyta	Diatoma	tenuis	56	9.0877	0.0022053	703.7168	6395.1637	0.00175996
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	9818	Bacillariophyta	Stephanodiscus	medius	30	2.0573	0.00049924	10602.8752	21813.4364	0.0060031
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	1298	Bacillariophyta	Stephanodiscus	parvus	6	9.0877	0.0022053	84.823	770.8456	0.00021214
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	2683	Chlorophyta	.	.	4	127.2277	0.03087421	33.5103	4263.4395	0.00117331
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	1000012	Chlorophyta	Closterium	.	320	18.1754	0.00441061	4825.4863	87705.0967	0.02413663
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	2171	Chlorophyta	Coelastrum	microporum	24	9.0877	0.0022053	2094.3951	19033.2242	0.00523798
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	2175	Chlorophyta	Coelastrum	pseudomicroporum	30	9.0877	0.0022053	1608.4954	14617.5158	0.00402277
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	8041	Chlorophyta	Monoraphidium	capricornutum	4	672.4894	0.16319229	7.8108	5252.6805	0.00144555
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	2363	Chlorophyta	Oocystis	parva	9	18.1754	0.00441061	146.6077	2664.6522	0.00073332
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	2381	Chlorophyta	Pediastrum	.	84	9.0877	0.0022053	7198.9307	65421.6875	0.01800419
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	2488	Chlorophyta	Scenedesmus	denticulatus	12	18.1754	0.00441061	75.3982	1370.3917	0.00037713
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	8303	Chlorophyta	Scenedesmus	opoliensis	24	2.0573	0.00049924	565.4867	1163.3833	0.00032017
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	1731	Chrysophyta	Erkenia	subaequiciliata	4	36.3508	0.00882121	30.2431	1099.3603	0.00030255
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	3015	Cryptophyta	Cryptomonas	erosa	22.6	2971.6763	0.72113354	1110.0294	3298648.07	0.90779491
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	3018	Cryptophyta	Cryptomonas	lucens	10	36.3508	0.00882121	167.5516	6090.6314	0.00167615
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	3069	Cryptophyta	Cryptomonas	rostratiformis	34	18.1754	0.00441061	2278.7019	41416.2963	0.01139785
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	3043	Cryptophyta	Rhodomonas	minuta	6	109.0523	0.02646361	21.7293	2369.631	0.00065213
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	4041	Cyanophyta	Aphanizomenon	flos-aquae	113.3333	36.3508	0.00882121	1424.1887	51770.3709	0.01424732
060	Onondaga	6/22/2004	2407506	South	Grab	Upper Mixed	0-5m	6033	Pyrrhophyta	Gymnodinium	sp. 2	12	9.0877	0.0022053	201.0619	1827.1893	0.00050285
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	1021	Bacillariophyta	Asterionella	formosa	58	40.3898	0.00890937	522	21083.4527	0.0159874
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	1076	Bacillariophyta	Cyclotella	meneghiniana	22	15.1462	0.00334102	4285.1324	64903.2948	0.04921562
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	9818	Bacillariophyta	Stephanodiscus	medius	24	5.0487	0.00111367	5428.6721	27407.8428	0.02078314
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	1298	Bacillariophyta	Stephanodiscus	parvus	6.5	757.3079	0.16705055	113.8827	86244.2715	0.0653983
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2683	Chlorophyta	.	.	4	30.2923	0.00668202	33.5103	1015.1046	0.00076975
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2080	Chlorophyta	Chlamydomonas	.	6	10.0974	0.00222733	50.2655	507.5528	0.00038487

Job ID	Lake	Date	Site	Station	Sample Type	Depth	Depth Note	Taxa Code	Division	Genus	Species	GALD	Concentration (natural unit/ml)	Relative Concentration (%)	Biovolume (um3/unit)	Total Biovolume (um3/ml)	Relative Total Biovolume (%)
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2082	Chlorophyta	Chlamydomonas	globosa	6	60.5846	0.01336404	113.0973	6851.9586	0.00519578
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2085	Chlorophyta	Chlamydomonas	platystigma	6	5.0487	0.00111367	50.2655	253.7764	0.00019244
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	1000012	Chlorophyta	Closterium	.	208	100.9744	0.02227341	4196.33	423721.8635	0.32130472
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2171	Chlorophyta	Coelastrum	microporum	30	25.2436	0.00556835	901.6371	22760.5641	0.01725914
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2175	Chlorophyta	Coelastrum	pseudomicroporum	22	15.1462	0.00334102	1080.7079	16368.5732	0.01241215
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	8011	Chlorophyta	Deasonia	Gigantica	12	10.0974	0.00222733	904.7787	9135.9478	0.00692771
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	8041	Chlorophyta	Monoraphidium	capricornutum	4	1272.2773	0.28064494	7.8108	9937.5037	0.00753553
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	4640	Chlorophyta	Nannochloris	.	1.5	1514.6159	0.33410113	0.7854	1189.5793	0.00090205
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2369	Chlorophyta	Oocystis	lacustris	40	1.2191	0.00026891	4825.4863	5882.985	0.00446102
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2363	Chlorophyta	Oocystis	parva	12.8	272.6309	0.06013821	378.6666	103236.1985	0.07828314
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2381	Chlorophyta	Pediastrum	.	40	5.0487	0.00111367	736.6762	3719.2715	0.00282029
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2389	Chlorophyta	Pediastrum	boryanum	40	5.0487	0.00111367	608.6762	3073.0354	0.00233026
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2387	Chlorophyta	Pediastrum	tetras	24	15.1462	0.00334102	402.1239	6090.6323	0.00461848
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2760	Chlorophyta	Phacotus	.	12	5.0487	0.00111367	105.3188	531.7251	0.0004032
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2480	Chlorophyta	Scenedesmus	.	12	5.0487	0.00111367	167.5516	845.921	0.00064145
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	102793	Chlorophyta	Scenedesmus	acutus	40	5.0487	0.00111367	536.1651	2706.9472	0.00205266
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	8303	Chlorophyta	Scenedesmus	opoliensis	40	10.0974	0.00222733	418.879	4229.6052	0.00320727
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	2884	Chlorophyta	Scenedesmus	quadricauda	12	10.0974	0.00222733	8.3776	84.5923	0.00006415
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	1731	Chrysophyta	Erkenia	subaequiciliata	4	30.2923	0.00668202	30.2431	916.1336	0.0006947
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	1631	Chrysophyta	Uroglena	.	4	20.1949	0.00445469	30.2431	610.7557	0.00046313
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	3015	Cryptophyta	Cryptomonas	erosa	16	15.1462	0.00334102	603.1858	9135.9478	0.00692771
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	3043	Cryptophyta	Rhodomonas	minuta	7.3333	212.0462	0.04677415	24.2601	5144.2625	0.00390085
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	3041	Cryptophyta	Rhodomonas	minuta	12	5.0487	0.00111367	94.2478	475.8307	0.00036082
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	10222	Cyanophyta	Anabaena	crassa	236.8	8.534	0.00188247	27609.1691	235617.7657	0.17866696
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	4086	Cyanophyta	Chroococcus	minutus	40	5.0487	0.00111367	904.7787	4567.9739	0.00346386
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	107379	Cyanophyta	Microcystis	flos-aquae	100	10.0974	0.00222733	12271.8463	123914.2199	0.09396311
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	4269	Cyanophyta	Microcystis	wesenbergii	280	5.0487	0.00111367	22907.4464	115653.2718	0.0876989
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	4285	Cyanophyta	Synechocystis	.	4	5.0487	0.00111367	33.5103	169.1841	0.00012829
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	7140	Miscellaneous	.	.	4	10.0974	0.00222733	30.2431	305.3779	0.00023157
060	Onondaga	7/7/2004	2408007	South	Grab	Upper Mixed	0-5m	6034	Pyrrhophyta	Gymnodinium	sp. 3	6	10.0974	0.00222733	45.6578	461.0269	0.00034959
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	1021	Bacillariophyta	Asterionella	formosa	60	18.9327	0.00152635	1792	33927.3952	0.00986646
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	1076	Bacillariophyta	Cyclotella	meneghiniana	30	227.1924	0.01831616	10602.8752	2408892.434	0.70053218
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	1210	Bacillariophyta	Navicula	.	12	18.9327	0.00152635	75.3982	1427.4914	0.00041513
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	2683	Chlorophyta	.	.	4	18.9327	0.00152635	33.5103	634.4404	0.0001845
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	2082	Chlorophyta	Chlamydomonas	globosa	6	18.9327	0.00152635	113.0973	2141.237	0.0006227
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	1000012	Chlorophyta	Closterium	.	165	37.8654	0.00305269	3361.5041	127284.6852	0.03701577
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	2173	Chlorophyta	Coelastrum	cambricum	16	18.9327	0.00152635	241.9445	4580.6622	0.00133211
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	2175	Chlorophyta	Coelastrum	pseudomicroporum	28	18.9327	0.00152635	2144.6606	40604.2119	0.01180815
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	8041	Chlorophyta	Monoraphidium	capricornutum	4	10905.2342	0.87917576	7.8108	85178.603	0.02477087
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	2363	Chlorophyta	Oocystis	parva	13	75.7308	0.00610539	225.6711	17090.2513	0.00497003
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	2371	Chlorophyta	Pandorina	morum	48	13.7154	0.00110573	3871.1124	53093.9407	0.0154403
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	2381	Chlorophyta	Pediastrum	.	40	2.7431	0.00022115	1387.141	3805.0449	0.00110655
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	2389	Chlorophyta	Pediastrum	boryanum	30	18.9327	0.00152635	460.668	8721.6882	0.00253636
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	2484	Chlorophyta	Scenedesmus	abundans	16	37.8654	0.00305269	47.1239	1784.3652	0.00051891
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	8303	Chlorophyta	Scenedesmus	opoliensis	41	37.8654	0.00305269	339.292	12847.4261	0.00373617
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	2884	Chlorophyta	Scenedesmus	quadricauda	30	132.5289	0.01068443	129.8525	17209.2073	0.00500463
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	2501	Chlorophyta	Selenastrum	minutum	6	94.6635	0.00763173	21.1595	2003.0321	0.0005825
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	1000035	Chrysophyta	.	.	5.5	18.9327	0.00152635	89.2736	1690.1901	0.00049153
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	1631	Chrysophyta	Uroglena	.	4	18.9327	0.00152635	30.2431	572.5835	0.00016651
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	3015	Cryptophyta	Cryptomonas	erosa	28	227.1924	0.01831616	1602.9104	364169.026	0.10590432
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	3069	Cryptophyta	Cryptomonas	rostratiformis	33	56.7981	0.00457904	1742.5367	98972.7643	0.02878236
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	3043	Cryptophyta	Rhodomonas	minuta	7.3333	359.7213	0.02900059	29.3215	10547.5671	0.00306735
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	4041	Cyanophyta	Aphanizomenon	flos-aquae	220	18.9327	0.00152635	2764.6015	52341.3658	0.01522144
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	107379	Cyanophyta	Microcystis	flos-aquae	160	2.7431	0.00022115	28274.3339	77558.885	0.02255497
060	Onondaga	7/20/2004	2408404	South	Grab	Upper Mixed	0-7m	6032	Pyrrhophyta	Gymnodinium	sp. 1	28	2.7431	0.00022115	4222.3005	11582.1268	0.00336821
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	1071	Bacillariophyta	Cyclotella	sp. 1	4	2527.5152	0.48708495	50.2655	127046.8157	0.04958844
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	1271	Bacillariophyta	Rhoicosphenia	curvata	20	9.4663	0.00182428	291.292	2757.4718	0.00107629
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	1298	Bacillariophyta	Stephanodiscus	parvus	6	9.4663	0.00182428	84.823	802.9641	0.00031341
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2683	Chlorophyta	.	.	3.5	425.9857	0.08209297	23.8237	10148.5557	0.00396115
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2080	Chlorophyta	Chlamydomonas	.	7.25	37.8654	0.00729715	165.1954	6255.1893	0.0024415
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2082	Chlorophyta	Chlamydomonas	globosa	7	94.6635	0.01824288	190.59	18041.9147	0.00704205
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	1000012	Chlorophyta	Closterium	.	105	47.3317	0.00912143	703.7168	33308.1445	0.01300071
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2173	Chlorophyta	Coelastrum	cambricum	20	2.7431	0.00052863	2903.3343	7964.0911	0.00310851
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2171	Chlorophyta	Coelastrum	microporum	12	28.399	0.00547286	141.3717	4014.8216	0.00156705
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2175	Chlorophyta	Coelastrum	pseudomicroporum	13	66.2644	0.01277001	586.4306	38859.4975	0.01516749
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	8241	Chlorophyta	Didymogenes	anomala	6	28.399	0.00547286	12.5664	356.8738	0.00013929
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	8041	Chlorophyta	Monoraphidium	capricornutum	4	681.5771	0.13134874	7.8108	5323.6627	0.00207791
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2369	Chlorophyta	Oocystis	lacustris	40	9.4663	0.00182428	4825.4863	45679.7379	0.01782954
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2363	Chlorophyta	Oocystis	parva	15	28.399	0.00547286	1560.3244	44311.7264	0.01729559
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2381	Chlorophyta	Pediastrum	.	40	2.7431	0.00052863	4828.2261	13244.2318	0.00516944

Job ID	Lake	Date	Site	Station	Sample Type	Depth	Depth Note	Taxa Code	Division	Genus	Species	GALD	Concentration (natural unit/ml)	Relative Concentration (%)	Biovolume (um3/unit)	Total Biovolume (um3/ml)	Relative Total Biovolume (%)
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2389	Chlorophyta	Pediastrum	boryanum	50	9.4663	0.00182428	1576.3762	14922.5274	0.00582451
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	8303	Chlorophyta	Scenedesmus	opoliensis	20	9.4663	0.00182428	150.7964	1427.4914	0.00055717
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2884	Chlorophyta	Scenedesmus	quadricauda	27.3333	75.7308	0.01459431	159.8722	12107.2484	0.00472566
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	8308	Chlorophyta	Scenedesmus	serratus	4	9.4663	0.00182428	2.0944	19.8263	0.00000774
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	2554	Chlorophyta	Tetraedron	minimum	10	2.7431	0.00052863	250	685.7711	0.00026767
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	1731	Chrysophyta	Erkenia	subaequiciliata	4	56.7981	0.01094573	30.2431	1717.7505	0.00067047
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	1631	Chrysophyta	Uroglena	.	4	18.9327	0.00364858	30.2431	572.5835	0.00022349
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	3015	Cryptophyta	Cryptomonas	erosa	18.6667	369.1876	0.07114724	508.2399	187635.8764	0.07323733
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	3069	Cryptophyta	Cryptomonas	rostratiformis	36	28.399	0.00547286	5428.6721	154169.1157	0.06017471
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	3043	Cryptophyta	Rhodomonas	minuta	6	454.3848	0.08756584	29.3215	13323.2426	0.00520028
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	10222	Cyanophyta	Anabaena	crassa	184	66.2644	0.01277001	24663.5967	1634319.515	0.63790148
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	4041	Cyanophyta	Aphanizomenon	flos-aquae	166.6667	28.399	0.00547286	2094.3951	59478.8255	0.02321555
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	107379	Cyanophyta	Microcystis	flos-aquae	70	9.4663	0.00182428	5026.5482	47583.06	0.01857244
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	4285	Cyanophyta	Synechocystis	.	2	18.9327	0.00364858	4.1888	79.3053	0.00003095
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	6032	Pyrrhophyta	Gymnodinium	sp. 1	20	9.4663	0.00182428	2073.4512	19628.0129	0.00766113
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	9.4663	0.00182428	1058.9262	10024.1651	0.00391259
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	6034	Pyrrhophyta	Gymnodinium	sp. 3	8	9.4663	0.00182428	75.3982	713.7457	0.00027859
060	Onondaga	8/3/2004	2409000	South	Grab	Upper Mixed	0-7.5m	6040	Pyrrhophyta	Peridinium	.	40	2.7431	0.00052863	16587.6092	45501.2125	0.01775986
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	1076	Bacillariophyta	Cyclotella	meneghiniana	18	5.6798	0.00161812	2987.6546	16969.3089	0.01151629
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	1071	Bacillariophyta	Cyclotella	sp. 1	4	477.104	0.13592235	50.2655	23981.8708	0.01627539
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	1298	Bacillariophyta	Stephanodiscus	parvus	6	227.1924	0.06472493	84.823	19271.1391	0.01307843
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2683	Chlorophyta	.	.	4	136.3154	0.03883495	33.5103	4567.9709	0.00310007
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2080	Chlorophyta	Chlamydomonas	.	10	119.276	0.03398059	509.5105	60772.3737	0.0412434
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	8315	Chlorophyta	Chlamydomonas	(palmeloid stage)	80	5.6798	0.00161812	7238.2295	41111.7644	0.02790065
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2082	Chlorophyta	Chlamydomonas	globosa	7	73.8375	0.02103559	190.59	14072.6935	0.00955049
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	1000012	Chlorophyta	Closterium	.	100	73.8375	0.02103559	579.7286	42805.7238	0.02905027
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2173	Chlorophyta	Coelastrum	cambricum	20	45.4385	0.01294499	1268.1981	57624.9885	0.03910742
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2171	Chlorophyta	Coelastrum	microporum	21	28.399	0.0080906	1114.2182	31642.7354	0.02147446
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2175	Chlorophyta	Coelastrum	pseudomicroporum	16	102.2366	0.02912622	638.4913	65277.1606	0.04430059
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	8011	Chlorophyta	Deasonia	Gigantica	8	5.6798	0.00161812	268.0826	1522.6581	0.00103336
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	8241	Chlorophyta	Didymogenes	anomala	4.5	11.3596	0.00323624	7.5608	85.8878	0.00005829
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2251	Chlorophyta	Eudorina	elegans	55	51.1183	0.01456311	7561.6669	386539.4446	0.26232645
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	8041	Chlorophyta	Monoraphidium	capricornutum	4	187.4337	0.05339806	7.8108	1464.0072	0.00099355
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2369	Chlorophyta	Oocystis	lacustris	16	5.6798	0.00161812	837.758	4758.3058	0.00322924
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2363	Chlorophyta	Oocystis	parva	16.6667	17.0394	0.00485436	1130.9734	19271.1402	0.01307843
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2371	Chlorophyta	Pandorina	morum	48	17.0394	0.00485436	6075.0862	103515.9962	0.07025152
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2381	Chlorophyta	Pediastrum	.	50	5.6798	0.00161812	1544.4007	8771.9017	0.00595308
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2389	Chlorophyta	Pediastrum	boryanum	24	11.3596	0.00323624	304.3381	3457.1648	0.00234622
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2387	Chlorophyta	Pediastrum	tetras	20	28.399	0.0080906	942.8705	26776.6239	0.01817206
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	8399	Chlorophyta	Scenedesmus	acutus	12	5.6798	0.00161812	84.6379	480.7271	0.00032625
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2488	Chlorophyta	Scenedesmus	denticulatus	16	5.6798	0.00161812	56.5487	321.1858	0.00021797
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	8303	Chlorophyta	Scenedesmus	opoliensis	35	11.3596	0.00323624	106.8142	1213.3686	0.00082346
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2884	Chlorophyta	Scenedesmus	quadricauda	34	22.7192	0.00647248	264.941	6019.2576	0.00408499
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2501	Chlorophyta	Selenastrum	minutum	8	39.7587	0.01132687	50.5844	2011.1683	0.00136489
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2641	Chlorophyta	Sphaerocystis	schroeteri	24	11.3596	0.00323624	2144.6606	24362.5271	0.01653372
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2530	Chlorophyta	Staurastrum	.	40	5.6798	0.00161812	3913.9218	22230.3301	0.0150867
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2554	Chlorophyta	Tetraedron	minimum	9.3333	68.1577	0.01941747	209.3333	14267.6791	0.00968281
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	8332	Chlorophyta	Tetraedron	muticum	8	68.1577	0.01941747	144	9814.7107	0.00666079
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	8	5.6798	0.00161812	55.4227	314.7904	0.00021363
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	1000035	Chrysophyta	.	.	5	22.7192	0.00647248	65.4498	1486.9696	0.00100914
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	1731	Chrysophyta	Erkenia	subaequiciliata	4	5.6798	0.00161812	30.2431	171.775	0.00011658
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	3015	Cryptophyta	Cryptomonas	erosa	14	272.6309	0.07766992	476.824	129996.9343	0.08822291
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	3061	Cryptophyta	Cryptomonas	ovata	14	11.3596	0.00323624	458.6725	5210.3448	0.00353602
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	3043	Cryptophyta	Rhodomonas	minuta	7	1124.6023	0.32038839	29.3215	32975.0255	0.02237863
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	3041	Cryptophyta	Rhodomonas	minuta	10	34.0789	0.00970875	201.0619	6851.9597	0.00465011
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	4041	Cyanophyta	Aphanizomenon	flos-aquae	169.5	90.877	0.02588998	2129.9998	193567.8882	0.13136558
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	4046	Cyanophyta	Aphanizomenon	issatschenkoi	520	5.6798	0.00161812	3675.6634	20877.0677	0.0141683
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	4166	Cyanophyta	Merismopedia	warmingiana	8	5.6798	0.00161812	1.1781	6.6914	0.00000454
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	4261	Cyanophyta	Microcystis	aeruginosa	100	5.6798	0.00161812	4908.7385	27880.6994	0.01892134
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	4285	Cyanophyta	Synechocystis	.	5	11.3596	0.00323624	65.4498	743.4848	0.00050457
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	6032	Pyrrhophyta	Gymnodinium	sp. 1	24	17.0394	0.00485436	1608.4954	27407.8422	0.01860044
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	6033	Pyrrhophyta	Gymnodinium	sp. 2	13	17.0394	0.00485436	613.2389	10449.2403	0.00709142
060	Onondaga	8/17/2004	2409710	South	Grab	Upper Mixed	0-7m	6034	Pyrrhophyta	Gymnodinium	sp. 3	8	5.6798	0.00161812	102.6254	582.8927	0.00039558
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	1076	Bacillariophyta	Cyclotella	meneghiniana	18	51.9297	0.01167119	2987.6546	155147.9667	0.07990245
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	9818	Bacillariophyta	Stephanodiscus	medius	20	25.9648	0.00583558	3141.5927	81570.962	0.0420097
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	1298	Bacillariophyta	Stephanodiscus	parvus	8	90.877	0.02042458	201.0619	18271.8925	0.00941017
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2683	Chlorophyta	.	.	6.4	428.4199	0.09628727	159.174	68193.3113	0.0351201
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	1000031	Chlorophyta	Ankistrodesmus	falcatus	50	12.9824	0.00291779	47.1239	611.7823	0.00031507
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2080	Chlorophyta	Chlamydomonas	.	7	25.9648	0.00583558	100.531	2610.2717	0.00134431
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2082	Chlorophyta	Chlamydomonas	globosa	8	103.8594	0.02334238	268.0826	27842.8907	0.01433931

Job ID	Lake	Date	Site	Station	Sample Type	Depth	Depth Note	Taxa Code	Division	Genus	Species	GALD	Concentration (natural unit/ml)	Relative Concentration (%)	Biovolume (um3/unit)	Total Biovolume (um3/ml)	Relative Total Biovolume (%)
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	1000012	Chlorophyta	Closterium	.	133.3333	51.9297	0.01167119	1340.4129	69607.2216	0.03584828
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2173	Chlorophyta	Coelastrum	cambricum	16	90.877	0.02042458	966.4377	87826.9118	0.04523157
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2171	Chlorophyta	Coelastrum	microporum	18.6667	103.8594	0.02334238	424.3768	44075.5083	0.02269924
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2175	Chlorophyta	Coelastrum	pseudomicroporum	14.5	233.6836	0.05252033	391.9137	91583.8	0.04716639
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	8011	Chlorophyta	Deasonia	Gigantica	8	12.9824	0.00291779	268.0826	3480.3613	0.00179241
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2211	Chlorophyta	Dictyosphaerium	pulchellum	20	12.9824	0.00291779	314.1593	4078.5485	0.00210049
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2251	Chlorophyta	Eudorina	elegans	14.2222	233.6836	0.05252033	665.3707	155486.2133	0.08007665
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2320	Chlorophyta	Kirchneriella	.	12	12.9824	0.00291779	84.6379	1098.8049	0.00056589
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	8041	Chlorophyta	Monoraphidium	capricornutum	4	311.5781	0.0700271	7.8108	2433.6744	0.00125336
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2363	Chlorophyta	Oocystis	parva	11.1429	90.877	0.02042458	447.0038	40622.3426	0.02092083
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2371	Chlorophyta	Pandorina	morum	19	25.9648	0.00583558	2166.191	56244.8097	0.02896653
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2381	Chlorophyta	Pediastrum	.	42	64.9121	0.01458898	734.8984	47703.8044	0.02456784
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2387	Chlorophyta	Pediastrum	tetras	20	51.9297	0.01167119	439.823	22839.8705	0.01176272
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2484	Chlorophyta	Scenedesmus	abundans	15	38.9473	0.0087534	47.1239	1835.347	0.00094522
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	102793	Chlorophyta	Scenedesmus	acutus	14	12.9824	0.00291779	94.2478	1223.5647	0.00063015
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2483	Chlorophyta	Scenedesmus	bijuga	14	64.9121	0.01458898	179.0708	11623.8631	0.00598638
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2488	Chlorophyta	Scenedesmus	denticulatus	12	12.9824	0.00291779	75.3982	978.8512	0.00050412
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	8303	Chlorophyta	Scenedesmus	opoliensis	30	12.9824	0.00291779	314.1593	4078.5485	0.00210049
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2884	Chlorophyta	Scenedesmus	quadricauda	22.8	116.8418	0.02626017	124.1976	14511.4705	0.00747352
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2501	Chlorophyta	Selenastrum	minutum	8	103.8594	0.02334238	50.5844	5253.6641	0.00270568
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	2554	Chlorophyta	Tetraedron	minimum	6	64.9121	0.01458898	54	3505.2538	0.00180523
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	8332	Chlorophyta	Tetraedron	muticum	7.3333	194.7363	0.04376694	103.3333	20122.747	0.01036338
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	1000035	Chrysophyta	.	.	8	64.9121	0.01458898	268.0826	17401.8067	0.00896207
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	1731	Chrysophyta	Erkenia	subaequiciliata	4	12.9824	0.00291779	30.2431	392.6287	0.00020221
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	1631	Chrysophyta	Uroglena	.	4	64.9121	0.01458898	30.2431	1963.1434	0.00101103
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	7180	Cryptophyta	.	.	10	12.9824	0.00291779	502.8643	6528.3964	0.00336218
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	3015	Cryptophyta	Cryptomonas	erosa	15.6	830.875	0.18673896	487.7846	405288.0215	0.20872659
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	3069	Cryptophyta	Cryptomonas	rostratiformis	40	12.9824	0.00291779	2680.8257	34803.6095	0.01792414
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	3043	Cryptophyta	Rhodomonas	minuta	6	467.3672	0.10504067	29.3215	13703.9067	0.00705762
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	3041	Cryptophyta	Rhodomonas	minuta	10	77.8945	0.01750677	94.2478	7341.3881	0.00378087
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	4041	Cyanophyta	Aphanizomenon	flos-aquae	169.3333	9.4049	0.00211375	2127.9054	20012.6543	0.01030668
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	4046	Cyanophyta	Aphanizomenon	issatschenkoi	295	103.8594	0.02334238	2085.2321	216570.8984	0.11153576
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	4183	Cyanophyta	Oscillatoria	agardhii	230	25.9648	0.00583558	3524.4743	91512.4227	0.04712963
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	6032	Pyrrhophyta	Gymnodinium	sp. 1	20	12.9824	0.00291779	2073.4512	26918.4177	0.0138632
060	Onondaga	8/31/2004	2410325	South	Grab	Upper Mixed	0-7m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	90.877	0.02042458	603.1858	54815.6866	0.02823052
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	1431	Bacillariophyta	Aulacoseira	ambigua	40	5.6798	0.00221746	3141.5927	17843.6479	0.00279977
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	1076	Bacillariophyta	Cyclotella	meneghiniana	10	5.6798	0.00221746	392.6991	2230.4561	0.00034997
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	9818	Bacillariophyta	Stephanodiscus	medius	20	1789.14	0.69850079	3292.3891	5890544.966	0.92426081
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	1298	Bacillariophyta	Stephanodiscus	parvus	6	39.7587	0.01552225	84.823	3372.4493	0.00052916
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2683	Chlorophyta	.	.	3	79.5173	0.03104447	14.1372	1124.1524	0.00017639
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	1000031	Chlorophyta	Ankistrodesmus	falcatus	60	5.6798	0.00221746	56.5487	321.1858	0.0000504
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2080	Chlorophyta	Chlamydomonas	.	9	17.0394	0.00665238	354.0575	6032.9374	0.0009466
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2082	Chlorophyta	Chlamydomonas	globosa	8	17.0394	0.00665238	268.0826	4567.9743	0.00071674
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	1000012	Chlorophyta	Closterium	.	100	17.0394	0.00665238	670.2064	11419.9339	0.00179185
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2173	Chlorophyta	Coelastrum	cambricum	22.6667	85.1971	0.03326193	1998.6135	170276.1579	0.02671732
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2175	Chlorophyta	Coelastrum	pseudomicroporum	15.3333	39.7587	0.01552225	566.8829	22538.508	0.00353642
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	8011	Chlorophyta	Deasonia	Gigantica	8	5.6798	0.00221746	268.0826	1522.6581	0.00023891
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2211	Chlorophyta	Dictyosphaerium	pulchellum	8	5.6798	0.00221746	111.5944	633.8349	0.00009945
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	8041	Chlorophyta	Monoraphidium	capricornutum	4	45.4385	0.01773971	7.8108	354.9108	0.00005569
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	102793	Chlorophyta	Scenedesmus	acutus	30	17.0394	0.00665238	226.1947	3854.2284	0.00060475
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2488	Chlorophyta	Scenedesmus	denticulatus	16	5.6798	0.00221746	201.0619	1141.9933	0.00017919
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	8303	Chlorophyta	Scenedesmus	opoliensis	40	2.7431	0.00107094	753.9822	2068.2368	0.00032452
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2884	Chlorophyta	Scenedesmus	quadricauda	35	34.0789	0.01330479	385.3687	13132.9247	0.00206063
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2501	Chlorophyta	Selenastrum	minutum	6	45.4385	0.01773971	12.2741	557.7164	0.00008751
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2538	Chlorophyta	Staurastrum	hexacerum	40	5.6798	0.00221746	1109.6105	6302.3762	0.00098888
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2551	Chlorophyta	Tetraedron	caudatum	6	5.6798	0.00221746	37.1506	211.0083	0.00003311
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2554	Chlorophyta	Tetraedron	minimum	8	5.6798	0.00221746	128	727.0156	0.00011407
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	8332	Chlorophyta	Tetraedron	muticum	8	34.0789	0.01330479	128	4362.0937	0.00068444
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	10	5.6798	0.00221746	120.3356	683.4833	0.00010724
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	1000035	Chrysophyta	.	.	9	11.3596	0.00443492	395.8407	4496.5995	0.00070554
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	1731	Chrysophyta	Erkenia	subaequiciliata	4	68.1577	0.02660955	30.2431	2061.3005	0.00032343
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	1631	Chrysophyta	Uroglena	.	4	5.6798	0.00221746	30.2431	171.775	0.00002695
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	3015	Cryptophyta	Cryptomonas	erosa	14	22.7192	0.00886984	402.1239	9135.9485	0.00143348
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	3069	Cryptophyta	Cryptomonas	rostratiformis	36	17.0394	0.00665238	2412.7432	41111.7649	0.00645068
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	3041	Cryptophyta	Rhodomonas	minuta	12	11.3596	0.00443492	94.2478	1070.6191	0.00016799
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	3043	Cryptophyta	Rhodomonas	minuta	8	28.399	0.0110873	31.4159	892.1816	0.00013999
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	10220	Cyanophyta	Anabaena	augstumalis	30	11.3596	0.00443492	506.5818	5754.5762	0.00090293
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	4041	Cyanophyta	Aphanizomenon	flos-aquae	160	17.0394	0.00665238	2010.6193	34259.8036	0.00537556
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	4046	Cyanophyta	Aphanizomenon	issatschenkoi	260	11.3596	0.00443492	1837.8317	20877.0677	0.00327573
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	4183	Cyanophyta	Oscillatoria	agardhii	560	2.7431	0.00107094	15833.627	43432.9757	0.00681489

Job ID	Lake	Date	Site	Station	Sample Type	Depth	Depth Note	Taxa Code	Division	Genus	Species	GALD	Concentration (natural unit/ml)	Relative Concentration (%)	Biovolume (um3/unit)	Total Biovolume (um3/ml)	Relative Total Biovolume (%)
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	6032	Pyrrhophyta	Gymnodinium	sp. 1	20	11.3596	0.00443492	2073.4512	23553.6155	0.0036957
060	Onondaga	9/14/2004	2410833	North	Grab	Upper Mixed	0-9m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	22.7192	0.00886984	907.0127	20606.6372	0.0032333
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	1296	Bacillariophyta	Stephanodiscus	hantzschii	11	18.9327	0.00474733	535.6415	10141.1389	0.00174203
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	9818	Bacillariophyta	Stephanodiscus	medius	21.5	1183.2936	0.29670798	3973.3293	4701615.279	0.80763885
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	1298	Bacillariophyta	Stephanodiscus	parvus	7	113.5962	0.02848397	142.9425	16237.7233	0.0027893
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2683	Chlorophyta	.	.	5.6	179.8606	0.04509961	112.2596	20191.0827	0.0034684
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2082	Chlorophyta	Chlamydomonas	globosa	8	18.9327	0.00474733	268.0826	5075.527	0.00087187
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	1000012	Chlorophyta	Closterium	.	100	9.4663	0.00237365	670.2064	6344.4077	0.00108984
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2162	Chlorophyta	Closterium	moniliferum	80	9.4663	0.00237365	613.6247	5808.7856	0.00099783
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2173	Chlorophyta	Coelastrum	cambricum	17	85.1971	0.02136296	836.4679	71264.6743	0.01224178
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2171	Chlorophyta	Coelastrum	microporum	14.6667	28.399	0.00712098	541.7502	15385.1895	0.00264285
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2175	Chlorophyta	Coelastrum	pseudomicroporum	13.3333	56.7981	0.01424198	799.3608	45402.1703	0.00779914
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	8011	Chlorophyta	Deasonia	Gigantica	12	2.7431	0.00068783	904.7787	2481.8844	0.00042634
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2211	Chlorophyta	Dictyosphaerium	pulchellum	12	9.4663	0.00237365	167.5516	1586.1019	0.00027246
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2251	Chlorophyta	Eudorina	elegans	40	9.4663	0.00237365	2536.3962	24010.4119	0.00412448
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	8041	Chlorophyta	Monoraphidium	capricornutum	4	217.726	0.05459426	7.8108	1700.6145	0.00029213
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	4640	Chlorophyta	Nannochloris	.	3	18.9327	0.00474733	6.2832	118.9579	0.00002043
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2369	Chlorophyta	Oocystis	lacustris	20	9.4663	0.00237365	1507.9645	14274.9184	0.00245213
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2363	Chlorophyta	Oocystis	parva	10.8	56.7981	0.01424198	762.9881	43336.2703	0.00744426
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2371	Chlorophyta	Pandorina	morum	80	9.4663	0.00237365	16091.6565	152329.238	0.02616697
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2381	Chlorophyta	Pediastrum	.	110	18.9327	0.00474733	877.0504	16604.9305	0.00285238
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	8101	Chlorophyta	Pyramichlamys	dissecta	16	9.4663	0.00237365	603.1858	5709.9674	0.00098085
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2480	Chlorophyta	Scenedesmus	.	12	9.4663	0.00237365	28.2743	267.6544	0.00004598
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	8399	Chlorophyta	Scenedesmus	acutus	20	9.4663	0.00237365	249.9463	2366.0789	0.00040644
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	102793	Chlorophyta	Scenedesmus	acutus	24	9.4663	0.00237365	150.7964	1427.4914	0.00024521
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2884	Chlorophyta	Scenedesmus	quadricauda	27.5	37.8654	0.00949466	154.4616	5848.7497	0.00100469
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2501	Chlorophyta	Selenastrum	minutum	8	37.8654	0.00949466	44.4266	1682.2308	0.00028897
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2538	Chlorophyta	Staurastrum	hexacerum	40	9.4663	0.00237365	1071.9114	10147.0875	0.00174306
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	2554	Chlorophyta	Tetraedron	minimum	10	9.4663	0.00237365	250	2366.5873	0.00040653
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	8332	Chlorophyta	Tetraedron	muticum	10	151.4616	0.03797863	250	37865.3964	0.00650448
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	1731	Chrysophyta	Erkenia	subaequiciliata	4	1079.1638	0.27059768	30.2431	32637.2586	0.0056064
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	3015	Cryptophyta	Cryptomonas	erosa	15	66.2644	0.01661564	484.8525	32128.4812	0.005519
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	3018	Cryptophyta	Cryptomonas	lucens	9	9.4663	0.00237365	84.823	802.9641	0.00013793
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	3061	Cryptophyta	Cryptomonas	ovata	12	9.4663	0.00237365	314.1593	2973.9416	0.00051086
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	3069	Cryptophyta	Cryptomonas	rostratiformis	40	9.4663	0.00237365	2680.8257	25377.6319	0.00435934
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	3043	Cryptophyta	Rhodomonas	minuta	8	236.6587	0.05934159	29.3215	6939.1889	0.00119201
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	3041	Cryptophyta	Rhodomonas	minuta	12	9.4663	0.00237365	94.2478	892.1826	0.00015326
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	10220	Cyanophyta	Anabaena	augstumalis	40	28.399	0.00712098	659.7345	18735.8313	0.00321842
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	4041	Cyanophyta	Aphanizomenon	flos-aquae	256	47.3317	0.01186831	3107.0351	147061.3946	0.02526206
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	4046	Cyanophyta	Aphanizomenon	issatschenkoi	349.6	47.3317	0.01186831	2471.1768	116965.1113	0.02009215
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	4172	Cyanophyta	Oscillatoria	limnetica	200	9.4663	0.00237365	353.4292	3345.6842	0.00057472
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	4174	Cyanophyta	Oscillatoria	tenuis	600	9.4663	0.00237365	16964.6003	160592.8287	0.02758648
060	Onondaga	9/14/2004	2410819	South	Grab	Upper Mixed	0-9m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	85.1971	0.02136296	603.1858	51389.7062	0.00882767
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	9818	Bacillariophyta	Stephanodiscus	medius	20	28.399	0.0045623	3141.5927	89218.2397	0.03932912
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	1298	Bacillariophyta	Stephanodiscus	parvus	6	14.1995	0.00228115	84.823	1204.4462	0.00053094
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	1000057	Chlorophyta	.	.	3	127.7957	0.02053037	13.9493	1782.6607	0.00078583
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2683	Chlorophyta	.	.	8	42.5986	0.00684346	268.0826	11419.9357	0.00503413
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	1000031	Chlorophyta	Ankistrodesmus	falcatus	40	14.1995	0.00228115	37.6991	535.3093	0.00023597
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2080	Chlorophyta	Chlamydomonas	.	10	56.7981	0.00912461	564.8584	32082.8808	0.01414275
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2082	Chlorophyta	Chlamydomonas	globosa	7	70.9976	0.01140576	190.59	13531.4361	0.00596492
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	1000012	Chlorophyta	Closterium	.	70	14.1995	0.00228115	117.2861	1665.4068	0.00073414
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2173	Chlorophyta	Coelastrum	cambricum	15	42.5986	0.00684346	755.0713	32164.9583	0.01417894
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2171	Chlorophyta	Coelastrum	microporum	20	14.1995	0.00228115	1072.3303	15226.5795	0.00671217
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2175	Chlorophyta	Coelastrum	pseudomicroporum	26	5.4862	0.00088136	2597.0499	14247.8543	0.00628073
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2251	Chlorophyta	Eudorina	elegans	30	113.5962	0.01824922	1019.384	115798.1377	0.05104606
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2291	Chlorophyta	Golenkinia	radiata	40	14.1995	0.00228115	523.5988	7434.8535	0.00327743
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	8041	Chlorophyta	Monoraphidium	capricornutum	4	766.7743	0.12318222	7.8108	5989.1205	0.00264012
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2363	Chlorophyta	Oocystis	parva	20	42.5986	0.00684346	882.4385	37590.619	0.01657067
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2371	Chlorophyta	Pandorina	morum	33.5	85.1971	0.01368691	4457.0898	379731.312	0.1673929
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2381	Chlorophyta	Pediastrum	.	40	2.7431	0.00044068	2006.4457	5503.85	0.0024262
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2387	Chlorophyta	Pediastrum	tetras	24	2.7431	0.00044068	1528.0707	4191.6269	0.00184775
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	102793	Chlorophyta	Scenedesmus	acutus	24	19.2016	0.00308474	134.0413	2573.8062	0.00113458
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2483	Chlorophyta	Scenedesmus	bijuga	24	2.7431	0.00044068	452.3893	1240.942	0.00054703
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2886	Chlorophyta	Scenedesmus	brasiliensis	12	2.7431	0.00044068	301.5929	827.2948	0.00036469
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	8303	Chlorophyta	Scenedesmus	opoliensis	40	14.1995	0.00228115	201.0619	2854.9832	0.00125853
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2884	Chlorophyta	Scenedesmus	quadricauda	32	2.7431	0.00044068	236.6666	649.1965	0.00028618
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2492	Chlorophyta	Schroederia	setigera	100	14.1995	0.00228115	134.0413	1903.3226	0.00083902
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2501	Chlorophyta	Selenastrum	minutum	8	14.1995	0.00228115	50.5844	718.2744	0.00031663
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2554	Chlorophyta	Tetraedron	minimum	6	14.1995	0.00228115	54	766.7743	0.00033801
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	8332	Chlorophyta	Tetraedron	muticum	10	70.9976	0.01140576	250	17749.4046	0.00782428

Job ID	Lake	Date	Site	Station	Sample Type	Depth	Depth Note	Taxa Code	Division	Genus	Species	GALD	Concentration (natural unit/ml)	Relative Concentration (%)	Biovolume (um3/unit)	Total Biovolume (um3/ml)	Relative Total Biovolume (%)
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	12	14.1995	0.00228115	55.4227	786.9759	0.00034691
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	1731	Chrysophyta	Erkenia	subaequiciliata	4	1150.1614	0.18477332	30.2431	34784.4467	0.01533366
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	3015	Cryptophyta	Cryptomonas	erosa	25	582.1805	0.09352724	1185.4276	690132.7967	0.30422388
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	3069	Cryptophyta	Cryptomonas	rostratiformis	36	14.1995	0.00228115	3769.9112	53530.9432	0.02359747
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	3043	Cryptophyta	Rhodomonas	minuta	9	2470.7171	0.39692047	67.8715	167691.2766	0.07392156
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	3041	Cryptophyta	Rhodomonas	minuta	12	184.5938	0.02965498	94.2478	17397.5602	0.00766918
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	4041	Cyanophyta	Aphanizomenon	flos-aquae	137.1429	19.2016	0.00308474	1723.388	33091.7915	0.0145875
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	4046	Cyanophyta	Aphanizomenon	issatschenkoi	180	19.2016	0.00308474	1565.5603	30061.2486	0.01325158
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	4174	Cyanophyta	Oscillatoria	tenuis	345.6	13.7154	0.00220338	9771.6098	134021.7534	0.05907938
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	4172	Cyanophyta	Oscillatoria	limnetica	110	14.1995	0.00228115	194.386	2760.1886	0.00121674
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	70.9976	0.01140576	603.1858	42824.7551	0.01887798
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	6034	Pyrrhophyta	Gymnodinium	sp. 3	8	14.1995	0.00228115	75.3982	1070.6185	0.00047195
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	6041	Pyrrhophyta	Peridinium	cinctum	30	14.1995	0.00228115	7021.4596	99701.3816	0.0439503
060	Onondaga	9/28/2004	2411406	South	Grab	Upper Mixed	0-9m	6044	Pyrrhophyta	Peridinium	umbonatum	28	28.399	0.0045623	5705.97	162044.1119	0.07143218
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	1071	Bacillariophyta	Cyclotella	sp. 1	4	63.6139	0.0166571	50.2655	3197.5828	0.00396363
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	9818	Bacillariophyta	Stephanodiscus	medius	20	18.1754	0.00475917	3141.5927	57099.6734	0.07077913
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	1298	Bacillariophyta	Stephanodiscus	parvus	6	18.1754	0.00475917	169.646	3083.3823	0.00382207
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2683	Chlorophyta	.	.	5	118.14	0.03093458	70.6858	8350.823	0.01035144
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2684	Chlorophyta	.	.	11.3333	72.7016	0.01903668	827.9842	60195.7439	0.07461693
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	1000031	Chlorophyta	Ankistrodesmus	falcatus	60	9.0877	0.00237959	56.5487	513.8973	0.00063701
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2082	Chlorophyta	Chlamydomonas	globosa	6	9.0877	0.00237959	113.0973	1027.7938	0.00127402
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	1000012	Chlorophyta	Closterium	.	190	9.0877	0.00237959	1989.6753	18081.5625	0.02241339
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2173	Chlorophyta	Coelastrum	cambricum	16	9.0877	0.00237959	845.4654	7683.3318	0.00952404
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2171	Chlorophyta	Coelastrum	microporum	10	9.0877	0.00237959	113.0973	1027.7938	0.00127402
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2861	Chlorophyta	Monomastix	astigmata	6	9.0877	0.00237959	14.1372	128.4746	0.00015925
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	8041	Chlorophyta	Monoraphidium	capricornutum	4	1935.6791	0.50685139	7.8108	15119.202	0.01874133
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2363	Chlorophyta	Oocystis	parva	22.6667	27.2631	0.00713876	1373.9232	37457.3855	0.04643111
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2367	Chlorophyta	Oocystis	pusilla	6	18.1754	0.00475917	37.6991	685.1959	0.00084935
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2381	Chlorophyta	Pediastrum	.	56	9.0877	0.00237959	2245.1042	20402.8225	0.02529076
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	102793	Chlorophyta	Scenedesmus	acutus	12	9.0877	0.00237959	94.2478	856.4953	0.00106169
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	8303	Chlorophyta	Scenedesmus	opoliensis	28	18.1754	0.00475917	248.5349	4517.2188	0.00559942
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2884	Chlorophyta	Scenedesmus	quadricauda	8	9.0877	0.00237959	14.1372	128.4746	0.00015925
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2501	Chlorophyta	Selenastrum	minutum	6	72.7016	0.01903668	21.1595	1538.3287	0.00190687
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2911	Chlorophyta	Stichococcus	bacillaris	3	36.3508	0.00951834	6.2832	228.3992	0.00028312
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2554	Chlorophyta	Tetraedron	minimum	8	9.0877	0.00237959	128	1163.225	0.0014419
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	8332	Chlorophyta	Tetraedron	muticum	8	9.0877	0.00237959	128	1163.225	0.0014419
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	6	9.0877	0.00237959	55.4227	503.6646	0.00062433
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	1731	Chrysophyta	Erkenia	subaequiciliata	4	90.877	0.02379585	30.2431	2748.4007	0.00340684
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	3015	Cryptophyta	Cryptomonas	erosa	12	127.2277	0.03331417	171.7404	21850.1416	0.02708481
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	3069	Cryptophyta	Cryptomonas	rostratiformis	32	2.1945	0.00057462	1206.3716	2647.3433	0.00328157
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	3043	Cryptophyta	Rhodomonas	minuta	7	372.5955	0.09756294	21.7293	8096.2394	0.01003587
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	3041	Cryptophyta	Rhodomonas	minuta	12	36.3508	0.00951834	94.2478	3425.9811	0.00424675
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	4041	Cyanophyta	Aphanizomenon	flos-aquae	170	45.4385	0.01189793	1201.6592	54601.5623	0.06768254
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	4183	Cyanophyta	Oscillatoria	agardhii	400	45.4385	0.01189793	6949.2029	315761.1869	0.39140856
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	4321	Cyanophyta	Synechococcus	elongatus	4	18.1754	0.00475917	8.3776	152.2661	0.00018874
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	4285	Cyanophyta	Synechocystis	.	2	463.4725	0.12135879	4.1888	1941.3934	0.0024065
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	6032	Pyrrhophyta	Gymnodinium	sp. 1	22	27.2631	0.00713876	1767.6695	48192.1245	0.05973758
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	6033	Pyrrhophyta	Gymnodinium	sp. 2	11	72.7016	0.01903668	240.8554	17510.5636	0.0217056
060	Onondaga	10/12/2004	2411870	South	Grab	Upper Mixed	0-11m	6040	Pyrrhophyta	Peridinium	.	40	9.0877	0.00237959	9424.778	85649.5092	0.10616869
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	1071	Bacillariophyta	Cyclotella	sp. 1	4	27.2631	0.00790118	50.2655	1370.3926	0.00927124
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	1298	Bacillariophyta	Stephanodiscus	parvus	6	18.1754	0.00526745	127.2345	2312.5367	0.01564521
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2683	Chlorophyta	.	.	5	154.4908	0.04477332	73.3038	11324.764	0.07661644
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2684	Chlorophyta	.	.	12	9.0877	0.00263373	904.7787	8222.353	0.05562742
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2687	Chlorophyta	.	.	5	18.1754	0.00526745	23.5619	428.2467	0.00289726
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2080	Chlorophyta	Chlamydomonas	.	12	9.0877	0.00263373	226.1947	2055.5885	0.01390686
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2085	Chlorophyta	Chlamydomonas	platystigma	10	9.0877	0.00263373	188.4956	1712.9905	0.01158905
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	1000012	Chlorophyta	Closterium	.	160	2.1945	0.00063599	1072.3303	2353.194	0.01592027
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2173	Chlorophyta	Coelastrum	cambricum	12	9.0877	0.00263373	241.9445	2198.7179	0.01487518
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2175	Chlorophyta	Coelastrum	pseudomicroporum	18	9.0877	0.00263373	1047.1976	9516.6125	0.06438359
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	10611	Chlorophyta	Coelastrum	reticulatum	24	9.0877	0.00263373	1809.5574	16444.706	0.11125484
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2324	Chlorophyta	Kirchneriella	obesa	12	9.0877	0.00263373	89.2665	811.2267	0.00548826
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	8041	Chlorophyta	Monoraphidium	capricornutum	4	445.2971	0.12905253	7.8108	3478.1263	0.02353088
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2381	Chlorophyta	Pediastrum	.	36	2.1945	0.00063599	2827.6413	6205.1671	0.04198037
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	102813	Chlorophyta	Scenedesmus	bijuga	24	2.1945	0.00063599	452.3893	992.7536	0.00671636
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	8226	Chlorophyta	Scenedesmus	intermedius	12	9.0877	0.00263373	25.1327	228.3983	0.0015452
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2884	Chlorophyta	Scenedesmus	quadricauda	15	9.0877	0.00263373	47.1239	428.2476	0.00289726
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	8308	Chlorophyta	Scenedesmus	serratus	12	9.0877	0.00263373	150.7964	1370.3917	0.00927123
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2491	Chlorophyta	Schroederia	judayi	24	9.0877	0.00263373	80.4248	730.8761	0.00494466
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2501	Chlorophyta	Selenastrum	minutum	6	72.7016	0.02106981	32.8964	2391.6196	0.01618024
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	2911	Chlorophyta	Stichococcus	bacillaris	4	18.1754	0.00526745	8.3776	152.2661	0.00103014

Job ID	Lake	Date	Site	Station	Sample Type	Depth	Depth Note	Taxa Code	Division	Genus	Species	GALD	Concentration (natural unit/ml)	Relative Concentration (%)	Biovolume (um3/unit)	Total Biovolume (um3/ml)	Relative Total Biovolume (%)
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	8332	Chlorophyta	Tetraedron	muticum	12	9.0877	0.00263373	432	3925.8843	0.02656014
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	1731	Chrysophyta	Erkenia	subaequiciliata	4	27.2631	0.00790118	30.2431	824.5202	0.0055782
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	1183	Chrysophyta	Mallomonas	akrokomas	16	9.0877	0.00263373	37.6991	342.5979	0.00231781
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	1570	Chrysophyta	Ochromonas	.	4.5	54.5262	0.01580236	47.5852	2594.6387	0.01755374
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	3015	Cryptophyta	Cryptomonas	erosa	16	45.4385	0.01316863	435.6342	19794.554	0.13391786
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	3069	Cryptophyta	Cryptomonas	rostratiformis	28	9.0877	0.00263373	1055.5751	9592.7447	0.06489865
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	3041	Cryptophyta	Rhodomonas	minuta	11	72.7016	0.02106981	120.9513	8793.3483	0.05949042
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	3043	Cryptophyta	Rhodomonas	minuta	6	118.14	0.03423841	14.1372	1670.1693	0.01129935
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	4041	Cyanophyta	Aphanizomenon	flos-aquae	226.6667	6.5834	0.00190795	2848.3773	18752.0146	0.12686468
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	4321	Cyanophyta	Synechococcus	elongatus	4	27.2631	0.00790118	8.3776	228.3992	0.00154521
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	4285	Cyanophyta	Synechocystis	.	1.625	2208.3099	0.63999514	2.3726	5239.4361	0.03544682
060	Onondaga	10/26/2004	2412407	South	Grab	Upper Mixed	0-6m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	2.1945	0.00063599	603.1858	1323.6717	0.00895515
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	9212	Bacillariophyta	Cocconeis	placentula	16	3.0292	0.00220045	201.0619	609.0631	0.00234953
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	9045	Bacillariophyta	Fragilaria	construens	22	12.1169	0.00880185	684.8672	8298.4858	0.03201232
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	9114	Bacillariophyta	Nitzschia	fonticola	12	3.0292	0.00220045	75.3982	228.3986	0.00088107
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	9818	Bacillariophyta	Stephanodiscus	medius	18	15.1462	0.01100237	2453.5839	37162.3708	0.14335793
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	1298	Bacillariophyta	Stephanodiscus	parvus	6	3.0292	0.00220045	84.823	256.9485	0.00099121
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	2683	Chlorophyta	.	.	6	99.9646	0.07261541	113.0973	11305.7316	0.0436131
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	2173	Chlorophyta	Coelastrum	cambricum	18	6.0585	0.00440096	2159.7402	13084.707	0.0504757
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	2840	Chlorophyta	Lobomonas	.	12	3.0292	0.00220045	444.8495	1347.5522	0.00519833
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	8041	Chlorophyta	Monoraphidium	capricornutum	4	121.1693	0.08801875	7.8108	946.4289	0.00365095
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	2830	Chlorophyta	Nephrocytium	.	30	6.0585	0.00440096	859.6036	5207.877	0.02008996
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	2363	Chlorophyta	Oocystis	parva	7	6.0585	0.00440096	95.295	577.3413	0.00222716
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	102793	Chlorophyta	Scenedesmus	acutus	48	4.3889	0.00318815	1507.9645	6618.3583	0.02553104
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	2483	Chlorophyta	Scenedesmus	bijuga	12	6.0585	0.00440096	75.3982	456.7972	0.00176215
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	2488	Chlorophyta	Scenedesmus	denticulatus	14	3.0292	0.00220045	134.0413	406.0422	0.00156635
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	8303	Chlorophyta	Scenedesmus	opoliensis	30	3.0292	0.00220045	113.0973	342.5979	0.00132161
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	2884	Chlorophyta	Scenedesmus	quadricauda	30	12.1169	0.00880185	128.4562	1556.4944	0.00600435
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	8308	Chlorophyta	Scenedesmus	serratus	8	3.0292	0.00220045	67.0206	203.0209	0.00078318
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	2501	Chlorophyta	Selenastrum	minutum	6	30.2923	0.02200467	44.6333	1352.0461	0.00521567
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	2892	Chlorophyta	Staurastrum	paradoxum	44	3.0292	0.00220045	4296.4421	13014.9187	0.05020648
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	1731	Chrysophyta	Erkenia	subaequiciliata	4	54.5262	0.03960845	30.2431	1649.0404	0.00636135
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	1180	Chrysophyta	Mallomonas	.	21	9.0877	0.00660141	1332.0353	12105.1307	0.04669687
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	1570	Chrysophyta	Ochromonas	.	4	12.1169	0.00880185	30.2431	366.4534	0.00141363
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	3015	Cryptophyta	Cryptomonas	erosa	22	87.8477	0.06381356	798.6627	70160.6969	0.2706526
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	3069	Cryptophyta	Cryptomonas	rostratiformis	32	9.0877	0.00660141	2144.6606	19490.0217	0.0751849
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	3041	Cryptophyta	Rhodomonas	minuta	12	254.4555	0.18483935	147.6549	37571.5961	0.14493656
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	3043	Cryptophyta	Rhodomonas	minuta	7	124.1985	0.09021919	33.5103	4161.929	0.0160551
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	4183	Cyanophyta	Oscillatoria	agardhii	210	3.0292	0.00220045	2638.9378	7993.9541	0.03083756
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	4285	Cyanophyta	Synechocystis	.	1.5	472.5601	0.34327299	1.7671	835.061	0.00322134
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	7140	Miscellaneous	.	.	4	3.0292	0.00220045	30.2431	91.6134	0.00035341
060	Onondaga	11/10/2004	2412990	South	Grab	Upper Mixed	0-6m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	3.0292	0.00220045	603.1858	1827.1896	0.00704858
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	1523	Bacillariophyta	Cyclostephanos	damasii	28	3.0292	0.00225757	8620.5302	26113.5834	0.05533492
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	1076	Bacillariophyta	Cyclotella	meneghiniana	12	6.0585	0.00451522	678.584	4111.1763	0.00871162
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	9045	Bacillariophyta	Fragilaria	construens	12	3.0292	0.00225757	150.7964	456.7972	0.00096796
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	9818	Bacillariophyta	Stephanodiscus	medius	40	4.3889	0.00327092	25132.7412	110305.9696	0.23373934
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	1298	Bacillariophyta	Stephanodiscus	parvus	6	3.0292	0.00225757	84.823	256.9485	0.00054448
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2683	Chlorophyta	.	.	5	95.4208	0.07111432	70.6858	6744.8955	0.01429249
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2080	Chlorophyta	Chlamydomonas	.	6	3.0292	0.00225757	50.2655	152.2658	0.00032265
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2082	Chlorophyta	Chlamydomonas	globosa	8	3.0292	0.00225757	268.0826	812.0843	0.00172081
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	1000012	Chlorophyta	Closterium	.	220	6.0585	0.00451522	1474.4542	8932.9268	0.01892895
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2171	Chlorophyta	Coelastrum	microporum	26	6.0585	0.00451522	3049.4393	18474.9165	0.03914851
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2175	Chlorophyta	Coelastrum	pseudomicroporum	24	3.0292	0.00225757	1047.1976	3172.2042	0.00672193
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2840	Chlorophyta	Lobomonas	.	8	3.0292	0.00225757	130.6903	395.8912	0.0008389
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	8041	Chlorophyta	Monoraphidium	capricornutum	4	163.5785	0.12191025	7.8108	1277.679	0.00270741
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2363	Chlorophyta	Oocystis	parva	9	6.0585	0.00451522	276.4602	1674.924	0.00354918
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2483	Chlorophyta	Scenedesmus	bijuga	11	21.2046	0.01580317	70.1622	1487.7629	0.00315258
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2884	Chlorophyta	Scenedesmus	quadricauda	20	24.2339	0.01806081	75.3982	1827.1889	0.00387183
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2501	Chlorophyta	Selenastrum	minutum	8	18.1754	0.01354559	62.4866	1135.7183	0.0024066
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2911	Chlorophyta	Stichococcus	bacillaris	4	12.1169	0.00903037	8.3776	101.5108	0.0002151
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	8332	Chlorophyta	Tetraedron	muticum	9	3.0292	0.00225757	181.845	550.8506	0.00116726
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	9	6.0585	0.00451522	45.8777	277.9484	0.00058898
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	1731	Chrysophyta	Erkenia	subaequiciliata	4	27.2631	0.02031839	30.2431	824.5202	0.00174717
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	1180	Chrysophyta	Mallomonas	.	10	3.0292	0.00225757	502.8643	1523.2925	0.00322787
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	1570	Chrysophyta	Ochromonas	.	4	81.7893	0.06095516	30.2431	2473.5607	0.0052415
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	3015	Cryptophyta	Cryptomonas	erosa	21.2	209.017	0.15577423	884.6725	184911.5814	0.3918293
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	3041	Cryptophyta	Rhodomonas	minuta	13	354.4201	0.26413888	217.8171	77198.7606	0.16358487
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	3043	Cryptophyta	Rhodomonas	minuta	8	127.2277	0.09481907	33.5103	4263.4395	0.00903427
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	4183	Cyanophyta	Oscillatoria	agardhii	130	3.0292	0.00225757	1633.6282	4948.6383	0.01048621
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	4285	Cyanophyta	Synechocystis	.	1.75	136.3154	0.10159186	2.978	405.9473	0.00086021

Job ID	Lake	Date	Site	Station	Sample Type	Depth	Depth Note	Taxa Code	Division	Genus	Species	GALD	Concentration (natural unit/ml)	Relative Concentration (%)	Biovolume (um3/unit)	Total Biovolume (um3/ml)	Relative Total Biovolume (%)
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	6032	Pyrrhophyta	Gymnodinium	sp. 1	26	3.0292	0.00225757	1742.5367	5278.5474	0.01118529
060	Onondaga	11/17/2004	2412885	North	Grab	Upper Mixed	0-6m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	3.0292	0.00225757	603.1858	1827.1896	0.00387183
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	1343	Bacillariophyta	Amphora	pediculus	10	3.0292	0.00217389	130.3761	394.9394	0.00096299
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	1076	Bacillariophyta	Cyclotella	meneghiniana	12	6.0585	0.00434785	678.584	4111.1763	0.01002441
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	1071	Bacillariophyta	Cyclotella	sp. 1	3	3.0292	0.00217389	21.2058	64.2373	0.00015663
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	9818	Bacillariophyta	Stephanodiscus	medius	22	18.1754	0.01304349	4285.1324	77883.9537	0.18990683
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	1298	Bacillariophyta	Stephanodiscus	parvus	6	6.0585	0.00434785	84.823	513.897	0.00125305
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2683	Chlorophyta	.	.	4	30.2923	0.02173912	33.5103	1015.1046	0.00247516
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2080	Chlorophyta	Chlamydomonas	.	10	6.0585	0.00434785	188.4956	1141.9937	0.00278456
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2082	Chlorophyta	Chlamydomonas	globosa	6	12.1169	0.00869563	113.0973	1370.3917	0.00334147
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	1000012	Chlorophyta	Closterium	.	160	6.0585	0.00434785	1072.3303	6496.6739	0.01584104
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2171	Chlorophyta	Coelastrum	microporum	46	6.0585	0.00434785	4245.3389	25720.2304	0.06271442
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2175	Chlorophyta	Coelastrum	pseudomicroporum	12	3.0292	0.00217389	268.0826	812.0843	0.00198013
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2840	Chlorophyta	Lobomonas	.	8	15.1462	0.01086959	130.6903	1979.456	0.00482657
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	8041	Chlorophyta	Monoraphidium	capricornutum	4	48.4677	0.0347826	7.8108	378.5716	0.00092308
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2363	Chlorophyta	Oocystis	parva	12	3.0292	0.00217389	113.0973	342.5979	0.00083537
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	102793	Chlorophyta	Scenedesmus	acutus	20	3.0292	0.00217389	201.0619	609.0631	0.0014851
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2483	Chlorophyta	Scenedesmus	bijuga	12	6.0585	0.00434785	134.0413	812.0843	0.00198013
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2488	Chlorophyta	Scenedesmus	denticulatus	10	3.0292	0.00217389	94.2478	285.4984	0.00069614
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2884	Chlorophyta	Scenedesmus	quadricauda	30.4	18.1754	0.01304349	314.997	5725.1934	0.01395991
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2501	Chlorophyta	Selenastrum	minutum	10	3.0292	0.00217389	95.2176	288.4362	0.0007033
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	10	3.0292	0.00217389	28.0858	85.0784	0.00020745
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	1731	Chrysophyta	Erkenia	subaequiciliata	4	3.0292	0.00217389	30.2431	91.6134	0.00022338
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	1570	Chrysophyta	Ochromonas	.	5	15.1462	0.01086959	64.9273	983.3992	0.00239785
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	3015	Cryptophyta	Cryptomonas	erosa	21.3333	139.3447	0.10000003	1038.82	144754.0184	0.35295815
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	3069	Cryptophyta	Cryptomonas	rostratiformis	30	3.0292	0.00217389	1130.9734	3425.9805	0.00835367
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	3041	Cryptophyta	Rhodomonas	minuta	12	736.1033	0.52826086	147.6549	108689.26	0.26502035
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	3043	Cryptophyta	Rhodomonas	minuta	7	209.017	0.15000001	31.4159	6566.4568	0.01601119
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	4041	Cyanophyta	Aphanizomenon	flos-aquae	220	3.0292	0.00217389	2764.6015	8374.6185	0.02042009
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	7140	Miscellaneous	.	.	4	72.7016	0.05217394	30.2431	2198.7206	0.00536121
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	6.0585	0.00434785	603.1858	3654.3791	0.00891058
060	Onondaga	11/17/2004	2412871	South	Grab	Upper Mixed	0-6m	6044	Pyrrhophyta	Peridinium	umbonatum	12	3.0292	0.00217389	444.8495	1347.5522	0.00328578
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	9043	Bacillariophyta	Fragilaria	pinnata	8	3.0292	0.0026011	201.0619	609.0631	0.00213477
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	9818	Bacillariophyta	Stephanodiscus	medius	20	6.0585	0.00520228	3518.5838	21317.2112	0.07471682
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	2683	Chlorophyta	.	.	5	48.4677	0.04161801	73.3038	3552.8671	0.0124528
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	2080	Chlorophyta	Chlamydomonas	.	8	3.0292	0.0026011	254.846	771.9876	0.00270582
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	1000012	Chlorophyta	Closterium	.	120	3.0292	0.0026011	804.2477	2436.2526	0.00853906
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	2173	Chlorophyta	Coelastrum	cambricum	24	3.0292	0.0026011	4077.5359	12351.8011	0.04329306
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	2171	Chlorophyta	Coelastrum	microporum	22	2.1945	0.00188436	4289.3212	9412.7762	0.03299178
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	8041	Chlorophyta	Monoraphidium	capricornutum	4	127.2277	0.10924727	7.8108	993.7504	0.00348309
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	2363	Chlorophyta	Oocystis	parva	7	6.0585	0.00520228	117.2861	710.5735	0.00249056
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	102793	Chlorophyta	Scenedesmus	acutus	36	3.0292	0.0026011	402.1239	1218.1265	0.00426953
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	2483	Chlorophyta	Scenedesmus	bijuga	18	6.0585	0.00520228	268.0826	1624.1686	0.00569271
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	2487	Chlorophyta	Scenedesmus	dimorphus	22	6.0585	0.00520228	370.2908	2243.3933	0.00786309
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	2884	Chlorophyta	Scenedesmus	quadricauda	20	12.1169	0.01040448	125.6637	1522.6579	0.00533692
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	2501	Chlorophyta	Selenastrum	minutum	8	18.1754	0.01560677	69.9254	1270.9214	0.00445458
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	10	6.0585	0.00520228	234.677	1421.782	0.00498335
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	1183	Chrysophyta	Mallomonas	akrokomas	16	3.0292	0.0026011	141.3717	428.2476	0.00150101
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	1570	Chrysophyta	Ochromonas	.	4	6.0585	0.00520228	30.2431	183.2267	0.00064221
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	3015	Cryptophyta	Cryptomonas	erosa	20	96.9354	0.08323602	753.9822	73087.5773	0.25617194
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	3069	Cryptophyta	Cryptomonas	rostratiformis	36	3.0292	0.0026011	1847.2565	5595.768	0.01961317
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	3041	Cryptophyta	Rhodomonas	minuta	12.6667	599.7879	0.51502299	165.4572	99239.223	0.34783345
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	3043	Cryptophyta	Rhodomonas	minuta	8	136.3154	0.11705065	33.5103	4567.9709	0.01601074
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	4183	Cyanophyta	Oscillatoria	agardhii	160	2.1945	0.00188436	3141.5927	6894.1232	0.0241639
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	7140	Miscellaneous	.	.	4	54.5262	0.0468203	30.2431	1649.0404	0.00577989
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	6032	Pyrrhophyta	Gymnodinium	sp. 1	40	3.0292	0.0026011	9424.778	28549.8364	0.10006717
060	Onondaga	11/23/2004	2413368	South	Grab	Upper Mixed	0-6m	6033	Pyrrhophyta	Gymnodinium	sp. 2	16	6.0585	0.00520228	603.1858	3654.3791	0.0128086
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	9212	Bacillariophyta	Cocconeis	placentula	28	3.0292	0.00231775	1407.4335	4263.4422	0.02149182
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	1115	Bacillariophyta	Cymbella	minuta	24	2.1945	0.00167909	1039.36	2280.8418	0.01149762
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	4272	Bacillariophyta	Diatoma	vulgaris	24	2.1945	0.00167909	301.5929	661.8358	0.00333628
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	1160	Bacillariophyta	Gomphonema	.	24	6.0585	0.00463557	1425.5574	8636.6874	0.04353715
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	1210	Bacillariophyta	Navicula	.	24	3.0292	0.00231775	603.1858	1827.1896	0.00921078
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	9818	Bacillariophyta	Stephanodiscus	medius	16	3.0292	0.00231775	1608.4954	4872.5053	0.02456208
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	1298	Bacillariophyta	Stephanodiscus	parvus	7	6.0585	0.00463557	142.9425	866.0119	0.00436553
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	2683	Chlorophyta	.	.	5	227.1924	0.17383288	68.5914	15583.4433	0.07855543
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	2171	Chlorophyta	Coelastrum	microporum	14	3.0292	0.00231775	523.5988	1586.1021	0.00799547
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	8041	Chlorophyta	Monoraphidium	capricornutum	4	21.2046	0.01622438	7.8108	165.6251	0.00083491
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	2363	Chlorophyta	Oocystis	parva	8	6.0585	0.00463557	67.0206	406.0419	0.00204684
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	102793	Chlorophyta	Scenedesmus	acutus	23	9.0877	0.00695332	209.4395	1903.3223	0.00959456
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	2884	Chlorophyta	Scenedesmus	quadricauda	16	9.0877	0.00695332	62.8319	570.9972	0.00287837

Job ID	Lake	Date	Site	Station	Sample Type	Depth	Depth Note	Taxa Code	Division	Genus	Species	GALD	Concentration (natural unit/ml)	Relative Concentration (%)	Biovolume (um3/unit)	Total Biovolume (um3/ml)	Relative Total Biovolume (%)
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	2501	Chlorophyta	Selenastrum	minutum	6	6.0585	0.00463557	32.7311	198.3002	0.00099962
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	2561	Chlorophyta	Tetrastrum	staurogeniaeforme	10	12.1169	0.00927107	45.8777	555.8967	0.00280225
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	1570	Chrysophyta	Ochromonas	.	4	6.0585	0.00463557	30.2431	183.2267	0.00092364
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	3015	Cryptophyta	Cryptomonas	erosa	28	30.2923	0.0231777	1876.578	56845.8959	0.28655759
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	3069	Cryptophyta	Cryptomonas	rostratiformis	34	6.0585	0.00463557	2278.7019	13805.4321	0.06959256
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	3041	Cryptophyta	Rhodomonas	minuta	12	318.0693	0.24336599	201.0619	63951.6238	0.32237725
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	3043	Cryptophyta	Rhodomonas	minuta	8	227.1924	0.17383288	33.5103	7613.2848	0.03837822
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	4285	Cyanophyta	Synechocystis	.	1.75	18.1754	0.01390664	2.978	54.1263	0.00027285
060	Onondaga	12/7/2004	2413775	South	Grab	Upper Mixed	0-6m	7140	Miscellaneous	.	.	4	381.6832	0.29203922	30.2431	11543.2831	0.05818917

APPENDIX 2B

Appendix A2-B. Abundance (#/L) x 10^{-3} and biomass (÷g/L) of microflagellates, Cyanophyta, Chlorophyta, Pyrrophyta, Cryptophyta, Bacillariophyceae, and Chrysophyta for each sampling date at both north ("N") and south ("S") stations, when taken. Samples taken where integrated upper mixed layer samples.

Date	Depth	Station	Variable	Bacillario	Chloro	Chryso	Crypto	Cyano	Misc. Micro	Pyrrho
3/30	Epi	S	Abund	112.07	415.44	526.76	943.39	8.65	21.64	69.24
			BM	252.81	61.59	20.28	52.23	0.09	0.14	40.70
3/30	Photic	S	Abund	68.16	640.68	31.81	572.52	6.74		36.35
			BM	89.89	66.81	0.96	42.41	42.69		12.03
4/6	UML	N	Abund	294.30	1637.98	25.96	292.10	6.49		181.75
			BM	508.62	216.43	2.93	53.78	0.92		100.82
4/6	UML	S	Abund	336.65	1757.14	36.06	468.81			158.67
			BM	777.88	152.32	2.01	109.20			68.64
6/2	UML	S	Abund	1408.59	2773.72	795.17	8587.87	8.23	136.32	45.44
			BM	2957.78	81.10	24.05	552.34	84.80	1.90	3.43
6/8	UML	S	Abund	393.80	4734.38	1075.38	5952.44	39.07		181.75
			BM	688.70	180.48	93.40	483.89	124.84		138.18
6/22	UML	N	Abund	67.32	6481.63	16.83	4108.73	36.10		33.66
			BM	5.71	94.75	1.10	3405.76	73.72		37.22
6/22	UML	S	Abund	20.23	883.56	36.35	3135.25	36.35		9.09
			BM	28.98	201.49	1.10	3348.52	51.77		1.83
7/7	UML	S	Abund	817.89	3378.81	50.49	232.24	33.78	10.10	10.10
			BM	199.64	622.14	1.53	14.76	479.92	0.31	0.46
7/20	UML	S	Abund	265.06	11432.88	37.87	643.71	21.68		2.74
			BM	2444.25	376.98	2.26	473.69	129.90		11.58
8/3	UML	S	Abund	2546.45	1560.71	75.73	851.97	123.06		31.14
			BM	130.61	256.67	2.29	355.13	1741.46		75.87
8/17	UML	S	Abund	709.98	1170.04	28.40	1442.67	119.28		39.76
			BM	60.22	955.07	1.66	175.03	243.08		38.44
8/31	UML	S	Abund	168.77	2492.62	142.81	1402.10	139.23		103.86
			BM	254.99	789.47	19.76	467.67	328.10		81.73
9/14	UML	N	Abund	1840.26	479.85	85.20	79.52	42.50		34.08
			BM	5913.99	251.83	6.73	52.21	104.32		44.16
9/14	UML	S	Abund	1315.82	1025.11	1079.16	340.79	142.00		85.20
			BM	4727.99	493.60	32.64	69.11	446.70		51.39
9/28	UML	S	Abund	42.60	1586.15	1150.16	3251.69	66.32		127.80
			BM	90.42	708.97	34.78	928.75	199.93		305.64
10/12	UML	S	Abund	99.96	2408.24	90.88	538.37	572.52		109.05
			BM	63.38	180.77	2.75	36.02	372.46		151.35
10/26	UML	S	Abund	45.44	824.48	90.88	245.37	2242.16		2.19
			BM	3.68	74.97	3.76	39.85	24.22		1.32
11/10	UML	S	Abund	36.35	307.31	75.73	475.59	475.59	3.03	3.03
			BM	46.56	56.42	14.12	131.38	8.83	0.09	1.83
11/17	UML	N	Abund	19.54	374.11	112.08	690.66	139.34		6.06
			BM	141.24	47.02	4.82	266.37	5.35		7.11
11/17	UML	S	Abund	36.35	166.61	18.18	1087.49	3.03	72.70	9.09
			BM	82.97	47.06	1.08	263.44	8.37	2.20	5.00
11/23	UML	S	Abund	9.09	244.53	9.09	836.07	2.19	54.53	9.09
			BM	21.93	39.53	0.61	182.49	6.89	1.65	32.20
12/7	UML	S	Abund	25.59	293.84	6.06	581.61	18.18	381.68	
			BM	23.41	20.97	0.18	142.22	0.05	11.54	

APPENDIX 3: METHODS

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APPENDIX 3: METHODS

A3-1 TRIBUTARY SAMPLING AND FIELD MEASUREMENTS

Tributaries to Onondaga Lake were sampled on 26 occasions between January 13 and December 28, 2004. These events encompassed the routine biweekly program plus seven high flow events to ensure that the flow record was adequately sampled. Sampling locations, parameters and schedules of the routine monitoring are detailed in Table A3-1.

In-situ data (pH, dissolved oxygen, temperature, salinity, specific conductance, and oxidation-reduction potential) were collected during the routine and high flow events at each location using a water quality meter. Instrument calibration and post-calibration checks were recorded in a bound calibration log book.

Water samples for chemical analysis are collected and analyzed according to EPA Requirements for Water Planning and Management (40 CFR 136, 1991) and EPA 600/4-82-029, 1982 as detailed in the EPA-approved Quality Assurance/Quality Control (QA/QC) plan for this project. Sampling and analysis are also consistent with New York State's Environmental Laboratory Approval Program, through which the County's environmental laboratory is certified (ELAP#10191 and # 10788). Samples are preserved immediately in the field in accordance with the specific analytical protocol, and placed on ice.

Tributary samples are collected as a composite of multiple samples across the entire cross section of the stream. According to NYSDEC guidance, composite samples are more representative of the water-suspended sediment ratio of the stream itself (NYSDEC 1997 Program Plan for Rotating Intensive Basin Studies Water Quality Section, April 1997). Since many contaminants of concern are transported with the suspended sediment fraction, the overall loading estimate is considered to be more accurate when based on the composite samples.

Most of the tributary streams in the Onondaga Lake watershed are sampled using a depth-integrating sampler, designed to accumulate a water-suspended sediment sample at a velocity comparable to the stream velocity. Depending on the depth and velocity of the stream, a depth-

Table A3-1. Sampling Program for Onondaga Lake Tributaries, 2004.

Parameter	Sampling Sites												Frequency[4]
	1	2a	2b	3a	3b	3c	4	5	6	7	8a	8b	
Cd, Cr, Cu, Ni,Pb, Hg, Zn, As, K	X	X	X	X	X	X[6]	X	X	X	X	X	X	Quarterly
CN	X	X	X	X	X		X	X	X	X	X	X	Quarterly
Ca, Na, Mg, Mn, Fe	X	X	X	X	X	X[6]	X	X	X	X	X	X	Biweekly
TP, SRP,TDP	X	X	X	X	X		X	X	X	X	X	X	Biweekly
BOD$_5$, TSS, TDS, Cl, SiO$_2$, SO$_4$, TOC, TOC-F, TIC, Turbidity	X	X	X	X	X	X[6]	X	X	X	X	X	X	Biweekly
TKN, NH$_3$-N, NO$_3$,NO$_2$, Org-N	X	X	X	X	X		X	X	X	X	X	X	Biweekly
ALK-T	X	X	X	X	X	X	X	X	X	X	X	X	Biweekly
Fecal Coliforms	X	X	X	X	X		X	X	X	X	X[5]		Biweekly
In situ: pH, Temperature, Salinity, Conductivity, Redox potential, Dissolved oxygen	X	X	X	X	X	X	X	X	X	X	X	X	Biweekly

Notes:

Sampling site numbers correspond to the following sites:

1 - Nine Mile Creek @ Lakeland (Rt. 48)
2a - Harbor Brook @ Hiawatha Blvd.
2b - Harbor Brook @ Velasko Rd.
3a - Onondaga Creek @ Kirkpatrick St.
3b - Onondaga Creek @ Dorwin Avenue
3c - Onondaga Creek @ Spencer Street
4 - Ley Creek @ Park St.
5 - Tributary 5A @ State Fair Blvd.[1]
6 - Metro Effluent[2]
7 - Allied East Flume
8a - Onondaga Lake Outlet @ Long Branch Rd.--2 ft.[3]
8b - Onondaga Lake Outlet @ Long Branch Rd.--12 ft.[3]

[1] Tributary 5A flow will also be monitored quarterly (during the Extended Tributary sampling events, which include the quarterly and biweekly parameters.

[2] Metro effluent sampled biweekly for all parameters. If any flow is bypassed on sampling date, this water is sampled for the same parameters as all other tributaries.

[3] Collect a composite (using a vertical Kemmerer sampler) of five (5) transects for all parameters and a side-by-side sample at mid-channel for the parameters Chloride and TP for each of the Onondaga lake Outlet 2 feet and 12 feet depth sites. This side-by-side method evaluation was discontinued in March 2003, when it was determined that mid-channel sampling was acceptable.

[4] A minimum of 5 tributary sampling events will be conducted for predetermined high flow conditions.

[5] Sample to be collected at the surface of the Lake Outlet.

[6] Includes parameters K, Ca, Na, Mg, Cl, SO$_4$

integrated sample is collected from a bridge using a sampling crane or by wading into the stream with a hand-held sampler. Multiple transects are sampled.

There are a few exceptions to this general approach, as summarized in Table A3-2. Discharge from the East Flume is directed over a v-notched weir, and the field team fills the churn with water cascading over the weir. Ley Creek at Park St. and Harbor Brook at Hiawatha Blvd. are sampled using a Kemmerer bottle, taking three samples over the cross section of these streams. The Kemmerer device collects a sample that encompasses the entire depth of the water column in these shallow streams.

Table A3-2. Summary of Tributary Sampling Techniques.

Tributary	Sampling Technique
Onondaga Creek at Kirkpatrick St.	Depth-integrating sampler, crane from bridge
Onondaga Creek at Dorwin Ave.	Depth-integrating sampler, crane from bridge
Harbor Brook at Velasko Rd.	Depth-integrating sampler, hand-held (wade stream)
Harbor Brook at Hiawatha Blvd.	Kemmerer sample, three points composited
Ninemile Creek at Rt. 48	Depth-integrating sampler, crane from bridge
Ley Creek at Park St.	Kemmerer sample, three points composited
Tributary 5A	Depth-integrating sampler, hand-held (wade stream)
East Flume	Sample bottles filled from sampling churn with water collected at weir with jar
Onondaga Lake Outlet	Wildco (point) sampler at 2 ft. and 12 ft. depths. Samples composited from 5 points along transect.

The Onondaga Lake outlet is sampled using a Wildco beta sampler at the central point of the outlet channel. Samples are collected at the 2 ft depth and 12 ft depths.

Daily mean flow values are coupled with the measured concentration data to estimate load when there is one sample taken in a 24-hour period. When there are multiple samples collected in a 24-hour period (e.g. storm event sampling), data may be calculated as flow weighted average, or paired with the instantaneous discharge at the time of sampling. There were no storm event samples collected during 2004.

The network of flow gauging stations in the Onondaga Lake watershed is partially funded by OCDWEP through a cooperative arrangement with the United States Geologic Survey (USGS). The USGS Water Resources Division office in Ithaca, NY, provided provisional and final discharge data to Onondaga County for their use in calculating annual loads. Discharge of the lake outlet to the Seneca River is an active area of research.

A3-2 LAKE SAMPLING AND FIELD MEASUREMENTS

Onondaga Lake was sampled between March 30 and December 7, 2004 at the "South Deep" station. The field team moors the sampling boat to the water quality buoy at South Deep. Sampling frequency at South Deep during 2004 was generally biweekly, although the spring sampling schedule was modified during the laboratory move[1]. Samples were obtained on March 30, April 6th, April 27th, May 11th, and June 2nd during this period. The "North Deep" station was sampled four times in 2004 (Table A3-3). These sampling events included the entire suite of analytical parameters. In addition to the biweekly program during the ice-free season, the County field team completed additional sampling events for a limited number of parameters in support of a broad range of AMP objectives.

During the summer recreational period (June – September), weekly samples of chlorophyll-*a* and Secchi disk transparency were collected at the primary mid-lake open water sampling site, South Deep station. In addition to the data collection program centered at South Deep, the AMP includes monitoring at a network of eight nearshore samples to assess recreational quality parameters of bacterial abundance and water clarity. Sampling at the nearshore stations occurs during dry and wet weather periods throughout the recreational season. Field sampling is conducted during the fall mixing period to track dissolved oxygen and nitrogen concentrations during this critical period. Field data during fall mixing are supplemented with high frequency data from the monitoring buoy at the South Deep station.

Sampling stations are located using GPS navigational equipment, with a differential to increase accuracy and precision. The coordinates of the stations are listed in Table A3-4.

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[1] The laboratory moved from the Metro POB 2nd floor to the Henry Clay Boulevard facility.

Table A3-3. 2004 Sampling Program for Onondaga Lake.

Parameter	**UML[2]**				**LML[2]**			**Frequency[1]**
	0m	**3m**	**6m**	**9m**	**12m**	**15m**	**18m**	
Cd, Cr, Cu, Ni,Pb, Zn, As, Se, K	Composite				Composite			Quarterly
Hg[3]		X					X	2004 three events: April, Sept, Oct.
Ca, Na, Mg, Mn, Fe	Composite				Composite			Biweekly
Cl, SO_4	Composite				Composite			Biweekly
TS, TSS, VSS, TVS, TDS, SiO_2, TOC, TOC-F, TIC	X		X		X		X	Biweekly
Turbidity	Composite							Biweekly
BOD_5	X	X	X	X	X	X	X	Biweekly
TP[4], SRP, TDP	X	X	X	X	X	X	X	Biweekly
NO_3, NO_2	Composite				Composite			Biweekly
TKN, NH_3-N, Org-N, TKN-F	X	X	X	X	X	X	X	Biweekly
ALK-T	Composite				Composite			Biweekly
Fecal coliforms, *E. coli*	X							Biweekly
Chlor-*a*[5], Phaeo-*a*	Composite							Biweekly
Sulfide[6]					X	X	X	Biweekly
pH, Temperature, Salinity Conductivity, Dissolved oxygen, Oxidation-Reduction Potential	Measured every half-meter from 0-18 meters depth							Biweekly
Underwater Illumination	Recorded at each site							Biweekly
Secchi Depth[7]								variable, see note 7
Phytoplankton[5]								variable, see note 5
Zooplankton[8]	Composite					X		variable, see note 8

Table A3-3. Footnotes:

1) Biweekly (March - December) samples were taken at the South Deep station. Spring sampling was modified in 2004 during relocation of the laboratory (see text for details). Quarterly sampling is conducted at the North Deep station.

2) Please note that "UML" and "LML" composite samples are based on the thermocline depth determined through the field profile (Temperature, pH, D.O., Specific Conductivity). Composites are made by mixing equal volume of samples from each depth.

3) Hg - Special low-level Hg analysis by Contract Laboratory. An equipment blank is included in the low-level Hg program.

4) TP concentration at 1-m depth is monitored biweekly at South Deep between June 1 and Sept. 30 per NYSDEC guidance.

5) Chlorophyll-a samples were collected as UML and photic zone composites. Phytoplankton samples are integrated UML samples. Chlorophyll-a samples were collected in duplicate at South Deep; biweekly (March – June) and monthly (August - November). Phytoplankton samples were collected at South Deep biweekly from March 30 - December 7, 2004 (18 samples). North Deep was sampled quarterly for both phytoplankotn and chlorophyll-a.

6) Sulfides are analyzed only when anoxic conditions are present.

7) Secchi disk transparency is measured weekly at eight (8) nearshore stations during summer (May – September), and bi-weekly at South Deep during the entire sampling period (in 2004, March – December). Secchi disk transparency is measured quarterly at North Deep.

8) Zooplankton was collected as a net tow through the epilimnion and as a 15-meter vertical net haul. Sampling occurs biweekly (March - Dec) at South Deep and quarterly at North Deep.
Winter sampling depends on weather.

Table A3-4. Coordinates of Sampling Stations, Onondaga Lake AMP

Station	Location
South Deep	43° 04.67’ N, 76° 11.88’ W
North Deep	43° 05.93’ N, 76° 13.73’ W
Nearshore Site 1	43° 05.477’ N, 76° 13.650’ W
Nearshore Site 2	43° 03.877’ N, 76° 11.043’ W
Nearshore Site 3	43° 03.937’ N, 76° 10.931’ W
Nearshore Site 4	43° 04.407’ N, 76° 10.768’ W
Nearshore Site 5	43° 06.529’ N, 76° 13.598’ W
Nearshore Site 6	43° 06.873’ N, 76° 14.156’ W
Nearshore Site 7	43° 06.732’ N, 76° 14.713’ W
Nearshore Site 8	43° 05.720’ N, 76° 12.225’ W

In-situ data for pH, DO, temperature, salinity, specific conductance, and oxidation-reduction potential (redox) are collected at half-meter intervals throughout the water column using a water quality meter. The instrument is calibrated prior to each sampling event and the calibration was checked following each sampling event. Other field data collected includes Secchi disk transparency and underwater illumination. Light data are collected using a Li-Cor photometer (Model # LI-1400), the instrument is lowered through the water column from the lake surface to the depth representing 1% of initial surface reading. Illumination is recorded at 20-cm intervals.

Samples are collected for laboratory analysis using a submersible pump or a WildCo Beta sampler, depending on the parameter to be analyzed. Pumping lines are purged of previous sample water prior to sample collection. All sample containers are rinsed with sample water prior to filling. Composite samples of the upper mixed layer (UML) and lower water layer (LWL) are created by mixing equal volumes collected at discrete depths. A churn is used to mix the water.

The water depths included in the composite samples of the UML and LWL are determined once the field temperature profiles are complete. The field team is guided by default definitions of the UML and LWL that vary depending on the lake’s annual stratification and mixing. Two periods are defined in the defaults: October 1 – May 31, (not strongly stratified) and June 1 – Sept 30 (strongly stratified). During the October 1 – May 31 period, default UML includes the 0, 3 and 6 m depths; default LWL includes the 9, 12, 15 and 18 m depths. During the June 1 – September 30 period, default UML includes 0 and 3 m depths (always); 6 m may be excluded based on field conditions. The LWL during the summer period typically includes 12, 15, and 18 m; 9m is excluded as it is in the metalimnion. Occasionally, the thermal structure during summer leads the field team to exclude the 12 m depth as well.

The field team records the depths included in the UML and LWL composite samples on the field sheets; this information is entered into the Laboratory Information Management System (LIMS) upon return to the Henry Clay Boulevard facility.

All sampling equipment used on Onondaga Lake is dedicated to this purpose only. Rinsate blanks were incorporated into each 2004 monitoring event to evaluate the effectiveness of equipment cleaning. Samples were preserved immediately in the field and placed on ice.

Phytoplankton samples were collected at the South Deep station on 18 occasions between March 30 and December 7, 2004. Samples were collected on four dates at North Deep. Samples were preserved in Lugol's iodine solution upon collection. Beginning in 2004, a single phytoplankton sample was obtained at each site and date. The sample is an integrated composite of the UML, collected using a 2 cm inner diameter Tygon tube lowered from the water's surface to the top of the thermocline. The depth of this sample (the tube composite sample) is recorded on the field sheets and entered into the LIMS.

Phytoplankton samples were processed by Dr. Ann St. Amand at PhycoTech, Inc. (620 Broad St., Ste. 100, St. Joseph, MI 49085). Raw water samples were run through filtration towers and the filters from these towers were then made into slides. The method used in counting the phytoplankton depends on the relative importance of soft algae and diatoms in the samples as well as their size. Phytoplankton specimens are identified to species when possible and density and biovolume estimates are made. Individual phytoplankton species are converted to biomass, based on estimates of biovolume and density. The Onondaga Lake phytoplankton biomass is reported in µg/L. PhycoTech reports biomass as total biovolume (μm^3/mL). Total biovolume (μm^3/mL) is converted to total biomass (µg/L) by multiplying total biovolume by 1×10^{-3}.

Zooplankton density, species composition, size structure, and biomass are determined based on organisms collected by vertical hauls using a 0.50 m diameter net with 80 micron nylon mesh. Vertical tows are taken from the UML and the first fifteen meters of the water column. Zooplankton samples were collected at the South Deep site throughout the year and at North

Deep on four dates in 2004. Samples are preserved in 70% ethyl alcohol. The zooplankton net is equipped with a flow meter to determine the volume of water strained in each haul.

A compound scope (40X-200X magnification) is used to identify zooplankton to species when possible and a dry weight conversion is used to estimate biomass. For each site, one to three 1-mL subsamples are withdrawn with a Henson-Stemple pipette from a known volume of sample, until (at least) 100 organisms are counted. Zooplankton length is measured using a compound scope equipped with a drawing tube and a digitizing pad interfaced with a computer.

A3-3 LABORATORY ANALYSIS

Chain-of-custody procedures, equipment description and calibration, reagents and analytical procedures used by the OCDWEP Environmental Laboratory are those outlined by the ELAP of the New York State Department of Health and modified for the DEC-approved Quality Assurance Project Plan for this monitoring program. A list of those methods and their precision and accuracy as determined by the ELAP program is presented in Table A3-5.

Effective June 1, 1999, the OCDWEP Environmental Laboratory began to measure certain metals in the water samples using an ICP (Inductively Coupled Plasma) instead of the flame atomic absorption (AA) method that had been used since the 1970s. This change in analytical technique has resulted in lower limits of detection for many of the inorganic metals present in the lake and streams. In some cases, this has lowered the Method Reporting Limit (MRL) as well. Four metals: Na, Ca, Mg, and K that are present in relatively high concentrations continue to be analyzed by flame AA. Lead (Pb) is measured using furnace AA, which achieves a lower limit of detection (and MRL) than the ICP-method is able to achieve for this metal.

Effective February 12, 2003 the analytical laboratory began to analyze water samples for mercury using a new automated flow injection system (FIMS flow injection mercury system). This change in analytical procedure has led to a lower detection limit. Upon completion of the demonstration of capability, quality control charts, methods refinement and side-by-side analyses the laboratory is now using this analytical procedure and is reporting results with a MRL of 0.00002 mg/l (20 ppt).

Table A3-5. Analytical procedures for water quality analyses, Onondaga Lake 2004 AMP.

Parameter	Code	Methods *	Minimal Reportable Limit (mg/l)	Accuracy (%)	Precision (%)
Oxygen Demand					
Bio Oxy Demand 5-day	BOD5	2:(5210)	2.0	95.5	12.0
Carbon. Bio Oxy Demand 5-day	CBOD5	2:(5210 B)	2.0	87	12.0
Total Alk as CaCO3	ALK-T	1:(310.1)	1.0	100	2.1
Organic Carbon					
Total Organic Carbon	TOC	1:(415.1)	0.1	103.0	6.2
Total Organic Carbon - Filtered	TOC-F	1:(415.1)	0.1		
Total Inorganic Carbon	TIC	OI ANAL 1989	1.0	102.8	3.6
Nitrogen					
Total Kjeldahl Nitrogen as N	TKN	3:(10-107-06-2-D)	0.1	99.1	3.6
Ammonia Nitrogen as N	NH3-N	3:(10-107-06-1-A)	0.05	99.6	6.4
Organic Nitrogen as N	ORG-N	3:(10-107-06-2-D)	0.001		
Nitrate as N	NO3	3:(10-107-04-1-B)	0.01	101.0	3.7
Nitrite as N	NO2	3:(10-107-04-1-B)	0.01	100.6	2.2
Phosphorus					
Total Phosphorus (Manual)**	TP	1:(365.2)	0.001	97.6	2.8
Total Phosphorus	TP	3:(10-115-01-1-E)	0.01	98.0	3.0
Total Dissolved Phosphorus	TDP	1:(365.2)	0.001	97.6	2.8
Soluble Reactive Phosphorus	SRP (OP)	1:(365.2)	0.001	96.5	2.7
Silica and Sulfate					
Silica	SiO2	1:(370.1)	0.1	98.9	2.8
Sulfates	SO4	1:(375.4)	5.0	100.9	5.9
Total Sulfides	S=	1:(376.1)	0.2		
Solids					
Total Solids	TS	1:(160.3)	1.0		
Total Volatile Solids	TVS	1:(160.4)	1.0		
Total Suspended Solids	TSS	1:(160.2)	1.0		
Total Volatile Suspended Solids	VSS	1:(160.4)	1.0		
Total Dissolved Solids	TDS	1:(160.1)	1.0	100.6	12.0
Inorganics					
Arsenic (VGA)	As	1:(206.3)	0.002	101.8	2.6
Total Cadmium	Cd	4:(200.7)	0.0015(0.0004)*	99.7	2.7
Total Calcium	Ca	1:(215.1)	2.0	99.6	3.6
Total Chromium	Cr	4:(200.7)	0.002(0.0005)*	102.9	2.8
Chloride	Cl	3:(10-117-07-1-B)	1.0	100.5	3.8
Residual Chlorine	CL2 RES	1:(330.4)	0.1		
Total Copper	Cu	4:(200.7)	0.002(0.0005)*	101.9	3.8
Chlorinated Cyanide	CN-CL2	3:(10-204-00-1-A)	0.002		
Total Cyanide	CN-T	3:(10-201-00-1-A)	0.002	101.0	9.3
Total Iron	Fe	4:(200.7)	0.02	102.8	2.6

Table A3-5 (continued). Analytical procedures for water quality analyses, Onondaga Lake 2004 AMP.

Parameter	**Code**	**Methods ***	**Minimal Reportable Limit (mg/l)**	**Accuracy (%)**	**Precision (%)**
Inorganics (continued)					
Total Lead - furnace	Pb - GFA	4:(200.9)	0.002 (0.0005)*	104.9	4.1
Total Magnesium	Mg	1:(242.1)	0.05	99.8	2.1
Total Manganese	Mn	4:(200.7)	0.002	104.9	2.6
Total Mercury (Cold Vapor)	Hg	1:(245.2)	0.00002	101.1	4.7
Selenium (VGA)	Se	2:(3114B)	0.002	99.4	2.6
Total Sodium	Na	1:(273.1)	1.0	100.8	2.9
Total Nickel	Ni	4:(200.7)	0.010(0.002)*	100.8	3.2
Potassium	K	1:(258.1)	0.020	100.3	1.2
Total Silver	Ag	4:(200.7)	0.0015	101.4	3.2
Total Zinc	Zn	4:(200.7)	0.002(0.0005)*	105.0	2.1
Water Quality					
Conductivity	COND	2:(2510B)	-		
Dissolved Oxygen - Field	DO - Field	1:(360.1)	0.1		
Dissolved Oxygen - Lab	DO - Lab	1:(360.1)	-		
Dissolved Oxygen - Winkler	DO - Winkler	1:(360.2)	-		
pH	pH	1:(150.1)	-		
Temperature	TEMP	1:(170.1)	-		
Phenols					
Phenol	PHENOL	3:(10-210-00-1-B)	0.01	96.9	15.8
Biological					
Phaeophytin *a*	PHEO-A	2:(10200 H.2)	0.0002		
Chlorophyll *a*	CHLOR-A	2:(10200 H.2)	0.0002		
Bacterial					
Enterococci	ECOCCI-MF	5:(1600)	2.0 (cells/100 ml)		
E. Coliform	ECOLI-MF	2:(9213 D)	2.0 (cells/100 ml)		
Fecal Coliform	FCOLI-MF	2:(9222 D)	2.0 (cells/100 ml)		

Notes:

Methods listed are applicable for all matrices of water, wastewater, and surface waters.

* Indicates method has a lower level of detection due to sample concentration

**Started in August 2000 for all AMP samples.

1: Indicates USEPA Methods for Chemical Analysis of Water and Waste 1979
2: Indicates Standard Methods (18th Edition)
3: Indicates Lachat Instruments QuickChem Methods: Approved for use by USEPA - NYSDOH - ELAP
4: Indicates USEPA "Methods for the Determination of Metals in Environmental Samples" Supplement 1, May 1994
5: USEPA Microbiological Methods Manual 1996

A3-4 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Some of the QA/QC methods for field and analytical procedures are required as part of the Environmental Laboratory Analytical Protocol (ELAP) certification program. Other methods and criteria are adapted from guidance provided by EPA and NYSDEC for use in their water programs. The EPA's standard criteria for precision, accuracy, representativeness, completeness, and comparability provide a benchmark for the County's program. These standard criteria are discussed in 40 CFR 30.503.

A3-4.1 Precision

The agreement between the concentrations of analytes measured in two individual samples collected from the same depth is considered "field precision". However, this evaluation includes both laboratory and field sources of variability. For routine lake monitoring, a single lake depth (6 m) was sampled in duplicate and the complete set of parameters analyzed. Sites for duplicate tributary samples were rotated throughout the watershed. The program goal is for 90% of the field duplicates to have a relative percent difference (RPD) less than 20 percent.

A3-4.2 Accuracy

Accuracy, how close a measured value is to a "true" concentration, was assessed through a blind laboratory audit, discussed in Appendix 6 (QA/QC review of 2003 data) for the 2003 AMP report. As an ELAP-certified laboratory, the Metro environmental laboratory analyzes QA/QC samples with each run. In addition, the laboratory participates in regular proficiency audits. Additional sets of QA/QC protocols that are used by the program are the requirements set forth by the National Environmental Laboratory Accreditation Conference (NELAC). As a *de facto* condition of NYSDOH-ELAP certification, the County is also certified under NELAC protocols. NELAC requirements cover all aspects of laboratory and field functions based on the standards set forth in ISO/IEC Guide 58. "ISO - International Organization for Standardization IEC - International Electrotechnical Commission". Statistical screening of outliers is also conducted to identify suspect data points.

A3-4.3 Representativeness

In order to obtain representative data that reflect the conditions of the lake and tributaries, samples were collected as described in Tables A3-1 and A3-2. Lake samples were collected during the ice-free period from the surface to the bottom. Conditions in the upper waters were analyzed and presented separately from those of the lower waters to describe differences between the UML and LWL during the period of thermal stratification.

The composite tributary sampling methodology is considered by NYSDEC to provide improved estimates of the true water quality in a stream's cross-section. Samples of the lake outlet were taken at 2 and 12 feet to accommodate the bidirectional flow and density stratification that occurs in the lake outlet, particularly during low flow.

A3-4.4 Comparability

Documentation of procedures and results of the monitoring program have been maintained since 1968. The data set collected in 2004 is comparable with that of previous years, with some exceptions brought about by the AMP.

A3-4.5 Completeness

Completeness refers to the number of samples successfully collected, analyzed, and validated as compared to the proposed scope of effort. Data validation is a several-party effort, with data scrutinized first by laboratory personnel for errors in sample coding or transcription, then by OCDWEP staff for completeness as compared to the work plan, and by EcoLogic scientists for limnological reasonableness. As a final check, Dr. William Walker statistically screens data for outliers prior to their inclusion in the long-term database.

A3-4.6 Field Audit

Audits of the field-sampling program on the lake and tributaries were completed in 2004 and are included in the QA/QC appendix (Appendix 4, Exhibits A4-3 and A4-4).

A3-5 CALCULATION OF VOLUME AVERAGES FOR THE UPPER AND LOWER WATER VOLUMES

For many of the water quality parameter measured as part of the AMP, average conditions in the lake's upper and lower waters are tracked over time. As described in Section A3-2, composite samples are created in the field based on the ambient stratification regime. These composite samples of the UML and LWL are analyzed for multiple parameters and tracked in the database. For other parameters, samples are collected and analyzed at discrete depths; results are also reduced into volume-weighted averages characterizing the UML and LWL. Concentrations of analytes measured at each depth are multiplied by a factor that represents the lake volume at that depth; the products are then summed and divided by the sum of factors. Thus, the volume-weighted measurements take into account differences in concentrations and volume in the layers of the lake. These volume-weighted results are used to characterize the water quality of the upper and lower waters of Onondaga Lake and track changes over time. Volume averaging factors are summarized in Table A3-6. Note that the field conditions on the sampling date are used to determine whether results of the discrete depth analyses are calculated with the upper or lower waters. This represents a (minor) change from previous years, when default depths were used to define the upper and lower waters regardless of the conditions on a specific sampling date.

Table A3-6
Volume Averaging Factors, Onondaga Lake Bathymetric Calculations

Sample Depth	Volume-Averaging Factor
0 m	1.6892
3 m	2.9252
6 m	2.5490
9 m	2.2726
12 m	1.9383
15 m	1.5005
18 m	0.8283

APPENDIX 4: QUALITY ASSURANCE/ QUALITY CONTROL REVIEW OF 2004 DATA

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APPENDIX 4: QUALITY ASSURANCE/QUALITY CONTROL REVIEW OF 2004 DATA

A4-1. METHODS

The Onondaga County laboratory is responsible for analysis and reporting of samples collected from Onondaga Lake, Metro effluent, the lake tributaries, and the Seneca River. In the first quarter of 2004 the Onondaga County laboratory relocated to a new facility on Henry Clay Boulevard. The new facility is much larger and laid out in a more efficient manner. Special quality control measures were implemented during the transition to ensure the continuity of data quality.

As of January 1, 2005 the laboratory began annotating AMP analytical results with standard data qualifiers (flags) as defined by National Environmental Laboratory Accreditation Conference (NELAC). The flags are defined in Exhibit A4-1.

Several techniques were employed to assess and document the integrity of the sample collection and analysis process throughout 2004.

- Audits of the field efforts.
- Proficiency samples of the laboratory (in addition to the proficiency samples required twice per year as part of the ELAP certification).
- Calculation of relative percent difference in field duplicates.
- Measurable concentrations of substances in equipment rinsate and laboratory blanks and laboratory QA/QC blanks.

In addition to these criteria, 2004 analytical and field data were screened for criteria of “limnological reasonableness”, which refers to compliance with a conceptual model of how lakes function and our cumulative understanding of the processes in Onondaga Lake. Examples of criteria for limnological reasonableness are noted below.

- Distribution of chemicals as a function of depth, thermal stratification, and season.
- Relationship between total and dissolved fractions of a parameter.
- Charge balance of samples for which major cations and anions are measured.

- Changes in concentration between sampling events that are not explicable (for example, a sudden reappearance of dissolved oxygen in the lower waters during stable thermal stratification).

Finally, the integrated database of AMP water quality results designed by Dr. William Walker has an outlier screening function that identifies results that are statistical outliers. This enables the program managers and laboratory staff to investigate and verify individual results and make any necessary corrections.

A4-2. FINDINGS

Overall, data quality was very high. The laboratory successfully completed more than 20,000 analyses of water collected from Onondaga Lake, the lake tributaries, and the Seneca River.

A4-2.1. Equipment Rinsate Blanks

Equipment rinsate blank sample analysis is an important step of data compliance procedures that must be undertaken by the field team and the analytical laboratory. Blanks measure background contamination and bias. Table A4-1 summarizes the different types of blanks and what they are designed to measure. Concentrations of substances present in rinsate blanks are tracked because of the importance of differentiating ambient concentrations, which are typically very low, from any trace contamination introduced during sample handling and preservation.

Table A4-1
Blank sample analyses and what they measure

Blank sample:	Measures:
• Field blank	• transport and field handling bias *(used in low-level Hg sampling)*
• Preservative blank	• contaminated acid preservative *(used to identify and eliminate potential sources of contamination in low-level metal samples)*
• Rinsate blank	• contaminated equipment
• Method blank	• response of entire laboratory analytical system

Rinsate blanks were collected as part of each sampling event. Laboratory DI water was processed through the sampling devices used to collect samples from the lake, streams, and river. These rinsate blank samples are routinely submitted to the Metro laboratory for analysis.

Results of the rinsate blank sampling efforts in 2004 indicate that trace concentrations of contaminants continue the decline reported in 2003 as the field and laboratory staff members have implemented various changes in their equipment and procedures. Results of 2004 rinsate blank analyses are summarized in Table A4-2 (lake data) and Table A4-3 (tributary data). Most parameters were reported at trace concentrations in blanks, less than twice the minimum reportable limit (MRL) of the corresponding analytical method. This is the criterion used by NELAC to assess data quality.

A notable finding is the continued reduction in phosphorus concentrations in blank samples. This issue, noted in 1999 and 2000 has been the focus of laboratory investigations. Total and soluble reactive P (SRP) concentrations in the 2004 rinsate blanks were consistently in the 0.001 – 0.002 mg/l range. Figure A4-1 is a plot showing the reduction in concentration of TP in blank samples.

Table A4-2. Summary of equipment rinsate blank analyses, 2004 Onondaga Lake samples.

				Blank Concentrations		Number of Measurements		Percent of Measurements	
Parameter	**U/M**	**LOD**	**N**	**Mean**	**Median**	**>2x LOD**	**>5x LOD**	**>2x LOD**	**>5x LOD**
Zn	mg/l	0.0005	4	0.006	0.004	4	3	100%	75%
SiO2*	mg/l	0.1	19	0.08	0.06	5	5	26%	26%
Cr	mg/l	0.0005	4	0.0015	<0.0005	1	1	25%	25%
Ni	mg/l	0.0025	4	0.0070	<0.0025	1	1	25%	25%
Fe	mg/l	0.02	18	0.02	<0.02	2	2	11%	11%
Chloride	mg/l	1	18	<1	<1	1	1	6%	6%
TVS	mg/l	10	18	<10	<10	1	1	6%	6%
ALK_T	mg/l	1	19	1	<1	1	1	5%	5%
Lead*	mg/l	0.0005	4	0.0010	0.0012	3	0	75%	0%
TKN*	mg/l	0.1	22	0.2	0.1	3	0	14%	0%
Organic N*	mg/l	0.1	20	0.1	0.1	2	0	10%	0%
SRP*	mg/l	0.001	21	0.001	0.001	2	0	10%	0%
TKN-F*	mg/l	0.1	22	0.1	0.1	2	0	9%	0%
TDP*	mg/l	0.001	21	0.001	0.001	1	0	5%	0%
TP*	mg/l	0.001	21	0.001	0.001	1	0	5%	0%
As	mg/l	0.002	4	<0.001	<0.001	0	0	0%	0%
BOD	mg/l	2	19	2	2	0	0	0%	0%
Ca	mg/l	2.5	18	2.5	2.5	0	0	0%	0%
Cd	mg/l	0.0004	4	<0.0004	<0.0004	0	0	0%	0%
Cu	mg/l	0.0005	4	<0.0005	<0.0005	0	0	0%	0%
K	mg/l	0.025	4	0.028	<0.025	0	0	0%	0%
Mg	mg/l	0.06	18	<0.06	<0.06	0	0	0%	0%
Mn	mg/l	0.002	18	<0.002	<0.002	0	0	0%	0%
Na*	mg/l	1.25	18	0.79	0.60	0	0	0%	0%
NH3*	mg/l	0.05	22	0.05	<0.05	0	0	0%	0%
Nitrate	mg/l	0.01	20	<0.01	<0.01	0	0	0%	0%
Nitrite	mg/l	0.01	20	<0.01	<0.01	0	0	0%	0%
Se	mg/l	0.002	4	<0.002	<0.002	0	0	0%	0%
SO4	mg/l	5	18	10	10	0	0	0%	0%
TDS	mg/l	10	19	10	10	0	0	0%	0%
TIC	mg/l	1	18	0.8	0.8	0	0	0%	0%
TOC**	mg/l	0.2	18	0.2	<0.2	0	0	0%	0%
TOC-F**	mg/l	0.2	18	0.2	<0.2	0	0	0%	0%
TS	mg/l	10	18	<10	<10	0	0	0%	0%
TSS*	mg/l	2	18	<3	<3	0	0	0%	0%
Turbidity	NTU	0.1	18	<0.1	<0.1	0	0	0%	0%
VSS*	mg/l	2	18	3	3	0	0	0%	0%

Notes:

* Parameter has two or more LOD in dataset.

**Different LOD in 2004.

Shaded areas have >20% of the observations above target levels (see text for discussion)

Table A4-3. Summary of equipment rinsate blank analyses, 2004 Onondaga Lake tributary samples.

				Blank Concentrations		Number of Measurements		Percent of Measurements	
Parameter	**Unit of Measure**	**LOD**	**N**	**Mean**	**Median**	**>2x LOD**	**>5x LOD**	**>2x LOD**	**>5x LOD**
Alk_T	mg/l	1	52	2.4	1.0	15	6	29%	12%
As	mg/l	**0.002**/ 0.001	8	0.0013	0.0010	0	0	0%	0%
BOD	mg/l	2	51	2.0	2.0	0	0	0%	0%
Ca	mg/l	2.5	53	2.5	2.5	0	0	0%	0%
Cd	mg/l	0.0004	8	0.0004	0.0004	0	0	0%	0%
Chloride	mg/l	1	53	1.2	1.0	2	1	4%	2%
Cr	mg/l	0.0005	8	0.0006	0.0005	0	0	0%	0%
Cu	mg/l	0.0005	8	0.0005	0.0005	0	0	0%	0%
Cyanide	mg/l	0.002	8	0.0024	0.0020	1	0	13%	0%
Fe	mg/l	0.02	53	0.038	0.020	3	2	6%	4%
K	mg/l	0.025	8	0.027	0.025	0	0	0%	0%
Lead	mg/l	0.002/ **0.0012**	8	0.0013	0.0012	6	0	75%	0%
Mercury	mg/l	0.00002	8	9.4E-05	3.3E-05	4	3	50%	38%
Mg	mg/l	0.06	53	0.063	0.060	1	0	2%	0%
Mn	mg/l	0.002/ 0.01	53	0.0023	0.0020	2	0	4%	0%
Na	mg/l	1.25/ 0.6/ 0.5	53	0.93	1.25	0	0	0%	0%
NH3	mg/l	0.05/ 0.02	53	0.049	0.050	0	0	0%	0%
Ni	mg/l	0.0025	8	0.0028	0.0025	0	0	0%	0%
Nitrate	mg/l	0.01	51	0.010	0.010	0	0	0%	0%
Nitrite	mg/l	0.01	51	0.010	0.010	0	0	0%	0%
Organic N	mg/l	0.1/ 0.5	53	0.11	0.10	4	0	8%	0%
SiO2*	mg/l	**0.06**/ 0.2	51	0.095	0.060	1	0	2%	0%
SO4*	mg/l	**2** / **10**	53	9.7	10	0	0	0%	0%
SRP	mg/l	**0.001/** 0.003	53	0.0012	0.0010	2	0	4%	0%
TDP	mg/l	**0.001/** 0.003	53	0.0011	0.0010	2	0	4%	0%
TDS	mg/l	**10**/ 1	53	9.7	10	0	0	0%	0%
TIC*	mg/l	**0.8**	51	0.81	0.80	0	0	0%	0%
TKN	mg/l	**0.1**/ 0.5	53	0.14	0.10	5	0	9%	0%
TOC*	mg/l	**1** / 0.2	53	0.23	0.20	0	0	0%	0%
TOC-F*	mg/l	**1** / 0.2	53	0.23	0.20	0	0	0%	0%
TP	mg/l	**0.001/** 0.003	53	0.0012	0.0010	2	0	4%	0%
TSS*	mg/l	1/ 2/ **4**	53	3.47	4.00	1	0	2%	0%
Turbidity	NTU	0.1	51	0.11	0.10	2	0	4%	0%
Zn	mg/l	0.0005	9	0.0035	0.0037	9	6	100%	67%

Notes:
*Dataset has more than one limit of detection (LOD). Bolded value is the most frequently used in the dataset.
Shaded areas have >20% of the observations above target levels (see text for discussion)

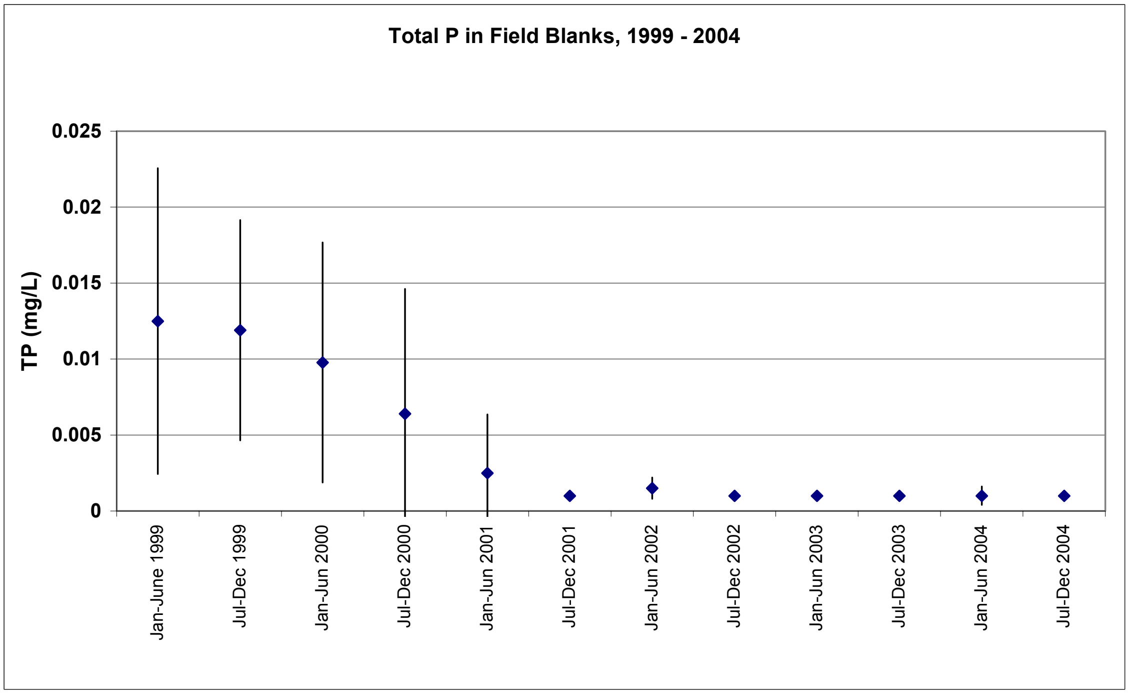

Figure A4-1. Mean TP in QC blanks and standard deviation. Laboratory minimum reportable limit (MRL) is 0.001 mg/l. Standard deviation for Jul - Dec 2001, Jun-Dec 2002, both periods in 2003, and Jul - Dec 2004 = 0.

Note that the rinsate blanks occasionally contained trace concentrations of certain metals. The water used to rinse the equipment is deionized laboratory water. The heavy metal zinc, monitored on a quarterly basis, was detected in rinsate blanks at concentrations above the MRL. An internal investigation of this was initiated and completed in 2004 (summarized in Exhibit A4-2, memo from Janaki Suryadevara dated 1/10/2005). Testing has been completed to evaluate the cleaning procedures, the acid used to preserve samples, and the pre-cleaned containers.

Investigations also focused on identifying and eliminating sources of trace concentrations of mercury that were detected in samples in 2004. As described in Exhibit A4-1, polyurethane can leach low levels of mercury into ambient samples. To remove this potential source, all polyurethane seals on the dunkers used to collect quarterly heavy metals samples have been replaced with silicone seals.

Of the heavy metals in the 2004 data set, chromium, mercury, nickel and zinc were measured in rinsate blanks at concentrations comparable to those reported in the actual samples. The method reporting limits for associated samples were raised as part of the QC review to correspond with concentrations measured in the blanks. This was done to account for the possibility of sample contamination as demonstrated by high blank levels. Results that are not different from laboratory control samples are considered non-detects. A total of 45 metals results were flagged as non-detects during the quality control review; out of a total of 1558 measurements. Of the rejected data, 27 were tributary samples (Table A4-4) and 18 were lake samples (Table A4-5). A total of 232 lake samples and 1376 tributary samples were screened. A higher concentration of lake samples were screened out, this is expected due to the lower ambient concentrations of metals in lake waters compared with the tributaries. This represents a 15% increase in the number of affected samples from 2003 to 2004.

Table A4-4. Onondaga Lake tributary samples affected by blank screening, for which reported results should be considered "non-detect."

Analyte	Date	Sample ID
Cr	09/09/04	Crk-Sawmill Crk @ Onondaga Lake Rec. Trail
	09/09/04	Crk-Harbor Brook @ Velasko Road
Hg	03/23/04	Crk-Harbour Brook @ Hiawatha
	03/23/04	Crk-Ley Creek @ Park Street
	03/23/04	Crk-Onondaga Lake Outlet 2 ft.
	03/23/04	Crk-Onondaga Lake Outlet 12 ft.
	03/23/04	Crk-Allied East Flume
	06/15/04	Crk-Harbor Brook @ Hiawatha
	06/15/04	Crk-Ley Creek @ Park Street
	06/15/04	Crk-Onondaga Lake Outlet 2 ft.
	06/15/04	Crk-Onondaga Lake Outlet 12 ft.
	06/15/04	Crk-Allied East Flume
	09/09/04	Crk-Metro By Pass
	09/09/04	Crk-Ley Creek @ Park Street
	09/09/04	Crk-Onondaga Lake Outlet 12 ft.
	09/09/04	Crk-Onondaga Creek @ Kirkpatrick
	09/09/04	Crk-Onondaga Creek @ Kirkpatrick-Duplicate
	09/09/04	Crk-Ninemile Creek @ Lakeland Rt 48
Ni	09/09/04	Crk-Metro By Pass
	09/09/04	Crk-Ley Creek @ Park Street
	09/09/04	Crk-Bloody Brk @ Onondaga Lake Parkway
	09/09/04	Crk-Sawmill Crk @ Onondaga Lake Rec. Trail
	09/09/04	Crk-Onondaga Lake Outlet 12 ft.
	09/09/04	Crk-Harbor Brook @ Velasko Road
	09/09/04	Crk-Allied East Flume
Zn	06/15/04	Crk-Onondaga Lake Outlet 12 ft.
	06/15/04	Crk-Onondaga Creek @ Kirkpatrick

A4-2.2. Field Duplicates

For field duplicates, 89% of the lake samples and 89% of the tributary samples were within 20% relative percent difference (RPD). There was a consistent pattern of increasing RPD with decreasing concentration; variability between duplicates increased as concentrations approached the analytical MRL. To assess the effect of sample concentration on relative percent difference between field duplicates, the data are also presented in histograms of absolute value of differences between replicate samples. A reasonable control limit for these analyses is plus or minus twice the MRL; this is comparable to screening methods used by USEPA for concentrations close to the limit of detection.

Table A4-5. Onondaga Lake samples affected by revised lake detection limits. Reported results should be placed with a designation of "non-detect."

Analyte	Date	Sample ID	
Cr	06/22/04	2407502	Lake Upper Mixed Layer South-Duplicate
		2407501	Lake Lower Water Layer South
		2407500	Lake Upper Mixed Layer South
		2407516	Lake Upper Mixed Layer North
		2407518	Lake Upper Mixed Layer North-Duplicate
		2407517	Lake Lower Water Layer North
Ni	06/22/04	2407502	Lake Upper Mixed Layer South-Duplicate
		2407501	Lake Lower Water Layer South
		2407500	Lake Upper Mixed Layer South
		2407516	Lake Upper Mixed Layer North
		2407518	Lake Upper Mixed Layer North-Duplicate
		2407517	Lake Lower Water Layer North
Zn	04/06/04	2405479	Lake Upper Mixed Layer South
		2405481	Lake Upper Mixed Layer South-Duplicate
		2405480	Lake Lower Water Layer South
		2405497	Lake Upper Mixed Layer North-Duplicate
		2405496	Lake Lower Water Layer North
		2405495	Lake Upper Mixed Layer North

In 2004, duplicate samples were collected at each tributary station on a rotating schedule. The majority of duplicate analyses met the data quality objective of 20% RPD. Summary histograms of distribution of RPD for selected analytical parameters measured in the lake tributaries are plotted in Figure A4-2. The consistently highest RPD between duplicate samples was detected for nickel. Summary histograms for the absolute value of differences (ABS) in concentration between selected results are presented in Figure A4-3.

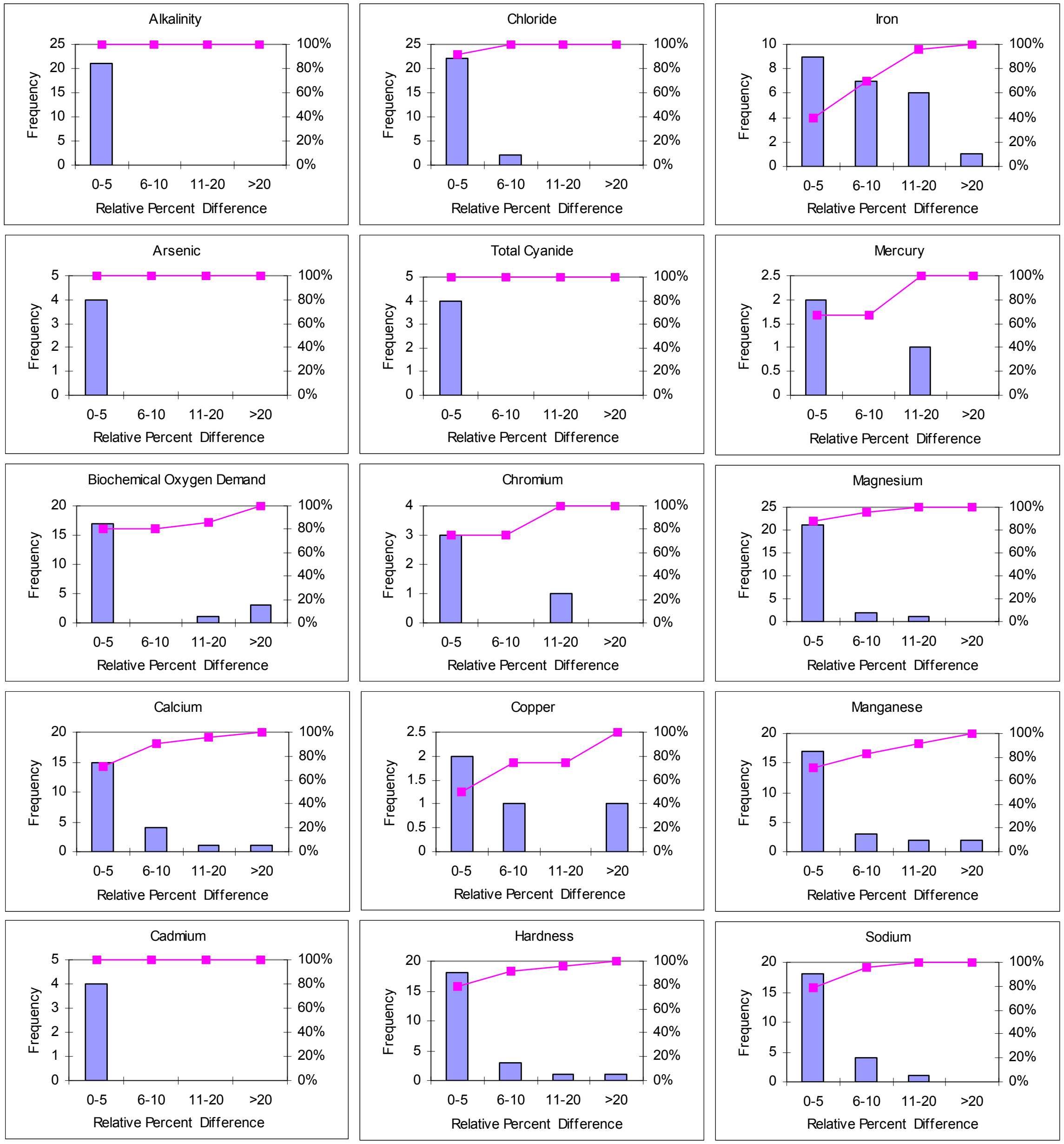

Figure A4-2 Summary RPD for tributary samples, 2004 . *(Hardness calculated based on Ca & Mg)*

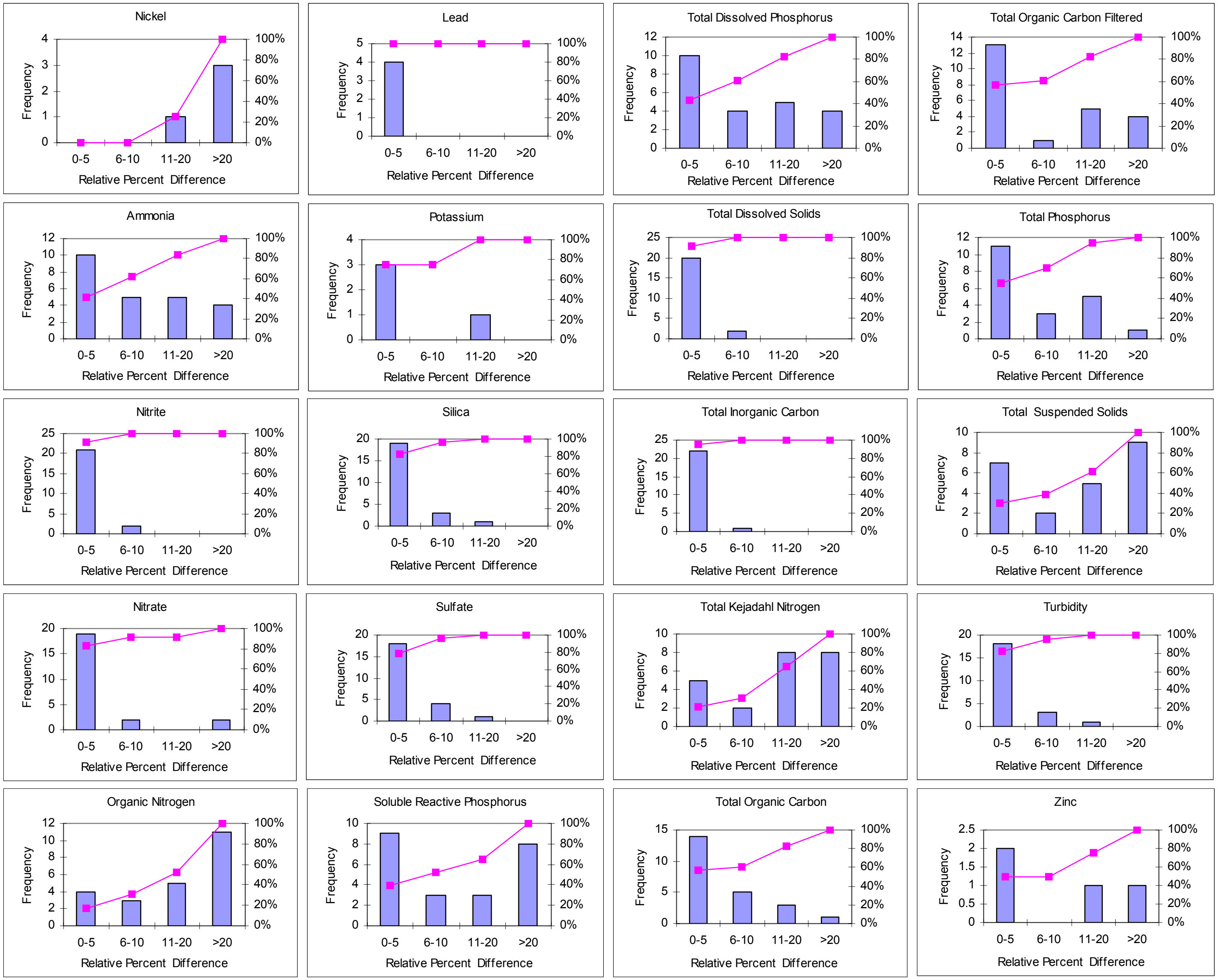

Figure A4-2 (cont.) Summary RPD for tributary samples, 2004.

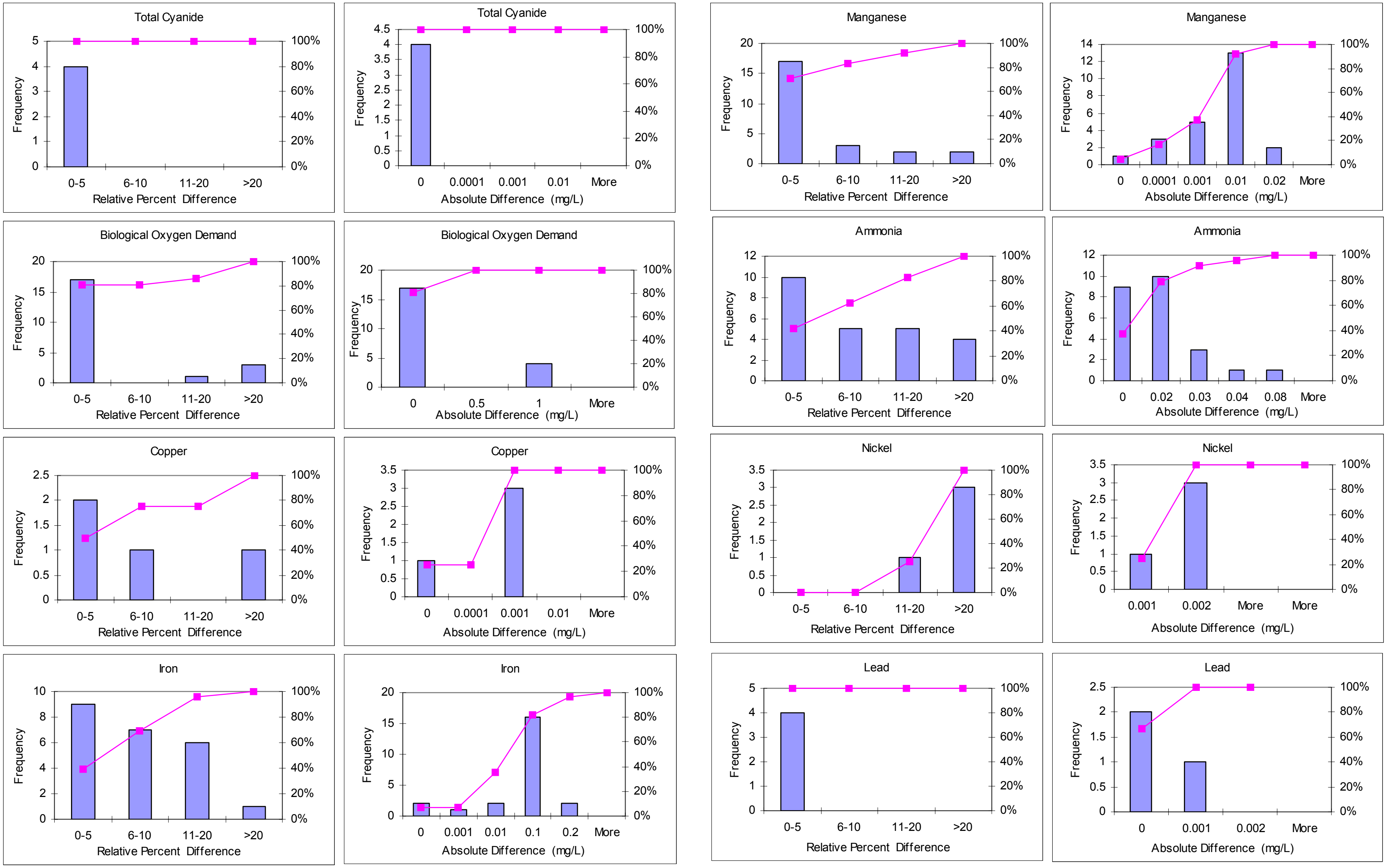

Figure A4-3. Relative percent difference and absolute difference of field duplicates. Onondaga Lake tributary samples, 2004.

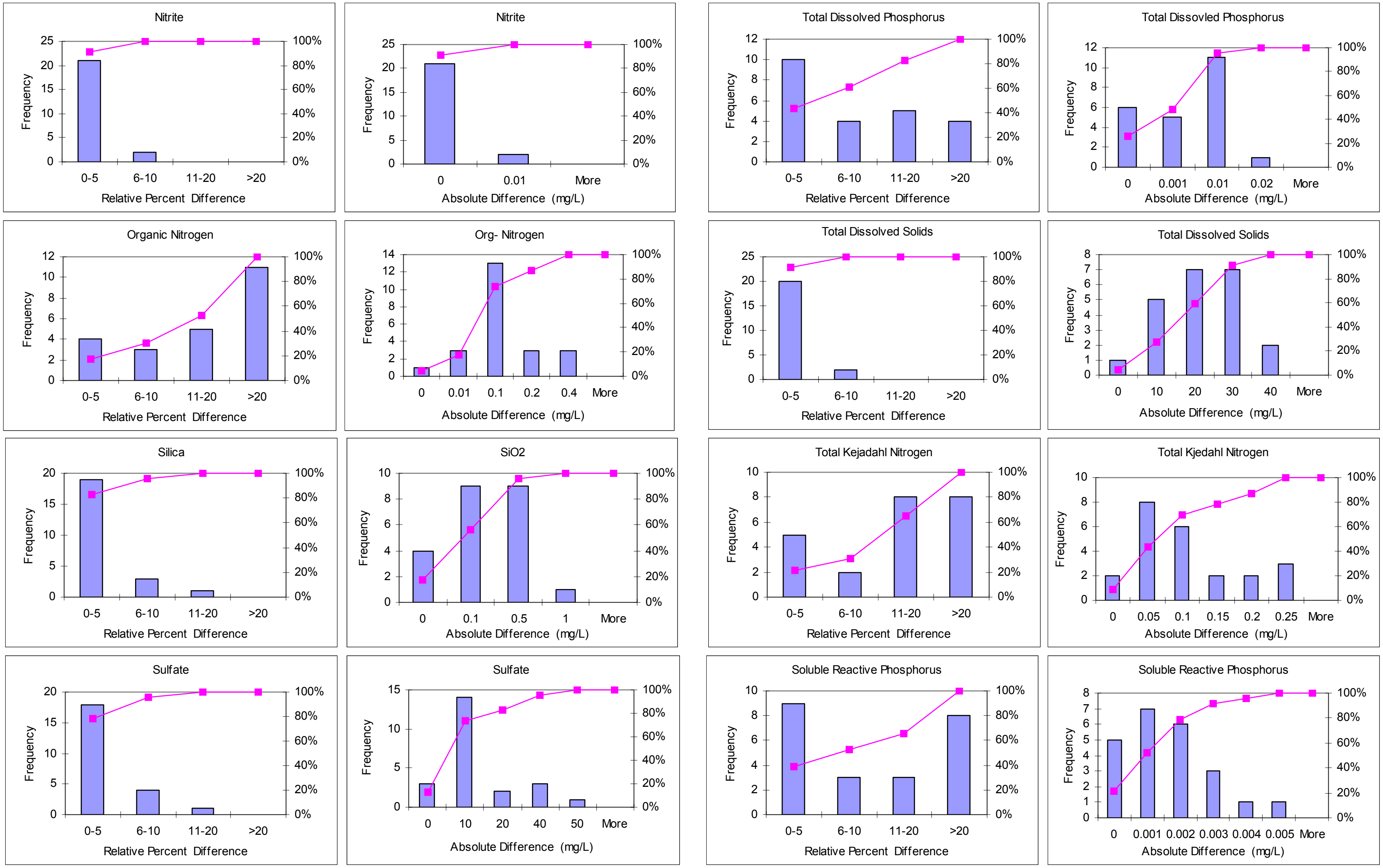

Figure A4-3 (cont.). Relative percent difference and absolute difference of field duplicates. Onondaga Lake tributary samples, 2004.

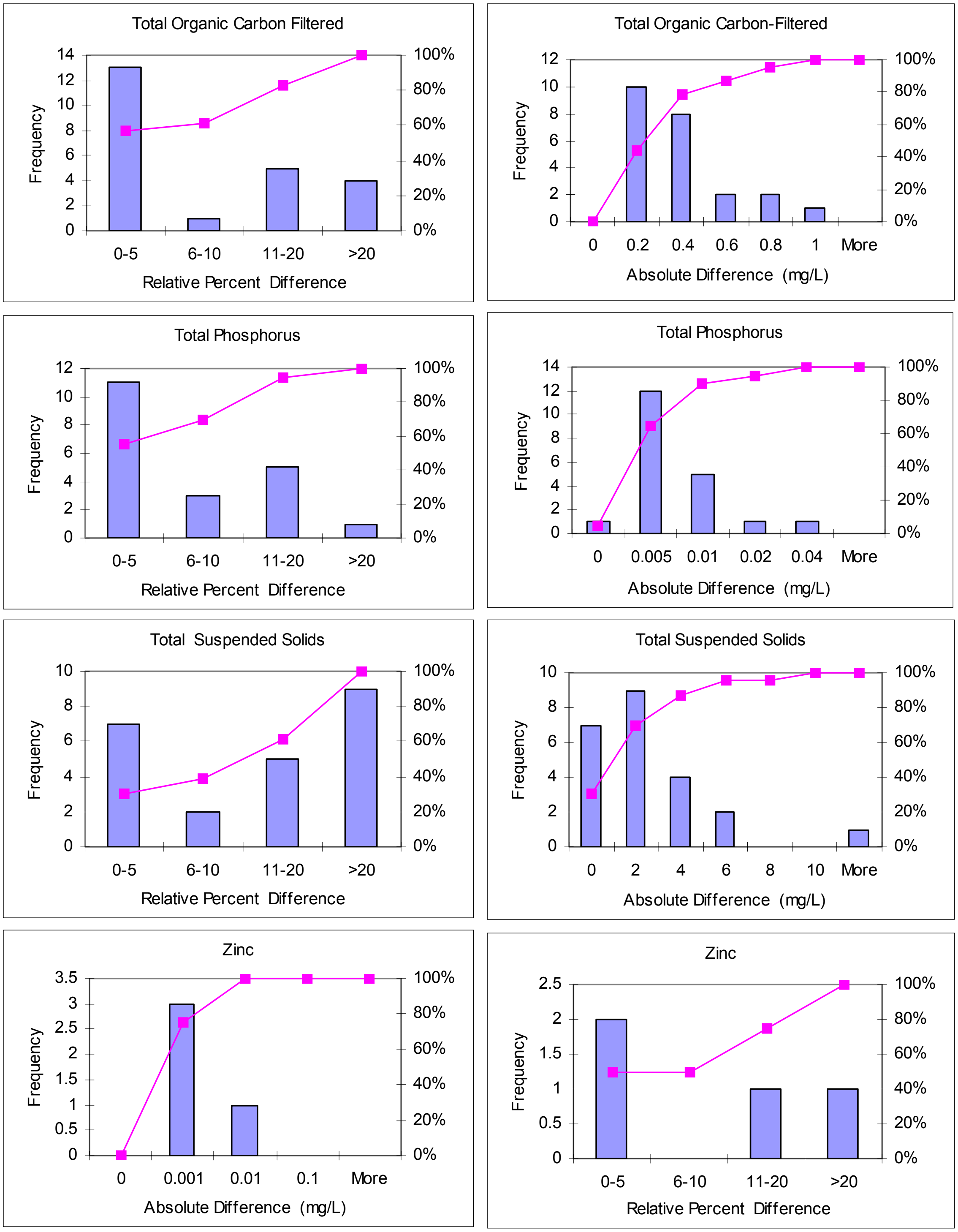

Figure A4-3 (cont.). Relative percent difference and absolute difference of field duplicates. Onondaga Lake tributary samples, 2004.

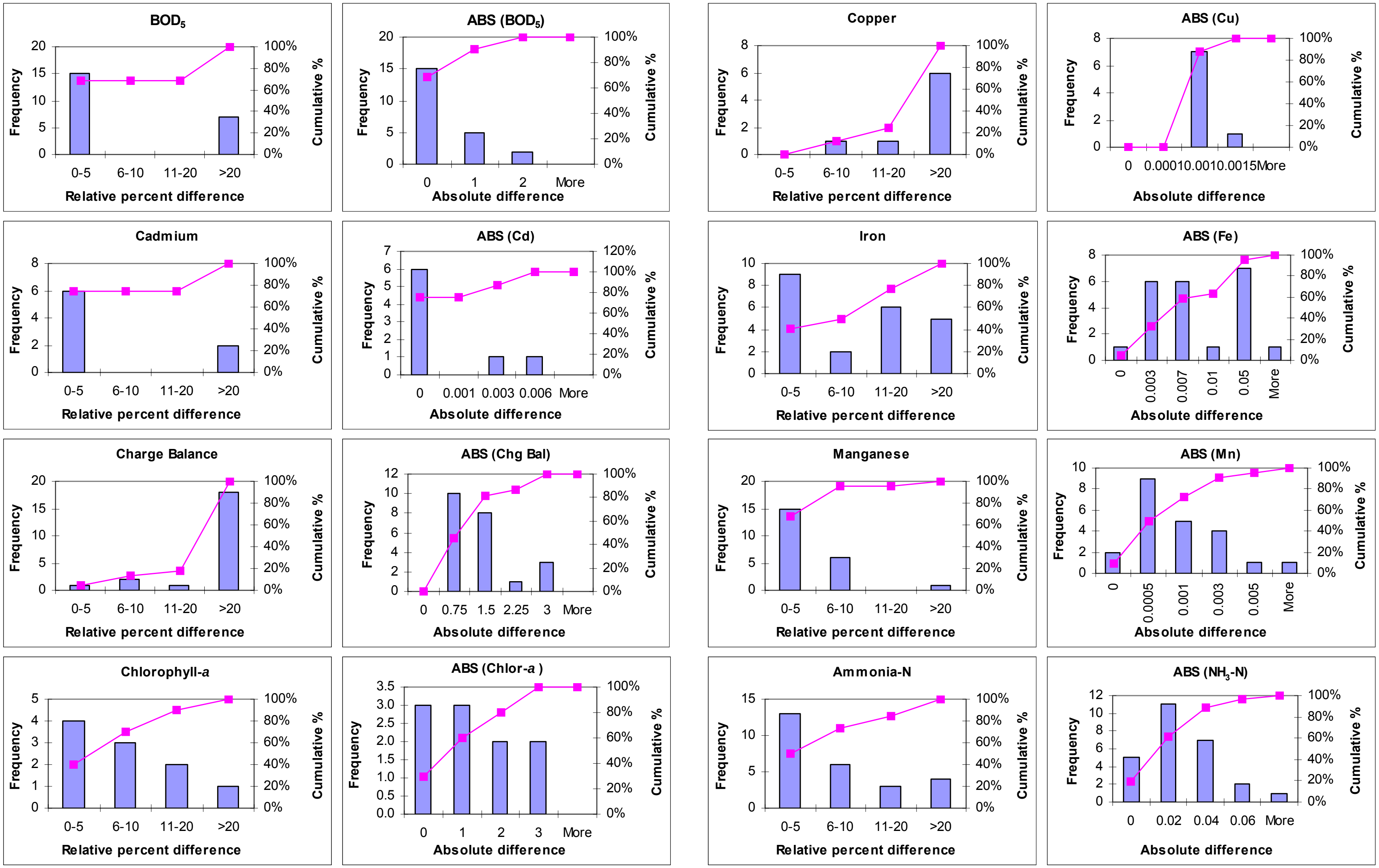

Figure A4-4 Relative percent differences and absolute differences of field duplicates, Onondaga Lake samples, 2004.

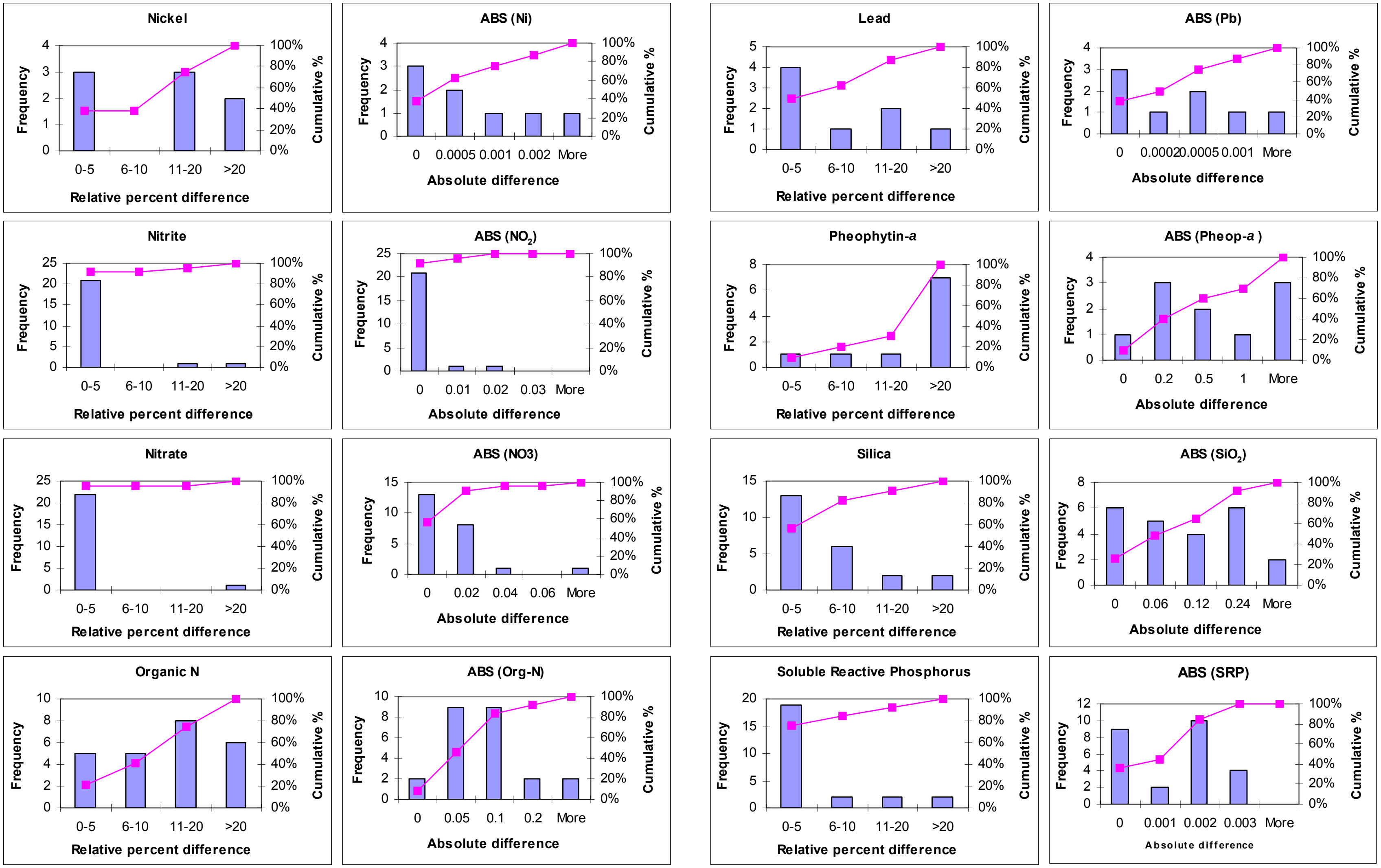

Figure A4-4 (cont.). Relative percent differences and absolute differences of field duplicates, Onondaga Lake samples, 2004.

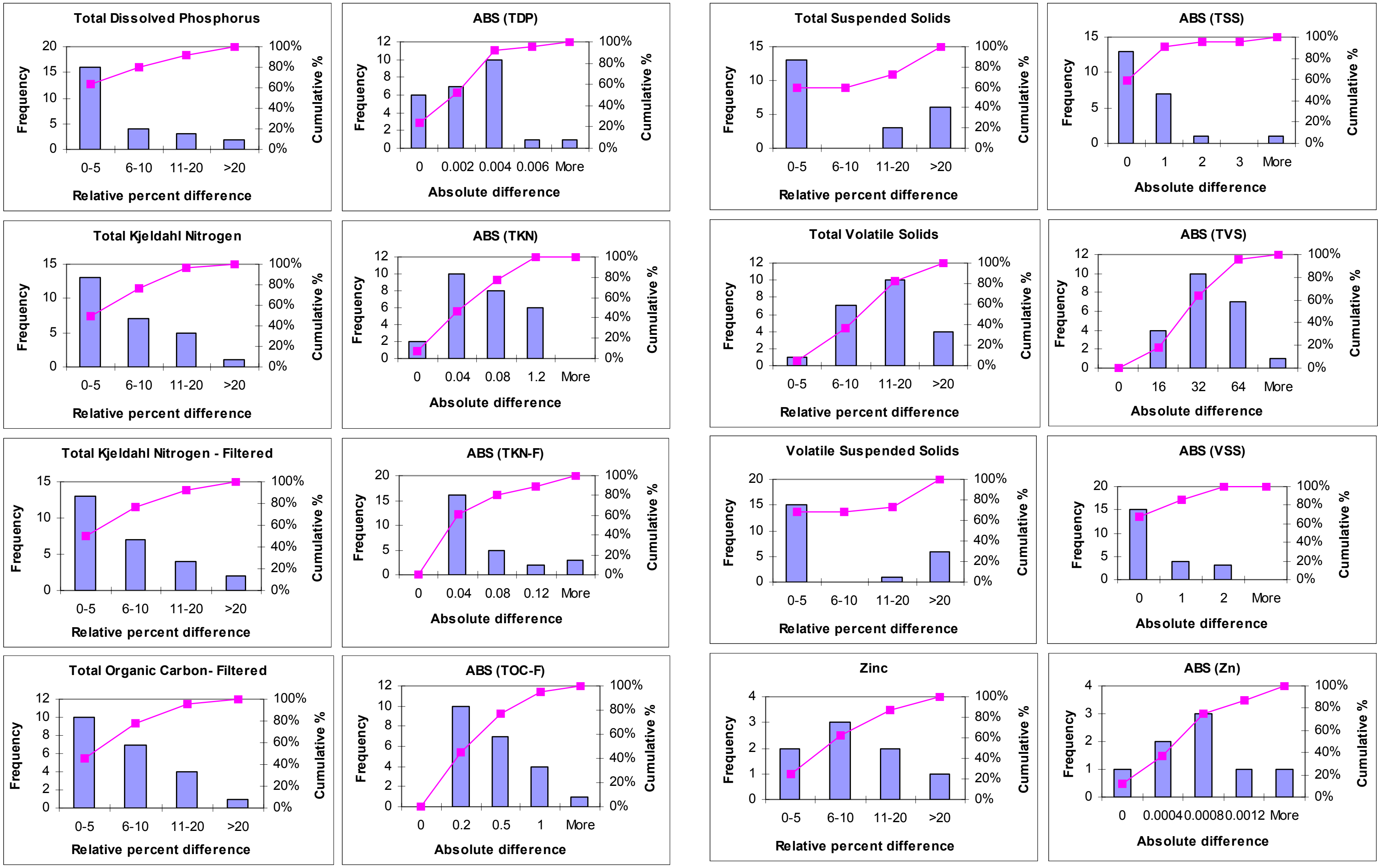

Figure A4-4 (cont.). Relative percent differences and absolute differences of field duplicates, Onondaga Lake samples, 2004.

For the lake samples, duplicates were consistently collected at the 6-m South Deep station. The composite of the upper mixed layer (UML) was analyzed as a second field duplicate. Histograms of the distribution of the relative percent difference (RPD) and absolute value of the difference (ABS) of each analyte are presented in Figure A4-4. Non-biological parameters where a significant (>10%) fraction of the duplicate analyses were greater than 20% RPD were analyzed for ABS greater than twice the method detection limit (2xMDL) and five times the method detection limit (5xMDL). Cadmium, copper, iron, NH_3-N, nickel, organic N, lead, TSS, TVS, VSS and zinc had duplicate pairs with ABS greater than 2xMDL. Cadmium, lead, and TVS had duplicate pairs with ABS greater than 5xMDL.

The microbiological samples, including fecal coliform bacteria, and *E. coli*, exhibited large variations in RPD and ABS. This result is characteristic of bacterial samples. Phaeophytin results were highly variable in 2004.

For the metals (which are analyzed quarterly) ambient concentrations are extremely low and results are close to the MRL. However, duplicate pairs for copper had RPDs greater than 20% in 6 out of 8 samples. Note that the Cu concentrations were close to the limit of detection, where variability is high and the RPD criterion is not appropriate. Other parameters (chlorophyll-*a*, phaeophytin, and the solids fractions) are strongly associated with algal abundance and exhibit large variations. The field team should evaluate the methods used to composite the samples and draw the duplicates to ensure that phytoplankton (even buoyant species) are uniformly distributed.

For the River samples, duplicate samples were collected at Buoy 316 and analyzed for the entire suite of laboratory parameters. Relative percent difference between the field duplicates is summarized in Table A4-6.

A4-2.3. Charge Balance

Charge balance results indicated that 91% of the tributary samples were within 10% RPD of the summed milliequivalents of anions and cations. The mean for the charge balance on tributary samples was 4.7%, median 3.6%. For lake samples, 100% of the analyses balanced anions and cations within 10%. The mean for lake samples was 2.9% and the median was 2.3%. River

Table A4-6. Summary of field duplicate results, 2004 Seneca River monitoring.

Parameter with RPD over Criteria*	Frequency**	Average RPD of Observations >20%	Average Concentrations*** (mg/m^3)	LOD**** (mg/m^3)	Ratio Average/LOD
Chlorophyll-a (tube composite)	3/4	68%	1	0.2	5
ORG-N (surface and bottom)	1/4	24%	0.428	0.1	4.3
Pheophytin-a (tube composite)	4/4	47%	1.76	0.1	17.6
TDP	2/4	34%	0.036	0.001	36
TP	1/4	21%	0.049	0.001	49
TSS (surface and bottom)	2/4	50%	6	1	6

Notes:
RPD = relative percent difference calculated between the sample result and the duplicate.
* Parameters with RPD <20% are not listed.
** Frequency = Number >20% RPD/Number of Observations
*** Average concentrations of all 2004 samples
**** Limit of Detection (LOD) of the Analytical Method

samples were not analyzed for all major anions and cations, consequently the charge balance was not calculated.

A4-2.4. Field and Laboratory Audit Results

The 2004 field audits indicated that samples were collected and handled in accordance with the Field Sampling Procedures of the Quality Assurance Project Plan. Results of the field audits were summarized in technical memoranda, included as Exhibits A4-3 and A4-4.

For the laboratory audit in 2004, OCDWEP participated in a program administered by the National Water Research Institute of Environment Canada. This agency manages performance evaluation (PE) studies to help laboratories assess the accuracy and integrity of their analytical results. The PE studies use various sources of natural waters. More than 200 laboratories from the US and Canada participate in the PE studies; results are evaluated for precision and systematic bias.

The Institute provides water samples for analysis of TP from various lakes and rivers in different geologic and land use settings. Lake Superior water is used as the blank. In 2004, OCDWEP requested a range of concentrations that encompass typical concentrations in Onondaga Lake.

Results of the PE study for total P in natural waters are summarized in Table A4-7. These results demonstrate that the Metro Laboratory performed in the top tier of participating laboratories, with all analyses within the acceptable error range.

Table A4-7

Results of TP Performance Evaluation Samples, June 2004
Environment Canada Proficiency Program

Sample	Median Value (round robin) TP, mg/l	Acceptable Range (+/-) mg/l	Metro Lab Result TP, mg/l	Result Code
2407127	0.003	0.005	0.002	Acceptable
2407128	0.002	0.0015	0.002	Acceptable
2407129	0.012	0.003	0.011	Acceptable
2407130	0.035	0.005	0.036	Acceptable
2407131	0.054	0.01	0.061	Acceptable
2407132	0.079	0.007	0.085	Acceptable
2407133	0.147	0.01	0.153	Acceptable
2407134	0.208	0.016	0.216	Acceptable
2407135	0.159	0.013	0.163	Acceptable
2407136	0.32	0.02	0.338	Acceptable

A4-2.5. Field Parameters

Several of the field YSI instrument profiles of dissolved oxygen were flagged. When the instrument readings indicated that detectable concentrations of DO (less than 0.2 mg/l) were present at depths that had been previously recorded as anoxic (DO of zero), and the thermal stratification regime had not changed, the trace concentrations were considered “zero” for the purpose of volume averaging, plotting, and calculations of volume-days of anoxia. Results of DO measurements collected at several depths on August 9 and 17 were modified based on this reasoning. Variable DO results in deep water were also reported during the last two weeks in October. These profiles were collected during the period of fall mixing where the water column is unstable. Results of these profiles (collected on October 18, 22, 26, 29) were therefore accepted.

A4-2.6. Sample composites of UML and LWL

The field teams are responsible for defining the water depths to be used in creating composite samples of the lake’s Upper Mixed Layer (UML) and Lower Water Layer (LWL). Thermal stratification at the time of sampling is used as the basis for the field teams to define the strata and decide which depths to composite. In 2004, a standard protocol was adopted to define the layers. However, several UML and LWL samples collected early in the season were not composited using the standard protocol. In each case, the sampling crews were overly conservative; that is, they decided not to sample deep enough within the UML or shallow enough in the LWL. The profiles and compositing depths for each sampling event were reviewed. In no case was water from the LWL included with a UML sample and vice-versa. Therefore, no data were rejected. The protocol has been reviewed with the field teams.

A4-3. RECOMMENDATIONS

(1) Continue to report only concentration, not annual load, of metals with a significant percentage of the observations flagged with respect to MRL or contamination of the associated field blanks.
(2) Continue to participate in the National Water Research Institute of Environment Canada performance evaluation program for phosphorus in waters.
(3) Design and implement an audit of the precision and accuracy of low level ammonia N analyses.
(4) Field teams need to consistently follow the protocol used to define composite samples of the UML and LWL.

EXHIBITS

EXHIBIT A4-1: Summary of NELAC Data Qualifiers

EXHIBIT A-4-2: Tributary Sampling – Hg QA/QC results

EXHIBIT A-4-3: Onondaga Lake Field Audit Memorandum

EXHIBIT A-4-4: Tributary audit summary Memorandum

EXHIBIT A4-1

Summary of NELAC Data Qualifiers
Implementation Date: January 1, 2005

Qualifier	NELAC Designation
N	Variance from quality control or assurance criteria, however result is considered acceptable under established NELAC guidelines
V	Reported value is considered estimate due to variance from quality assurance or control criteria
J	Indicates that the reported value is greater than the MRL but below the PQL, result is considered estimated
U	Indicates that the measured value is below the MRL. Possible MRL/PQL elevation dependent upon analyzed mass, volume, and/or dilutions. Value reported is the <MRL
P	Unacceptable for quality assurance criteria

EXHIBIT A-4-2

Onondaga County

Department of Water Environment Protection
INTER-OFFICE MEMO

TO: Joseph J. Mastriano
Jeanne C. Powers
Mike Gena
Jeff Noce

FROM: Janaki Suryadevara

DATE: January 10, 2005

RE: Tributary Sampling – Hg QA/QC results

This memo summarizes the investigation resulting from the exceedance of the acceptance criteria for the Quality Assurance/Quality Control (QA/QC) Mercury blank results relating to the Tributary sampling program. It should be noted that based on the investigation, only the QA/QC blank samples and not the sample data appear to be effected for the parameter Mercury.

On September 24, 2004, Mike Gena, Laboratory Director, notified me (via e-mail), that the last three (3/23/04, 6/15/04 & 9/9/04) quarterly tributary Crew B samples failed the QA/QC blank acceptance criteria for the parameter Mercury. This failure was based on the acceptance criteria (2 x Method Detection Limit, MDL) for equipment blanks of each analyte (as established in the OCDWEP Laboratory Standard Operating Procedure (SOP) entitled *"SOP for Quality Assurance of Field Blanks and Duplicates*", Doc #QA-1, dated June 20, 2003 – Attachment 1. It should be noted that although the SOP references the use of the MDL for determining the failure of "Acceptance Criteria", the laboratory has switched to using the MRL (Minimial Reportable Limit), in accordance with the NELAC requirements. The SOP will be revised in the near future to reflect this change in this response criteria.

The following table summarizes the results of the QA/QC samples, as collected by the two (2) tributary sampling crews (Crew A & B), during these sampling events:

Sample Date	**Crew**	**Hg, mg/l***
3/23/04	Crew A	<0.000020
	Crew B	0.000374
6/15/04	Crew A	<0.000020
	Crew B	0.000107
9/9/04	Crew A	<0.000020
	Crew B	0.0000467

MRL = 0.00002 mg/l; Exceedance Limit = 2 x MRL = 0.00004 mg/l

In response to this information, an investigation was initiated to focus primarily on three (3) areas. These included a review of the following:

EXHIBIT A-4-2

I. Analytical Method;
II. QA/QC Sample Collection; and
III. Sample Containers

I. Analytical Method:
All samples were analyzed by OCDWEP Environmental Laboratory (EPA Method 245.1). It should be noted that during 2002, the laboratory metals section purchased a new automated mercury system (FIMS – Flow Injection Mercury System). This change in instrumentation to the FIMS allowed for the capability of making determinations below the previous reportable limit of 0.0002mg/l (using the AA Cold Vapor Method). The new reportable limit is 0.00002mg/l, which is ten times lower than the previous level – Attachment 2.

The following table summarizes the data for the QA/QC Mercury samples collected by Crew A and Crew B from March 1999 through September 2004:

Crew A (Churn):

Start_ Date	IC Code	Sample Number	Source	SResult	Para_ Comments	Units
30-Mar-99	990	9905867	Crk00-Blank Churn (Crew A)	<0.0002		Mg/l
14-Sep-99	990	9916016	Crk00-Blank Churn (Crew A)	<0.0002		Mg/l
09-Nov-99	990	9919257	Crk00-Blank Churn (Crew A)	<0.0002		Mg/l
30-Mar-00	990	2005572	Crk-Blank Churn (Crew A)	<0.0002		Mg/l
20-Jun-00	990	2010395	Crk-Blank Churn (Crew A)	<0.0002		Mg/l
12-Sep-00	990	2015582	Crk-Blank Churn (Crew A)	<0.0002		Mg/l
08-Nov-00	990	2019263	Crk-Blank Churn (Crew A)	<0.0002		Mg/l
27-Mar-01	990	2105250	Crk-Blank Churn (Crew A)	<0.0002		Mg/l
19-Jun-01	990	2110579	Crk-Blank Churn (Crew A)	<0.0002		Mg/l
11-Sep-01	990	2116596	Crk-Blank Churn (Crew A)	<0.0002		Mg/l
07-Nov-01	990	2120171	Crk-Blank Churn (Crew A)	0.0002		Mg/l
26-Mar-02	990	2205381	Crk-Blank Churn (Crew A)	<0.0002		Mg/l
18-Jun-02	990	2211279	Crk-Blank Churn (Crew A)	<0.0002		Mg/l
10-Sep-02	990	2216854	Crk-Blank Churn (Crew A)	<0.0002		Mg/l
06-Nov-02	990	2220407	Crk-Blank Churn (Crew A)	<0.0002		Mg/l
08-Apr-03	990	2306142	Crk-Blank Churn (Crew A)	<0.000020		Mg/l
17-Jun-03	990	2311051	Crk-Blank Churn (Crew A)	<0.000020		Mg/l
09-Sep-03	990	2317181	Crk-Blank Churn (Crew A)	<0.000020		Mg/l
29-Oct-03	990	2320481	Crk-Blank Churn (Crew A)	<0.000020		Mg/l
23-Mar-04	990	2404847	Crk-Blank Churn (Crew A)	<0.000020		Mg/l
15-Jun-04	990	2407268	Crk-Blank Churn (Crew A)	<0.000020		Mg/l
09-Sep-04	990	2410635	Crk-Blank Churn (Crew A)	<0.000020		Mg/l

EXHIBIT A-4-2

Crew B (Dunker-Churn):

Start_Date	IC Code	Sample Number	Source	SResult	Para_ Comments	Units
30-Mar-99	888	9906004	Crk00-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
22-Jun-99	888	9910748	Crk00-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
14-Sep-99	888	9916017	Crk00-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
09-Nov-99	888	9919256	Crk00-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
30-Mar-00	888	2005573	Crk-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
20-Jun-00	888	2010396	Crk-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
12-Sep-00	888	2015583	Crk-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
08-Nov-00	888	2019264	Crk-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
27-Mar-01	888	2105251	Crk-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
19-Jun-01	888	2110580	Crk-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
11-Sep-01	888	2116597	Crk-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
07-Nov-01	888	2120172	Crk-Blank Dunker Churn (Crew B)	0.0002		Mg/l
26-Mar-02	888	2205382	Crk-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
18-Jun-02	888	2211280	Crk-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
10-Sep-02	888	2216855	Crk-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
06-Nov-02	888	2220408	Crk-Blank Dunker Churn (Crew B)	<0.0002		Mg/l
08-Apr-03	888	2306143	Crk-Blank Dunker Churn (Crew B)	0.000386		Mg/l
17-Jun-03	888	2311052	Crk-Blank Dunker Churn (Crew B)	0.000258		Mg/l
09-Sep-03	888	2317182	Crk-Blank Dunker Churn (Crew B)	0.000022		Mg/l
29-Oct-03	888	2320482	Crk-Blank Dunker Churn (Crew B)	0.00042	N,P	Mg/l
23-Mar-04	888	2404848	Crk-Blank Dunker Churn (Crew B)	0.000374	N,P	Mg/l
15-Jun-04	888	2407269	Crk-Blank Dunker Churn (Crew B)	0.000107	P	Mg/l
09-Sep-04	888	2410625	Crk-Blank Dunker Churn (Crew B)	0.0000467	P	Mg/l

Result Codes:

> N – Variance from quality control or assurance criteria, however result is considered acceptable under established NELAC guidelines.
> P – Unacceptable for quality assurance criteria.

Based on the review of these data, it was evident that there were no detectable levels in the Crew A QA/QC samples. Detectable levels were present in the Crew B QA/QC blanks from April 2003, following a change in the analytical instrumentation/methodology in 2003. Most concentrations were present at or over the exceedance limit levels.

II. QA/QC Sample Collection:

The procedures for the QA/QC sample collection utilized by Crew A and Crew B were then reviewed including:

1. QA/QC sample collection procedures; and
2. Crew B personnel.

Crew A & Crew B utilize different QA/QC sample collection procedures, due to the differences in the sampling techniques (primarily based on the depth of the water at each sampling site).

1. QA/QC Sample Collection Procedures:

As documented in the "*SOP for Freshwater Sampling Quality Assurance and Quality Control Methodology,*" Doc #00066, Rev. Date – 5/30/02, the tributary equipment blank samples are to

EXHIBIT A-4-2

be collected in accordance with the following procedure by the two tributary sampling crews (Crew A & B).

Crew A (Crane) - "Churn Equipment Blank":
This method involves rinsing the clean churn three times with DI water, then filling with same. Blank samples are then collected from the churn and preserved according to the preservation SOP.

Crew B (Wade) - "Dunker/Churn Equipment Blank":
At three (3) of the sampling locations (Onondaga Lake Outlet, Harbor Brook @ Hiawatha Blvd., and Ley Creek @ Park Street), the vertical Kemmerer sampler (dunker) is used to collect grab samples which are then composited into the sample churn. The equipment blank procedure covers both these sample methods, and involves rinsing the clean dunker and the clean churn 3 times with DI water. The dunker is then filled with DI water and emptied into the churn 3 times to generate the sample volume for the equipment blanks. Blank samples are then collected from the churn and preserved according to preservation SOP.

Sample Preservation:
There is currently an SOP for the routine maintenance of all field preservation kits. Based on the current procedures, all AMP preservation kits have a unique number assigned and reagents are replenished on a monthly basis (or earlier, as needed). This schedule is recorded in a log-book which is reviewed as part of the laboratory audit program. Based on the review of this documentation, it seemed unlikely that the field preservation kits/techniques were the source of contamination.

2. Crew B Personnel:
The QA/QC blank samples are not always prepared by the personnel assigned to the individual sampling crews, but collected by the personnel scheduled to prepare for the sampling event. Based on this information, it did not appear that the problem was related to any specific personnel assigned to Crew B.

Special Samples:
Special samples were collected on Monday, October 4, by Kelly O'Brien, WWTech II, for the parameters Mercury and Zinc, utilizing Crew B equipment to evaluate equipment cleaning procedures. The parameter Zinc was added based on the review of the QA/QC Zinc data of the Crew A & B equipment rinsate blanks. These special samples were preserved using the same AMP preservation kit (as noted on the C-O-C form).

The following table summarizes the results of data, received on October 12, from these special samples:

Sample	Purpose	Hg, mg/l	Zn, mg/l
Dunker Blank (DI Rinsed)	To evaluate current cleaning procedure.	0.0000220	0.0045
Dunker Blank	Additional cleaning of equipment to	<0.000020	0.0049
(HNO_3 Rinse) Teflon Dunker Blank	evaluate acid rinsing of equipment. Use of Teflon dunker to evaluate	<0.000020	0.0056
(HNO_3 Rinse) Preservation Kit Test –	contamination. To evaluate background concentrations	<0.000020	0.0045
(HNO_3 Rinse)	from acid used in preservation.		

Based on the results of these data:

- It appeared that the cleaning procedure for the dunker blank, when performed properly may not contribute to the contamination (as indicated by the close to detection limit value for the DI rinsed dunker). The cleaning procedures employed by the WWTechs during the tributary sampling events needed to be evaluated to check for conformance with the SOP (subsequently performed a demonstration of capability on November 1, 2004).
- The parameter zinc appeared in all the samples, regardless of the equipment cleaning method. This appears to indicate that the source of zinc is not related to the equipment. The source of zinc was subsequently investigated further. In order to rule out the acid from the preservation kit, special "sample container" samples were collected on October 21, as described below.

Meeting with Laboratory and Technician Staff:

A meeting was held with Jeff Noce, Kelly O'Brien and Janaki Suryadevara on Friday, October 15, to discuss these issues.

Based on the discussions at this meeting, it was decided that:

- The laboratory will provide Technicians with "A Cationox", a metal free soap for cleaning of the sampling equipment. "Liquinox" is typically the solution used by the sampling crews. However, since the move to the Henry Clay Boulevard Facility, a "Nutrad" soap was being used, as the sampling technicians were out of the Liquinox soap solution.
- The condition of the dunkers used by Crew B are not ideal, due to age of equipment. New dunkers have been ordered (P.R. dated 10/22/04).
- Based on the review of the QA/QC data, the parameter "Zinc" has been present in the QA/QC Crew A & B blanks (since 1998) and also in all the special samples collected on October 4. This indicates that there may be a source for the background contamination of zinc, potentially from the certified pre-cleaned sample containers used for the metals samples. These containers are provided by SCI SPEC Scientific Specialties, Inc., and are certified as Class 3000 bottles washed under EPA protocol "C". A copy of the Certificate Of Analysis received for a different lot, Lot Number 4-072-010) is included as Attachment 4; Zn = 20µg/l = 0.020mg/l; OCDWEP Lab Minimal Reportable Limit, MRL = 0.0020mg/l & OCDWEP Lab Method Detection Limit, MDL=0.0019mg/l).

It was agreed at the meeting that collection of additional special samples for Hg and Zn analysis would provide additional information.

III. Sample Containers:

In order to evaluate the background concentrations of the sample containers, special sample container samples were collected on October 21.

One sample container was collected from each of the two (2) pre-cleaned bottle lots currently on the shelves. These two (2) bottles were delivered to OCDWEP Lab empty where they were filled with DI water and preserved with 2ml concentration HNO_3 from the Lab, and analyzed for all the metals parameters. The Certificate of Analysis for the two sample containers is included as Attachment 3.

Results of the two sample containers indicate detectable concentrations for the parameters Potassium, Lead and Zinc. The data from the two bottles are summarized for these parameters in the following table:

EXHIBIT A-4-2

Parameter	Bottle Number	Bottle, mg/l	MRL, mg/l	Exceedance Level, mg/l	Bottle Specification*, mg/l
Potassium	3258014	0.0370	0.02	0.04	0.750
Potassium	4072010	0.0280	0.02	0.04	0.750
Zinc	3258014	0.0022	0.002	0.004	0.020
Zinc	4072010	0.0046	0.002	0.004	0.020
Lead	3258014	<0.005	0.005	0.010	0.002
Lead	4072010	0.0053	0.005	0.010	0.002

*Lot Number: 4-072-010. Elements either were not found or found in concentrations less than those listed, as per SCI SPEC's Certificate of Analysis.

Demonstration of Capability:
On November 1, a Demonstration of Capability for cleaning the equipment used by Tributary Sampling Crew B, was performed by Dan Walpole, WWTI, and observed by Jeff Noce & Kelly O'Brien. The cleaning technique demonstrated was in accordance with the cleaning technique specified in the SOP (#00078) – Attachment 5.

During this demonstration, it was determined that improper polyurethane seals were being used for the dunker by Crew B during tributary sampling events. As stated in the Wildco catalog, Silicone seals are required for trace metals analysis as the polyurethane seals leach mercury at the nanogram level. Silicone seals were purchased for the first time during 2002. However, while attempting to collect samples with these seals, they would fall off the dunker into the tributary. The seals were lost during one of the 2003 tributary sampling events at the Onondaga Lake Outlet sampling site. It does not appear that this loss was documented in the field sheets. It is also not clear that this information was transmitted to the appropriate supervisor at the time.

Sample Data:
As part of the review of the QA/QC data, the data from the sampling sites was also reviewed. The following table summarizes the results of the mercury, mg/l, for samples collected from the three (3) sites and QA/QC samples from April 2003 through September 2004 by Crew B using the Dunker/Churn method.

EXHIBIT A-4-2

Start_Date	IC Code 902	IC Code 1906	IC Code 1907	IC Code 908	IC Code 888
	(HB@ Hiawatha)	**(OL Outlet @2ft)**	**(OL Outlet @12 ft)**	**(LC @ Park Street)**	**(Creek Blank: Crew B)**
08-Apr-03	0.000096	0.000079	0.000064	0.000081	0.000386
17-Jun-03	0.000085	0.000173	0.000120	0.000240	0.000258
09-Sep-03	<0.000020	0.000024	0.000032	0.000028	0.000022
29-Oct-03	0.000059	<0.000020	0.000027	0.000030	0.00042
23-Mar-04	0.0000634	0.0000645	0.0000433	0.0000328	0.000374
15-Jun-04	0.0000729	0.000104	0.0000714	0.0000782	0.000107
09-Sep-04	0.0000717	0.0000657	0.0000409	0.0000207	0.0000467

Based on the review of these sample data, it appears that during most occasions, mercury was measured in the Crew B equipment QA/QC rinsate blanks at concentrations higher than the values reported in the actual samples. The source of contamination was therefore determined to be related to the handling and collection of QA/QC blanks. Any potential effects of the DI water used for the QA/QC sample preparation will be further investigated.

Conclusion:

Based on this review of information and discussion with laboratory and sampling personnel, the mercury contamination is determined to be from the improper seals used for the dunker by Crew B.

The following actions are being taken to resolve these issues:

Equipment:

- **In the future, all trace metals quarterly sampling event will utilize a dedicated dunker (with silicone seals only)**. The sampling crews will be informed of this requirement. An additional set of seals have been purchased and utilized for back-up in case of any loss of the seals in the field. Further equipment evaluation will be based on examining the effectiveness of this modification.

Sample Containers:

- The containers currently used are certified as Class 3000 bottles washed under EPA protocol "C". This is the best type available without getting into the "ultra-clean" bottles (like those used for Low Level Mercury samples). The limits that are noted in their analysis sheets by SCI SPEC are standard for the parameters in question. Unfortunately, some of them are over the lower detection limits that we customarily use for AMP work and Zinc is primarily the parameter of concern. Jeff Noce, QA/QC Officer, is contacting the company, to find out if we can get a custom analysis sheet with lower limits for the parameters of interest.
- In the future, in addition to receiving the C-O-A for each bottle lot, all pre-cleaned sample containers will be checked by our laboratory by lot to insure that they are clean. This will be performed by delivering (1) one randomly selected container from each lot received to the OCDWEP Lab empty where they will be preserved with acid from Lab and analyzed for all the AMP quarterly metals parameters to be analyzed for the sampling event (Lake/Tributary). The lot will not be used for the quarterly sampling event, if measurable concentrations of the quarterly metals parameters are detected.

EXHIBIT A-4-2

It is crucial that each container lot is checked prior to use. Samples containers will be used from the lot once the data is available from the lab and is deemed "acceptable". Each sampling event (Lake or Tributary), will use containers from one lot (i.e., sample containers from different lots will not be mixed during each sampling event). The sample lot # will be recorded on the C-O-C forms for the respective samples), to insure this.

Procedural:

- The Technicians will use "Cationox", a metal free soap for cleaning of the sampling equipment to insure this.
- The SOP's, will be reviewed with the sampling crew and signed of by them will be revised and updated to reflect the equipment, cleaning and sample container procedures.

These include the following:

1. "*SOP for Freshwater Sampling Quality Assurance and Quality Control Methodology",* Doc #00066, Rev. Date – 5/30/02 &
2. *"SOP for Preparations for Tributary Sampling*", Doc.#00078, Rev.#2 Dated 6/24/03.

Data:

- The remainder of the 2003 Mercury QA/QC data should be coded accordingly by the lab (if flags were in place at the time of analysis, they should be applied). It should be noted that only the QA/QC blank samples and not the appear to be effected for the parameter Mercury.
- A complete review of all the AMP quarterly metals data from 1998 should be completed in the near future and coded in the LIMS database, as appropriate.

If you have any questions or comments relating to this memo, please contact me.

JS
attach
cc w/attach: Kelly O'Brien
Dave Snyder
Tony Deskins
Janaki Suryadevara
Dr. Elizabeth Moran, EcoLogic, LLC.
File - AMP Correspondence

w:\js\lakememo\2004\hginvestigationmemorev1.doc

EXHIBIT A4-3

EcoLogic Memorandum

TO: Joseph J. Mastriano, Jeanne C. Powers, and Janaki Suryadevara
FROM: Liz Moran
RE: Onondaga Lake Field Audit
DATE: October 8, 2004

On September 14, 2004 I accompanied the AMP sampling technicians on their sampling event of Onondaga Lake. This was a double lake event, with samples collected from South Deep, North Deep, and the nearshore stations. Metals samples were collected using a modified clean hands-dirty hands protocol. The field team included: Zach Wakefield, Steve Stahl, Chris Gandino, Val Murakami, and Dan Walpole (training, second time out).

The objectives of the audit were to assess compliance with the Quality Assurance Project Plan (QAPP) and provide an opportunity for informal training.

I met the sampling team at the marina shortly after 8 am.

Sampling proceeded in an efficient manner. The team provided guidance to the newest member, Dan Walpole. The equipment is well maintained and the boat operations are well organized. I reviewed performance with respect to the following:

- Locating and documenting stations
    - ➢ *Acceptable, note that the field crews are relying on buoys and water depth, not recording GPS coordinates*
- Field determination of UML and LW
    - ➢ *Acceptable. I asked some questions to make sure they understood the upcoming change in season and how that would affect the composition decisions.*
- Equipment used properly (pumps are allowed to run prior to sample collection, specified equipment used, etc)
    - ➢ *Acceptable.*
- Samples preserved and iced
    - ➢ *Acceptable*
- SRP and TDP samples filtered in field
    - ➢ *Acceptable*
- Tube sampling for chlorophyll-*a* as specified in QAPP
    - ➢ *Acceptable. It is now the case that the UML as defined for the chlorophyll sample is different from the UML sample for the water quality samples.*
- Flow meters on zooplankton net are set and recorded properly
    - ➢ *Acceptable. This is highly sensitive to the rate at which the net is drawn upward through the water column.*
- Bottle tracking: containers as specified in QAPP
    - ➢ *Acceptable.*
- Duplicate samples collected in accordance with QAPP
    - ➢ *Acceptable*
- Internal checks in place to confirm all samples collected prior to leaving station
    - ➢ *Acceptable*
- For quarterly metals, efforts are made to minimize contamination
    - ➢ *Yes.*

EXHIBIT A4-3

Discussion of metals sampling

The sample crew changes gloves before collecting these samples; samples are placed in bags and stored in a separate cooler. It is misleading to refer to this protocol as "clean hands, dirty hands" however, since other provisions of Method 1669 are not feasible. The only means of documenting how well the sampling teams are meeting the overall objective of minimizing contamination is by analyzing the associated blanks.

I have reread Method 1669 to see if there are other measures the field team could employ to help minimize environmental contamination. Here are two comments for discussion:

- The method calls for sample containers to be filled with weak acid solution after cleaning; the weak acid solution is to be discarded to a carboy just before the bottles are filled with samples. The lab purchases certified clean bottles. I am not convinced that adding the weak acid solution to the bottles would be an improvement, unless ultra pure HCl was used.

- The method suggests cleaning the boat prior to sampling (using water to be sampled). It is the case that the particles from the atmosphere will deposit on the DWEP boat as it is moored in the marina. Would it be possible to wipe down the boat surfaces with lake water prior to sampling to remove particulate material?

Discussion of near-shore sampling

Sampling was completed for the near-shore areas. Locations for the macroalgae stations have been moved slightly away from the mouths of the creeks.

Secchi disk transparency is measured at the nearshore stations. The objective of this measurement is to determine whether water clarity meets the NYSDOH swimming safety guidance value of 1.2 m (4 ft) for designated swimming beaches. Data are evaluated and reported as to whether this guidance value is met.

According to the QAPP, samples for bacteria and measurements of water clarity are to be obtained in 4 – 5 ft of water. If the Secchi disk is visible on the bottom in 4-5 ft there is no need to bring the boat farther offshore to measure the Secchi disk transparency in deeper water. However, the database must be able to track Secchi disk visible on the bottom.

The sampling crews are not following this protocol. They are moving the boat to deeper water to determine water clarity. This introduces uncertainty in the location.

Summary of recommendations

(1) Discuss with the lab whether adding dilute HCl to the sample bottles is reasonable.
(2) Discuss with the field crew if wiping down the boat surfaces prior to sampling is reasonable.
(3) Re-train the field crews to collect the nearshore samples at set locations and water depths.
(4) Verify with Bill Walker that the database can accommodate a notation when the Secchi disk is visible on the bottom.

EXHIBIT A4-4

EcoLogic Memorandum

TO: Joseph J. Mastriano, Jeanne C. Powers, and Janaki Suryadevara
FROM: Liz Moran
RE: Tributary audit summary
DATE: October 8, 2004

On August 24, 2004 I completed the tributary field audit component of the annual AMP audit sequence. I arrived at the OCDWEP Henry Clay facility at 7:30 a.m. to observe the preparations and instrument calibrations.

The move to the new lab has allowed a tremendous improvement in the preparations for sampling. There is adequate clean space to calibrate the instruments and prepare the field blanks. Equipment is well organized. Instrument maintenance and calibration logs are accessible.

Kelly O'Brien was my liaison for the audit. We went over the findings of the 2003 audit and discussed the changes that had been made in response to recommendations from that evaluation. As usual, I met with the technicians informally to discuss recent conditions and issues, providing a forum for the field team to ask questions related to the tributary monitoring program. The only specific issue that arose was streambank erosion at Tributary 5a. Technicians were concerned that the stream channel had changed with the sediment making it more difficult to collect a representative sample.

Kelly and I then decided which sites would be included in this audit.

Two teams were deployed to complete the tributary sampling. I went with Crew A (Ethan, Chris and Mindy) to the new Metro outfall site, then met crew B (Bob R, Dan W, and Steve S) at Ley Creek, then A again at Spencer and Inner Harbor, then B again at 5A.

- The new Metro effluent outfall is sampled using a bucket tossed in mid-stream. This method is acceptable, since the velocity is high and the flow is very well mixed.
- The Ley Creek sampling requires some field judgment to determine where to sample across the stream. The field team exhibited a good understanding of the criteria to use in selecting optimal sites.
- At Spencer St, we walked (slightly upstream) to check out the new automated sampling station. It is well-positioned to collect samples that have been challenging, i.e. the first flush when the upstream CSO is activated.
- We made our way past the construction to sample the Inner Harbor site. It occurred to me that we are not tracking these data in the annual AMP. Janaki and I should review this.
- At Tributary 5a it was evident that some attempt had been made to stabilize the streambanks and restore the affected areas. Water levels were relatively high and the stream channel was well-defined. The crew was able to collect representative samples without a problem. The field team should notify Kelly if problems recur when streamflow is low.

EXHIBIT A4-4

Conclusion

Overall, the tributary monitoring program is proceeding in accordance with the Field Sampling Plan and the project QAPP. The field teams are trained and attentive to both the details of their assignments and opportunities for improvements.

APPENDIX 5:
TRIBUTARY MACROINVERTEBRATES

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2004 Tributary Macroinvertebrate Physical Habitat Field Sheets

APPENDIX 5. TRIBUTARY MACROINVERTEBRATES

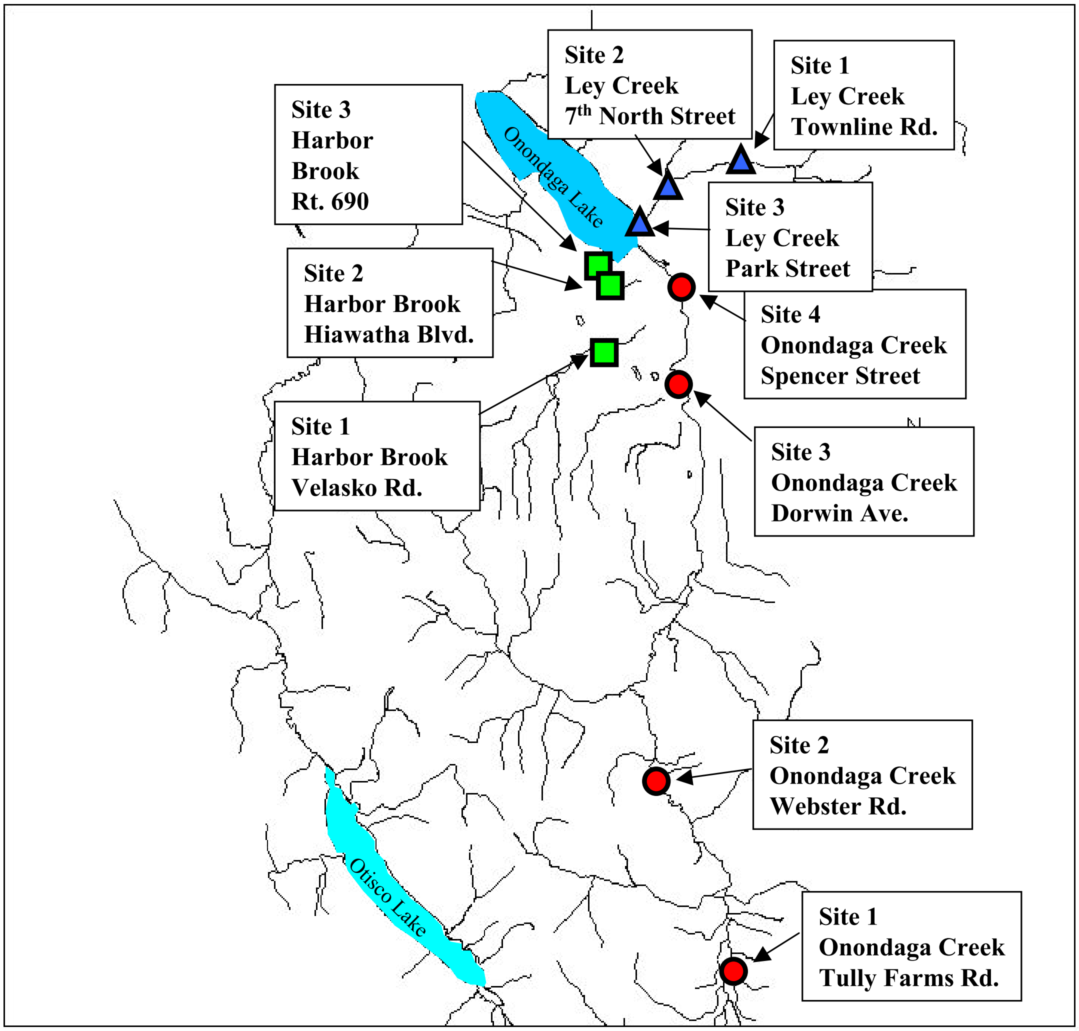
A5-1. FIELD METHODS

The 2004 sampling effort took place in July, consistent with Onondaga County Department of Water Environment Protection (OCDWEP) tributary macroinvertebrate investigations in 1999, 2000, and 2002. Ten (10) sites were sampled in the tributary system of Onondaga Lake between July 19 and July 22, 2004 by OCDWEP technicians (Figure A5-1).

Waterbody	Site Designation	Sample Method	Description
Onondaga Creek	OC1	Kick	Tully Farms Road
	OC2	Kick	Webster Road
	OC3	Kick	Dorwin Avenue
	OC4	Kick	Spencer Street
Ley Creek	LC1	Kick	Townline Road
	LC2	Jab	7th North Street
	LC3	Jab	Park Street
Harbor Brook	HB1	Kick	Velasko Road
	HB2	Kick	Hiawatha Boulevard
	HB3	Jab	Rt. 690

At each location, the following water quality parameters were recorded (Table A-5.1):

- water temperature (°C),
- dissolved oxygen (mg/L),
- conductivity (µS), and
- pH.



Legend

● Onondaga Creek sites

🟩 Harbor Brook sites

▲ Ley Creek sites

Figure A5-1. Onondaga Lake tributary macroinvertebrate monitoring locations.

Table A5-1. Water quality results for each Onondaga Lake tributary site in the 2004-monitoring program.

Site	Temperature °C	Dissolved Oxygen (mg/L)	Specific Conductance (µS)	PH	Discharge (CFS)
Onondaga Creek					
Site 1 – Tully Farms Rd.	19.17	9.84	489	-	3.10
Site 2 – Webster Rd.	17.13	9.50	1444	8.06	33.82
Site 3 – Dorwin Ave.	21.51	10.85	1080	8.08	66.90
Site 4 – Spencer Street	17.89	9.87	1498	7.89	78.88
Ley Creek					
Site 1 – Townline Road	19.2	7.54	1390	7.73	7.12
Site 2 – 7th North Street	23.8	4.42	1554	7.34	-
Site 3 – Park Street	22.6	6.45	1925	7.46	-
Harbor Brook					
Site 1 – Velasko Road	16.67	9.57	2227	7.65	2.32
Site 2 – Hiawatha Blvd.	15.4	8.60	2203	7.85	3.52
Site 3 – Rt. 690	17.3	8.51	2371	8.11	1.44

In addition to water quality parameters, other site features noted and measured were:

Site Features	**Measurement/Observation Method**
Substrate type	Visual estimate of the percentage of clay, silt, sand, gravel, cobble and boulder present in the sampled segment
Tributary width Estimated high water mark	Measured
Percentage of overhead vegetative cover	Observation
Presence of submerged aquatic vegetation	Observation
Velocity Water depth Cross-sectional areas	Measured to calculate discharge (CFS)

A5-1.1 Kick Sampling Method

Kick sampling was conducted at the four Onondaga Creek sites (OC1, OC2, OC3 and OC4), two Harbor Brook sites (HB1 and HB2), and one Ley Creek Site (LC1). Kick sampling was conducted in riffle areas with substrate predominately composed of cobble, gravel and/or sand, a water depth of less than 0.5m and a mean water column velocity of greater than 0.4m/sec. OCDWEP technicians used a standard 9 x 18-inch D-net with 0.8 mm mesh to collect the samples.

At each station, sampling progressed diagonally 5 m across the stream for 5 minutes. The sample was taken by positioning the D-net on the bottom about 0.5 m downstream of the person sampling. The sampler used his/her feet to disturb the bottom so the streambed material, including macroinvertebrates, was carried into the net. The material from the net was placed into a U.S. No. 30 mesh wash bucket and gently rinsed with water to remove fine materials. The remaining contents were placed into labeled wide-mouth glass sample jars, preserved with 10% formalin, and stored for transport to the processing laboratory. Four replicates were collected at each of these locations.

A5-1.2 Jab Sampling Method

Jab sampling, an alternate method of sampling developed by NYSDEC for streams with soft or sandy beds, was used for two Ley Creek sites (LC2 and LC3) and one Harbor Brook site (HB3). Jab samples were collected from the mid section of slow water velocity, soft-bottomed areas. OCDWEP technicians used a standard 9 x 18-inch D-net with 0.8 mm mesh to collect the samples.

The D-net was jabbed into the soft bottom sediments and raked across the bottom until the net was filled with sediment. The net was brought to the surface and the collected materials rinsed while still in the net to remove most fine particles. The material from the net was placed into a U.S. No. 30 mesh wash bucket and gently rinsed with water to remove remaining fine particles. The rinsed contents were placed into labeled wide-mouth glass sample jars, preserved with 10% formalin, and stored for transport to the processing laboratory. Four replicates were taken at each jab sample site.

A5-2 LABORATORY METHODS

Once at the laboratory, the samples that had been fixed in the field with formalin were rinsed through a U.S. No. 60 sieve with water, transferred back to their original sample bottle and preserved with 75% ethyl alcohol. Then, the laboratory sorted and identified the organisms in the samples.

A5-2.1 Sorting

Samples were washed through a U.S. No. 60 sieve with tap water to remove any remaining fine sediments and excess alcohol, and then emptied into a shallow pan. A small amount of tap water was added. The material was distributed evenly in the pan and the contents examined under magnification. Invertebrates were separated from other debris, sorted into major groups, placed in labeled vials containing 75% ethyl alcohol, and counted. Sorting continued until at least 100 organisms had been removed. Due to possible fragments or unidentifiable pieces of organisms (particularly oligochaetes), it is often necessary to sort slightly more than 100 organisms to make sure that 100 identifiable organisms are removed from each sample.

A5-2.2 Identification

The sorted organisms were sent to the Aquatic Resources Center (ARC) of College Grove, Tennessee, for identification. The organisms were identified to the lowest possible taxonomic level. Generally, chironomids and oligochaetes needed to be cleared, slide-mounted and viewed through a compound microscope for proper identification. Most other organisms could be identified using a dissecting stereomicroscope. The number of individuals of each species from each sample was recorded on laboratory data sheets and entered into an Excel spreadsheet. Identified organisms were returned to Onondaga County for an archived reference collection.

NYSDEC guidance (Bode et al, 2002) recommends a minimum subsample size of 100-organisms for stream benthic invertebrate sampling. When samples contained more than 100 individuals, subsampling was performed based on the distribution of individuals in the major taxonomic groups (e.g., Oligochaeta, Chironomidae, Amphipoda, Ephemeroptera, and Trichoptera). For those groups with less than or equal to 25 individuals, the actual count of individuals was recorded for each taxon identified. For those groups with more than 25 individuals in a group, a percentage of that group was used such that the final total number of organisms equaled 100.

<table>
<tr><th colspan="2">Example 1: One taxonomic group exceeds 25 individuals.</th><th colspan="3">Example 2: Two taxonomic groups exceed 25 individuals.</th></tr>
<tr><td rowspan="3"><i>Taxa Distribution</i>
15 amphipods
10 isopods
8 plecopterans
96 oligochaetes</td><td rowspan="3"><i>Subsampling</i>
15+10+8=33
100-33=67
67/96=69.8%
33+(96*69.8%)=100</td><td rowspan="3"><i>Taxa Distribution</i>
15 amphipods
10 isopods
8 plecopterans
50 oligochaetes
30 chironomids</td><td colspan="2"><i>Subsampling</i>
15+10+8=33
100-33=67
50+30=80
(oligochaetes plus chironomids)</td></tr>
<tr><td><i>Oligochaetes</i>
50/80*67=42
42/50 = 84%</td><td><i>Chironomids</i>
30/80*67=25
25/30 = 83%</td></tr>
<tr><td colspan="2">33+(50*84%)+(30*83%)=100</td></tr>
</table>

The individuals that were not permanently mounted on slides were returned to their original major group vial and labeled with the inventory of the individuals for each taxon in that vial.

Raw data from the 2004 sampling event are presented in Table A5-2. The Taxonomic List of Voucher Collection Specimens is presented in Table A5-3.

A5-3 ANALYSIS

Biological monitoring programs that use benthic macroinvertebrates to assess water quality often rely on several different indices of community composition to evaluate the ecological status of the sampled community (Novak and Bode 1992). Each index should contribute different information to the assessment to avoid redundancy and conflicting results. The Onondaga County macroinvertebrate monitoring program used four indices to assess water quality:

- NYSDEC's Biological Assessment Profiles (Bode et al. 2002) were used as the primary measure of the macroinvertebrate community.
- The Hilsenhoff Biotic Index and Oligochaete Richness were used as indicators of organic richness.

Table A5-2. Raw invertebrate data from Onondaga Lake tributaries, 2004.

	Facility code	**3187**	**3188**	**3189**	**3190**	**3191**	**3192**	**3193**	**3194**	**3195**	**3196**	**3197**	**3198**	**3199**	**3200**	**3201**	**3202**	**3203**	**3204**	**3205**	**3206**
	Trib	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**HB**	**HB**	**HB**	**HB**
	Site	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**4**	**4**	**4**	**4**	**1**	**1**	**1**	**1**
	Replicate	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Oligochaeta	Enchytraeidae													7	10	11	2				
	Lumbricidae							1						1	4	1					
	Eiseniella tetraedra					2															
	Dero digitata																				
	Nais communis																				
	Nais variabilis																				
	Ophidonais serpentina																				
	Paranais													1							
	Ilyodrilus templetoni																				
	Limnodrilus cervix																				
	Limnodrilus hoffmeisteri								2					1	1	1					
	Limnodrilus udekemianus													1							
	Potamothrix bavaricus																				
	Potamothrix moldaviensis										1										
	Tubifex tubifex																				
	Tubificid immature: bifids						27	5	44		1			6							2
	Tubificid immature: h+p						1		2												
Hirudinea	Erpobdellidae													2							
	Mooreobdella microstoma																				
Amphipoda	*Crangonyx*																				
	Crangonyx pseudogracilis																				
	Gammarus fasciatus									13	6	5	2		1	3	3				
	Gammarus pseudolimnaeus	2		1	1	1		4		11	4	17	5	14	21	22	6	72	37	70	49
	Gammarus (immature/damaged)																				
Isopoda	*Caecidotea* (immature/female)																				
	Caecidotea racovitzai									1				26	33	16	24				
Cambaridae	Cambaridae	1	1						3			1									
Ephemeroptera	Baetidae																			3	
	Baetis	34	2	3	5					1		1	4				1	3	22	9	26
	Leptophlebiidae		1																		
	Leucrocuta	1		2	1																
	Tricorythodes	3		2	2		1	2			16	1									
Plecoptera	*Leuctra*	5	3	11	16														5		4
	Perlidae				1																
	Agnetina	4		1	2				1												
Megaloptera	*Nigronia serricornis*		1		2	3		3			1										
	Sialis		2	3	2				2	2	1	1									
Hemiptera	Corixidae									1											

Table A5-2. Raw invertebrate data from Onondaga Lake tributaries, 2004.

	Facility code	**3187**	**3188**	**3189**	**3190**	**3191**	**3192**	**3193**	**3194**	**3195**	**3196**	**3197**	**3198**	**3199**	**3200**	**3201**	**3202**	**3203**	**3204**	**3205**	**3206**
	Trib	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**HB**	**HB**	**HB**	**HB**
	Site	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**4**	**4**	**4**	**4**	**1**	**1**	**1**	**1**
	Replicate	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Trichoptera	Hydropsychidae (v. e. instars)	1					1		1			1	1								
	Cheumatopsyche	1			1			1	1	2	4	3	6		1	2	1				
	Hydropsyche (early instar)	3	2		2																
	Hydropsyche betteni					5		1													
	Hydropsyche bronta	2	1	1	1	23	5	13	1	14	22	13	9								
	Hydropsyche slossonae											1				1		5	6	8	
	Hydropsyche sparna	2	1				1	1			2	1	2		1						
	Glossosoma																		1		
	Hydroptila												1	1							
	Pycnopsyche							1													
Coleoptera	*Dubiraphia*					1	3	1	1	2	2	2	1								
	Macronychus							1													
	Optioservus	1	1	2		18	7	24	8	2	1		3								
	Stenelmis	2		3	1	6	3	11		33	22	31	28	1	2	2	2				
Chironomidae	Chironomidae pupae					2	5									1		1			
	Chironomus													1		1					
	Cladotanytarsus						2				1										
	Cricotopus						1													1	
	Cricotopus bicinctus	1		1		1	2			2		1	1	12		5	16	2	1		1
	Cricotopus cf. *intersectus*							1									1				
	Cricotopus cf. *triannulatus*						2	1						1		1			1		1
	Cricotopus trifascia						2	1		4	2	1	6	1	1	2					1
	Cricotopus cf. *vierriensis*													1							
	Cryptochironomus	3	1	2	4						1	1									
	Demicryptochironomus	1	3		1								1								
	Diamesa		1		2	4	3		1			1					1				
	Dicrotendipes modestus																				
	Dicrotendipes neomodestus														1						
	Endochironomus														1						
	Eukiefferiella coerulescens grp.																				
	Eukiefferiella devonica grp.									1			1	1		1	1				1
	Micropsectra	1	1	2			1														1
	Microtendipes pedellus grp.	1	8	5	4	10	18	12	17	1		1	2	1							
	Nanocladius cf. *minimus*																				
	Nanocladius cf. *rectinervus*																				
	Natarsia								1												
	Nilothauma		1																		
	Pagastia	2	17	8	12	2		1						6	9	5	16	1	6	3	8
	Parachironomus frequens																				
	Parametriocnemus			1	1																

Table A5-2. Raw invertebrate data from Onondaga Lake tributaries, 2004.

	Facility code	**3187**	**3188**	**3189**	**3190**	**3191**	**3192**	**3193**	**3194**	**3195**	**3196**	**3197**	**3198**	**3199**	**3200**	**3201**	**3202**	**3203**	**3204**	**3205**	**3206**
	Trib	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**OC**	**HB**	**HB**	**HB**	**HB**
	Site	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**4**	**4**	**4**	**4**	**1**	**1**	**1**	**1**
	Replicate	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Chironomidae	*Paratanytarsus*		1				1		1												
(continued)	*Paratendipes*								1												1
	Phaenopsectra obediens grp.								1					1		1					
	Polypedilum aviceps		1	2	1																
	Polypedilum fallax			26	10				2	6	6	11	12		1		1				
	Polypedilum flavum									1	1	1	5		1		1				
	Polypedilum halterale grp.									1											
	Polypedilum illinoense grp.			1	1																
	Polypedilum laetum	9	3				1														
	Polypedilum scalaenum grp.			1					1												
	Polypedilum tritum								1												
	Potthastia gaedii grp.									1											
	Procladius																				
	Prodiamesa															1		7	11		2
	Psectrocladius						1														
	Rheocricotopus															1					
	Rheotanytarsus (exiguus grp.)			2			4														
	Stempellinella				1																
	Stictochironomus																				
	Thienemannimyia grp.	5	38	14	23				1					5	3	4	8		1		
	Tvetenia bavarica																		1		
	Tvetenia paucunca															1					
	Tvetenia vitracies		1					1		1	5	5	7	6	8	4	9				
Diptera	*Atherix*					15	3	12	3												
	Chelifera													1		1	1				
	Hemerodromia			1							1						1				
	Muscidae															1					
	Psychodidae pupae													1							
	Simulium													1	1	11	4	2			2
	Stratiomyidae																1				
	Euparyphus																		1		
	Chrysops		1			1	3														
	Antocha				1	2	2	2	3												
	Dicranota	1	1		1														2		1
	Hexatoma	14	6	5	1													7	3	5	
	Pseudolimnophila																		1		
	Tipula					2			1										1	1	
	Tipulidae pupae					2															
Bivalvia	*Pisidium compressum*																				
	Sphaerium												3								
Gastropoda	*Ferrissia rivularis*																				
	Valvata piscinalis																				
Total number of individuals		**100**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table A5-2. Raw invertebrate data from Onondaga Lake tributaries, 2004.

	Facility code	**3207**	**3208**	**3209**	**3210**	**3211**	**3212**	**3213**	**3214**	**3215**	**3216**	**3217**	**3218**	**3219**	**3220**	**3221**	**3222**	**3223**	**3224**	**3225**	**3226**
	Trib	**HB**	**HB**	**HB**	**HB**	**HB**	**HB**	**HB**	**HB**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**
	Site	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**
	Replicate	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Oligochaeta	Enchytraeidae	8	7	2	9									1							
	Lumbricidae	1																			
	Eiseniella tetraedra																				
	Dero digitata							1										1			
	Nais communis						1														
	Nais variabilis				1																
	Ophidonais serpentina	5	4	7	16			44													
	Paranais																				
	Ilyodrilus templetoni															3					
	Limnodrilus cervix										1	1	2	2		7	5				
	Limnodrilus hoffmeisteri	15	11	2	4	19	7	4	1	12	4	9	13	21	4	18	3				
	Limnodrilus udekemianus		1	1		4		1			1	1	3	2			1				
	Potamothrix bavaricus																1				
	Potamothrix moldaviensis									1											
	Tubifex tubifex	5	2	4	1	3															
	Tubificid immature: bifids	32	25	22	13	5	11	9		34	44	31	43	42	18	38	25	2	3		4
	Tubificid immature: h+p	5	30	52	18	1	2	5		3	7	2	1	2		3	4				
Hirudinea	Erpobdellidae																				
	Mooreobdella microstoma			1																	
Amphipoda	*Crangonyx*										1		1								
	Crangonyx pseudogracilis		1						1	1		3									4
	Gammarus fasciatus	11	8	1	16					7	12	9	2				17	9	7	1	
	Gammarus pseudolimnaeus	3		2	1												1				
	Gammarus (immature/damaged)													1			6				2
Isopoda	*Caecidotea* (immature/female)				9				1		1								1		1
	Caecidotea racovitzai	1					5	17		1					1		15	8		2	
Cambaridae	Cambaridae	1	1	1	1																
Ephemeroptera	Baetidae																				
	Baetis																				
	Leptophlebiidae																				
	Leucrocuta																				
	Tricorythodes																				
Plecoptera	*Leuctra*																				
	Perlidae																				
	Agnetina																				
Megaloptera	*Nigronia serricornis*																				
	Sialis																				
Hemiptera	Corixidae																				

Table A5-2. Raw invertebrate data from Onondaga Lake tributaries, 2004.

	Facility code	3207	3208	3209	3210	3211	3212	3213	3214	3215	3216	3217	3218	3219	3220	3221	3222	3223	3224	3225	3226
	Trib	HB	HB	HB	HB	HB	HB	HB	HB	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC
	Site	2	2	2	2	3	3	3	3	1	1	1	1	2	2	2	2	3	3	3	3
	Replicate	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Trichoptera	Hydropsychidae (v. e. instars)																				
	Cheumatopsyche									1											
	Hydropsyche (early instar)									1											
	Hydropsyche betteni																				
	Hydropsyche bronta																				
	Hydropsyche slossonae																				
	Hydropsyche sparna																				
	Glossosoma																				
	Hydroptila							1											1		
	Pycnopsyche																				
Coleoptera	*Dubiraphia*																				
	Macronychus																				
	Optioservus																				
	Stenelmis																				
Chironomidae	Chironomidae pupae						1			2											
	Chironomus	9	3	3	2	7	2	11	6	11	9	8	6	13		31	7	1	6		
	Cladotanytarsus																				
	Cricotopus								1											1	
	Cricotopus bicinctus		1		3		1		1	1		2		1							
	Cricotopus cf. *intersectus*									1				1							
	Cricotopus cf. *triannulatus*									1										1	
	Cricotopus trifascia																				
	Cricotopus cf. *vierriensis*																				
	Cryptochironomus						1	1		1	2	2	3								
	Demicryptochironomus																				
	Diamesa																				
	Dicrotendipes modestus											1		5			5		1	10	
	Dicrotendipes neomodestus																				
	Endochironomus																				
	Eukiefferiella coerulescens grp.		1																		
	Eukiefferiella devonica grp.													1							
	Micropsectra				1							1									
	Microtendipes pedellus grp.																				
	Nanocladius cf. *minimus*																			6	1
	Nanocladius cf. *rectinervus*																			4	
	Natarsia	1										2									
	Nilothauma																				
	Pagastia																				
	Parachironomus frequens																			1	
	Parametriocnemus																				

Table A5-2. Raw invertebrate data from Onondaga Lake tributaries, 2004.

	Facility code	**3207**	**3208**	**3209**	**3210**	**3211**	**3212**	**3213**	**3214**	**3215**	**3216**	**3217**	**3218**	**3219**	**3220**	**3221**	**3222**	**3223**	**3224**	**3225**	**3226**
	Trib	**HB**	**HB**	**HB**	**HB**	**HB**	**HB**	**HB**	**HB**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**	**LC**
	Site	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**
	Replicate	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Chironomidae	*Paratanytarsus*				1							2					1			2	
(continued)	*Paratendipes*																				
	Phaenopsectra obediens grp.																				
	Polypedilum aviceps																				
	Polypedilum fallax									1											
	Polypedilum flavum																				
	Polypedilum halterale grp.																				
	Polypedilum illinoense grp.											3									
	Polypedilum laetum																				
	Polypedilum scalaenum grp.									1	16	19	25				1				
	Polypedilum tritum																				
	Potthastia gaedii grp.																				
	Procladius									12	1	1		8			6	1			
	Prodiamesa	2	2	1	2	3		4	1												
	Psectrocladius																				
	Rheocricotopus																				
	Rheotanytarsus (exiguus grp.)									2		1									
	Stempellinella																				
	Stictochironomus			1							1										
	Thienemannimyia grp.	1			1			1	1	3		2	1							2	
	Tvetenia bavarica																				
	Tvetenia paucunca																				
	Tvetenia vitracies																				
Diptera	*Atherix*																				
	Chelifera							1													
	Hemerodromia																				
	Muscidae																				
	Psychodidae pupae		3																		
	Simulium																				
	Stratiomyidae																				
	Euparyphus																				
	Chrysops																				
	Antocha																				
	Dicranota																				
	Hexatoma																				
	Pseudolimnophila																				
	Tipula				1																
	Tipulidae pupae																				
Bivalvia	*Pisidium compressum*									2											
	Sphaerium																				
Gastropoda	*Ferrissia rivularis*									1											
	Valvata piscinalis					3															
Total number of individuals		**100**	**100**	**100**	**100**	**45**	**31**	**100**	**13**	**100**	**100**	**100**	**100**	**100**	**23**	**100**	**98**	**22**	**19**	**30**	**12**

Table A5-3. TAXONOMIC LIST OF VOUCHER COLLECTION SPECIMENS FROM ONONDAGA LAKE AND ADJACENT STREAMS, NEW YORK, 1999 - 2004

Platyhelminthes	
Turbellaria	
Tricladida	
Planariidae	
Cura foremanii	J3
Dugesia polychroa	J2
Dugesia tigrina	J1
Cnidaria	
Hydrozoa	
Hydroida	
Hydridae	
Hydra	Y1
Annelida	
Oligochaeta	
Enchytraeida	
Enchytraeidae	L10
Enchytraeus	L39*
Lumbricillus	L38*
Lumbriculida	
Lumbriculidae	L40*
Tubificida	
Naididae	
Amphichaeta leydigi	L29
Chaetogaster diaphanus	L26
Chaetogaster diastrophus	L31
Dero digitata	L7
Dero lodeni	L33
Dero nivea	L25
Dero trifida	L22
Nais barbata	L19
Nais communis	L34
Nais elinguis	L24
Nais variabilis	L18
Ophidonais serpentina	L8
Paranais frici	L42*
Paranais litoralis	L21
Pristina aequiseta	L30
Pristina leidyi	L35
Pristinella jenkinae	L23
Pristinella osborni	L27
Stylaria lacustris	L9
Vejdovskyella intermedia	L16
Tubificidae	
Aulodrilus limnobius	L28
Aulodrilus pigueti	L13
Ilyodrilus templetoni	L17
Limnodrilus cervix	L5
Limnodrilus claparedeianus	L12
Limnodrilus hoffmeisteri	L3
Limnodrilus profundicola	L4
Limnodrilus udekemianus	L2
Quistadrilus multisetosus	L41*
Potamothrix bavaricus	L11
Potamothrix bedoti	L20
Potamothrix moldaviensis	L14
Tubifex tubifex	L6
Lumbricida	
Lumbricidae	
Eiseniella tetraedra	L36*
Allolobophora chlorotica	L37*
Hirudinea	
Rhynchobdellida	
Glossiphoniidae	
Helobdella	H1
Helobdella stagnalis	H3*
Helobdella triserialis	H2
Piscicolidae	
Piscicola	H6[1]
Arynchobdellida	
Erpobdellidae	
Mooreobdella fervida	H5*
Mooreobdella microstoma	H4*
Arthropoda	
Arachnida	
Hydrachnida	
Hygrobatidae	
Hygrobates	W7
Limnesiidae	
Limnesia	W3
Pionidae	
Piona	W2
Torrenticolidae	
Torrenticola	W1
Unionicolidae	
Neumania	W5
Koenikea	W6
Unionicola	W4
Malacostraca	
Amphipoda	
Crangonyctidae	
Crangonyx pseudogracilis	A4*
Gammaridae	
Gammarus fasciatus	A1
Gammarus pseudogracilis	A4*
Gammarus pseudolimnaeus	A2
Hyalellidae	
Hyalella azteca	A3
Isopoda	
Asellidae	
Caecidotea racovitzai	I2
Caecidotea	I1

Table A5-3. TAXONOMIC LIST OF VOUCHER COLLECTION SPECIMENS FROM ONONDAGA LAKE AND ADJACENT STREAMS, NEW YORK, 1999 - 2004

Entognatha	
Collembola	
Entomobryidae	
Orchesella	S2
Isotomidae	
Isotomus cf. *sensibilis*	S1
Isotomurus	S3
Insecta	
Ephemeroptera	
Baetidae	
Baetis	E1
Procloeon	E5*
Caenidae	
Caenis	E4
Ephemerellidae	
Timpanoga (Dannella)	E3, E9[1]
Heptageniidae	
Epeorus	E8*
Heptagenia	E6*
Leucrocuta	E10[2]
Leptophlebiidae	
Paraleptophlebia	E7*
Tricorythidae	
Tricorythodes	E2
Odonata	
Aeshnidae	
Boyeria	N5*
Calopterygidae	
Calopteryx maculata	N1
Coenagrionidae	
Coenagrion/Enallagma	N3
Ischnura	N2
Gomphidae	
Lanthus parvulus	N4*
Plecoptera	
Chloroperlidae	
Alloperla	P6[1]
Sweltsa	P5*
Leuctridae	
Leuctra	P1
Perlidae	
Acroneuria	P3
Agnetina	P2
Pteronarcyidae	
Pteronarcys	P4*
Hemiptera	
Corixidae	
Hesperocorixa	U4[1]
Tichocorixa	U3[1]
Saldidae	U2
Veliidae	
Rhagovelia	U1
Megaloptera	
Corydalidae	
Nigronia serricornis	M1
Sialidae	
Sialis	M2
Trichoptera	
Glossosomatidae	
Glossosoma	T14*
Helicopsychidae	
Helicopsyche borealis	T15[1]
Hydropsychidae	
Cheumatopsyche	T4
Hydropsyche betteni	T8
Hydropsyche bronta	T6
Hydropsyche slossonae	T2
Hydropsyche sparna	T3
Hydroptilidae	
Hydroptila	T1
Leptoceridae	
Nectopsyche	T12
Oecetis (Pseudosetodes) avara grp.	T9
Limnephilidae	
Pycnopsyche	T16[2]
Philopotamidae	
Chimarra	T7
Dolophilodes	T13*
Polycentropodidae	
Nyctiophylax	T11
Polycentropus	T10
Rhyacophilidae	
Rhyacophila	T5
Lepidoptera	
Pyralidae	
Acentria	LE1
Coleoptera	
Dytiscidae	
Agabus	C2
Elmidae	
Ancyronyx	C9
Dubiraphia	C7
Macronychus	C5
Optioservus	C1
Promoresia	C6

Table A5-3. TAXONOMIC LIST OF VOUCHER COLLECTION SPECIMENS FROM ONONDAGA LAKE AND ADJACENT STREAMS, NEW YORK, 1999 - 2004

Stenelmis	C4
Gyrinidae	
Dineutus	C12[1]
Haliplidae	
Haliplus	C11
Hydrophilidae	
Berosus	C10
Hydrobius	C3
Tropisternus	C13[1]
Lampyridae	C8
Diptera	
Athericidae	
Atherix	Z6*
Ceratopogonidae	
Bezzia/Palpomyia	R1
Monohelea	R2
Mallochohelea	R3
Chironomidae	
Ablabesmyia mallochi	34
Alotanypus	75
Brillia flavifrons	22
Chironomus	81*
Cladopelma	67
Cladotanytarsus	20
Corynoneura	41
Cricotopus bicinctus	7
Cricotopus cf. *intersectus*	83*
Cricotopus sylvestris grp.	44
Cricotopus cf. *triannulatus*	43
Cricotopus trifascia	3
Cricotopus cf. *vierriensis*	39
Cricotopus/Orthocladius	19
Cryptochironomus	27
Cryptotendipes	63
Demicryptochironomus	89[2]
Diamesa	25
Dicrotendipes fumidus	38
Dicrotendipes simpsoni	48
Dicrotendipes modestus	36
Dicrotendipes neomodestus	37
Dicrotendipes nervosus	30
Doncricotopus cf. *bicaudatus*	54
Endochironomus	35
Eukiefferiella brehmi grp.	64
Eukiefferiella claripennis grp.	76
Eukiefferiella coerulescens grp.	90[2]
Eukiefferiella devonica grp.	13
Glyptotendipes (*Glyptotendipes*)	46
Heleniella	84[1]
Heterotrissocladius marcidus grp.	29
Labrundinia neopilosella	51
Labrundinia pilosella	47
Larsia	79*
Micropsectra	17

Table A5-3. TAXONOMIC LIST OF VOUCHER COLLECTION SPECIMENS FROM ONONDAGA LAKE AND ADJACENT STREAMS, NEW YORK, 1999 - 2004

Microtendipes pedellus grp.	4
Nanocladius cf. *minimus*	16
Nanocladius cf. *rectinervis*	70
Natarsia	80*
Nilotanypus fimbriatus	66
Nilothauma	91[2]
Orthocladius (*Euorthocladius*)	73
Pagastia sp. A of Oliver	12
Parachironomus cf. *carinatus*	52
Parachironomus cf. *frequens*	49
Parachironomus cf. *monochromus*	53
Paracladopelma	88[1]
Parakiefferiella cf. sp. A of Epler	50
Parakiefferiella cf. sp. B of Epler	69
Paralauterborniella	61
Parametriocnemus	31
Paratanytarsus	8
Paratendipes	55
Phaenopsectra obediens grp.	15
Phaenopsecra punctipes	32
Polypedilum aviceps	77*
Polypedilum convictum grp.	5
Polypedilum fallax	42
Polypedilum flavum	92[2]
Polypedilum halterale grp.	71
Polypedilum illinoense grp.	28
Polypedilum laetum	14
Polypedilum scalaenum grp.	56
Polypedilum tritum	93[2]
Potthastia gaedii grp.	68
Procladius (*Holotanypus*)	33
Prodiamesa	11
Psectrocladius	82*
Psectrotanypus	87[1]
Pseudosmittia	60
Rheocricotopus	45
Rheotanytarsus	23
Stempellinella	78*
Stenochironomus	65
Stictochironomus	74
Sublettea	85[1]
Tanypus	86[1]
Tanytarsus cf. sp. A of Epler	9
Tanytarsus cf. sp. C of Epler	10
Tanytarsus cf. sp. E of Epler	72
Tanytarsus cf. sp. G of Epler	40
Tanytarsus cf. sp. L of Epler	62
Tanytarsus cf. sp. P of Epler	26
Tanytarsus cf. sp. T of Epler	58
Tanytarsus cf. sp. W of Epler	18
Thienemanniella cf. *xena*	24
Thienemanniella cf. sp. A of Epler	57
Thienemannimyia grp.	1, 2
Tvetenia bavarica grp.	21

Table A5-3. TAXONOMIC LIST OF VOUCHER COLLECTION SPECIMENS FROM ONONDAGA LAKE AND ADJACENT STREAMS, NEW YORK, 1999 - 2004

Tvetenia discoloripes grp.	6
Zavrelimyia	59
Empididae	
Chelifera	Q2
Clinocera	Q1
Hemerodromia	Q3
Muscidae	Z1
Psychodidae	
Pericoma	Z3*
Psychoda	Z4*
Simuliidae	
Simulium	Z2
Stratiomyiidae	
Caloparyphus	Z9 [1]
Euparyphus	Z11 [2]
Stratiomys	Z10 [1]
Tabanidae	
Chrysops	Z5*
Tipulidae	
Antocha	V3
Dicranota	V2
Gonomyia	V5 [1]
Hexatoma	V1
Pseudolimnophila	V6 [2]
Tipula	V4*
Mollusca	
Bivalvia	
Veneroida	
Dreissenidae	
Dreissena polymorpha	B3
Sphaeriidae	
Musculium	B5*
Pisidium casertanum	B6*
Pisidium compressum	B2
Pisidium punctatum	B4
Pisidium dubium	B1
Sphaerium	B7 [1]
Gastropoda	
Limnophila	
Ancylidae	
Ferrissia rivularis	G6
Lymnaeidae	
Fossaria	G5
Fossaria rustica	G7
Pseudosuccinea columella	G8
Physidae	
Physa cf. *heterostropha*	G1, G4
Planorbidae	
Gyraulus circumstriatus	G2
Micromenetus dilatatus	G3
Valvatidae	
Valvata piscinalis	G9

* Taxa added from the samples collected in 2000.
[1] Taxa added from the samples collected in 2002.
[2] Taxa added from the samples collected in 2004.

Alphanumeric/numeric designation following taxon pertains to the code found in the vial/on the vial lid or on the microscope slide.

- NYSDEC's Impact Source Determination (Bode et al. 2002) was used to identify the primary factor influencing the macroinvertebrate community.

A5-3.1 NYSDEC Biological Assessment Profiles

Using NYSDEC Biological Assessment Profiles, an overall assessment of water quality for each site was calculated by averaging results of four individual metrics obtained through a scaled ranking of the index values. These individual metrics (defined below) were species richness, EPT richness, Hilsenhoff Biotic Index (HBI), and either the Percent Model Affinity (PMA) or the Non-Chironomid/Oligochaete (NCO) richness, depending on the sampling method.

- Species richness. This is the total number of species or taxa found in the sample. Higher species richness values are mostly associated with clean-water conditions. (Bode et al, 2002, Appendix IV)

- EPT richness. EPT denotes the total number of species of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) found in a 100-organism subsample. These are thought of as clean-water organisms, and their presence generally is correlated with good water quality. (Bode et al, 2002, Appendix IV)

- HBI. The Hilsenhoff Biotic Index is calculated by multiplying the number of individuals of each species by its assigned tolerance value, summing these products, and dividing by the total number of individuals. On a 0-10 scale, tolerance values range from intolerant (0) to tolerant (10). Tolerance values, listed in the species list, are mostly from Hilsenhoff (1987). High HBI values are indicative of organic (sewage) pollution, while low values indicate lack of sewage effects. (Bode et al, 2002, Appendix IV).

- PMA. This index applied to samples collected using the kick method. This is a measure of similarity to a model non-impacted community based on percent abundance in seven major groups (Novak and Bode, 1992). Percentage similarity as calculated in Washington (1984) is used to measure similarity to a kick sample community of 40% Ephemeroptera, 5% Plecoptera, 10%

Trichoptera, 10% Coleoptera, 20% Chironomidae, 5% Oligochaeta, and 10% Other. (Bode et al, 2002, Appendix IV).

- NCO richness. This index applied to samples collected using the jab method. NCO denotes the total number of species of organisms other than those in the groups Chironomidae and Oligochaeta. Since Chironomidae and Oligochaeta are generally the most abundant groups in impacted communities, NCO taxa are considered less pollution-tolerant, and their presence would be more indicative of good water quality. This measure is the Sandy Stream counterpart of EPT richness. (Bode et al, 2002, Appendix IV).

The index values calculated from the four metrics were converted to a common scale of water quality ranging from 0-10, with 0 being severely impacted and 10 being non-impacted. After the index values for a site were converted to a common scale value, they were averaged to obtain a score denoting overall assessment of water quality. The score resulted in a designation to one of four categories of water quality: non-impacted, slightly impacted, moderately impacted, or severely impacted. These results are presented in Tables A5-4, A5-5, and A5-6.

Table A5-4. Mean index value and corresponding mean NYSDEC water quality scale value from kick samples from monitoring sites in Onondaga Creek in 2004.

Index	**Site 1 Tully Farms Road**		**Site 2 Webster Road**		**Site 3 Dorwin Ave.**		**Site 4 Spencer Street**	
	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean
Species Richness	25	7.09	22.25	6.21	20.25	5.66	22	6.14
EPT Richness	7.75	6.25	4.0	4.21	5.0	4.79	1.75	2.60
HBI	3.4	8.63	5.0	6.82	5.3	6.53	6.4	5.15
PMA	55	5.89	51	5.30	54.75	5.91	38	3.14
NYSDEC Mean Water Quality Value	**6.89**		**5.64**		**5.72**		**4.26**	
State of Impact	**Slight**		**Slight**		**Slight**		**Moderate**	

Table A5-5. Mean index value and corresponding NYSDEC water quality value from kick and jab samples from sites in Ley Creek in 2004.

Index	**Site 1 Townline Road**		**Site 2 7th North Street**		**Site 3 Park Street**	
	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean
Species Richness	16.25	4.41	11.33	2.58	18	5.91
EPT Richness	0.5	0.76	0	0	1.0	1.5
HBI	8.6	2.23	9.4	1.05	7.6	3.98
PMA	33.75	2.42	-	-	-	-
NCO	-	-	1.67	1.81	6.0	5.45
NYSDEC Mean Water Quality Value	**2.46**		**1.36**		**4.2**	
State of Impact	**Severe**		**Severe**		**Moderate**	

Table A5-6. Mean index value and corresponding NYSDEC water quality value from kick and jab samples from sites in Harbor Brook in 2004.

Index	**Site 1 Velasko Road**		**Site 2 Hiawatha Blvd**		**Site 3 Rt. 690**	
	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean
Species Richness	11.8	2.78	15.5	4.12	15.0	4.43
EPT Richness	2.8	3.47	0	0	0.75	0.75
HBI	4.1	7.92	8.9	1.81	2.71	2.77
PMA	46	4.46	23	0.65	-	-
NCO	-	-	-	-	3.89	3.89
NYSDEC Mean Water Quality Value	**4.66**		**1.64**		**2.96**	
State of Impact	**Moderate**		**Severe**		**Severe**	

A5-3.2 Hilsenhoff Biotic Index (HBI)

Although this index is included as part of the Biological Assessment Profile, this index was reviewed independently because it directly tests for the impacts of organic enrichment.

The HBI is considered by many investigators to be the most reliable index of composition of the macroinvertebrate community and water quality status (Novak and Bode 1992). The HBI implies the presence of organic, oxygen-demanding pollution, based on species-specific tolerance levels. Taxa are assigned tolerance values ranging from zero to ten, where zero and ten represent the extremes for intolerance and tolerance respectively (Hilsenhoff 1987).

HBI not only includes the numbers of species and the distribution of individuals among species, but also weighs abundance of each species according to its known ability to tolerate adverse water quality conditions, particularly organic inputs. High HBI values are associated with adverse impacts of organic pollution. Low HBI values indicate that the macroinvertebrate community is not impacted by organic pollution.

A raw HBI score is ranked on a scale from 0 to 10 with zero being best and ten being worst. NYSDEC converts these HBI values into their water quality scale of 0 to 10 with zero being worse and ten being best. In order to avoid confusion, the separate HBI values are presented in Tables A5-4, A5-5, and A5-6 as the NYSDEC score for HBI and not the raw HBI calculation.

A5-3.3 Percent Oligochaetes (NCO Richness)

The percent contribution of oligochaetes is used as an index of change over time. Oligochaetes can often thrive in areas where other invertebrates may not because of factors such as competition, soft substrate, organic enrichment, or low oxygen conditions.

Some oligochaetes are found at the extremes of environmental conditions. For example, *Tubifex tubifex* may be found in very unproductive cold pristine headwater streams and near extremely productive, warm sewage discharges (Dr. Deedee Kathman, personal communication). Since few organisms are suited for the extreme conditions found in these two very different settings, *T. tubifex* can thrive by taking advantage of the lack of competition.

As oligochaetes are often found in high relative proportions in areas impaired by organic enrichment, their percent contribution to the community can be a good measure of the relative amount of organic enrichment at different locations. More importantly, the change in the percent contribution of oligochaetes over time, as well as the species composition, is a good measure of the change in organic enrichment at the study sites.

The NCO index is used only for samples collected using the jab method. These results are presented in Tables A5-5 and A5-6.

A5-3.4 NYSDEC Impact Source Determination

The NYSDEC Impact Source Determination (ISD) indicates the probable primary factor influencing the macroinvertebrate community in stream riffle habitats based on similarity to impacted community models (Bode et al. 2002). The methods used for constructing these models can be found in NYSDEC guidance (Bode, et al. 2002).

The community types used for impact source determination are:

- Natural
- Nutrient Additions-Nonpoint Sources
- Toxic
- Sewage Effluent/Animal Waste
- Municipal/Industrial
- Siltation
- Impoundment

The model community exhibiting the highest similarity to the test data is considered to indicate the likely impact source type for that site. If data from a site do not match any of the modeled communities (based on a standard of 50% affinity) the determination is "inconclusive." The results of this analysis are presented in Table A5-7, A5-8, and A5-9.

Table A5-7. Impact Source Determination, Onondaga Creek, 2000, 2002, 2004. Numbers represent similarity to macroinvertebrate community type models for each impact category. The highest similarities (within 5 percentage points of the highest) at each station are highlighted. Highest numbers represent probable type of impact. See Appendix 5 text for further explanation. * Note: Similarities less than 50% are less conclusive.

Onondaga Creek	**STATION**											
	Site 1 Tully Farms Road			**Site 2 Webster Road**			**Site 3 Dorwin Ave.**			**Site 4 Spencer Street**		
Community Type	**2000**	**2002**	**2004**	**2000**	**2002**	**2004**	**2000**	**2002**	**2004**	**2000**	**2002**	**2004**
Natural: minimal human impacts	**51**	**73**	**45***	47	70	**52**	41	48	39	12	23	24
Nutrient additions; mostly nonpoint, agricultural	36	60	39	50	74	50	**57**	**75**	**60**	12	35	29
Toxic: industrial, municipal, or urban run-off	27	48	**43***	45	63	41	51	**76**	**62**	21	44	**46***
Organic: sewage effluent, animal wastes	31	50	32	**64**	**80**	43	43	**72**	47	**41***	**66**	**48***
Complex: municipal/industrial	18	40	35	51	**81**	41	45	**72**	**58**	**42***	34	**49***
Siltation	30	57	33	49	70	45	**59**	**76**	**61**	24	32	33
Impoundment	21	49	29	50	**81**	**57**	**54**	**73**	**63**	**46***	59	**46***

Table A5-8. Impact Source Determination, Harbor Brook, 2000, 2002, and 2004. No data from Site 3 Rt. 690 because ISD is only applicable to kick samples in riffle habitats and this site is sampled with jab nets. Numbers represent similarity to macroinvertebrate community type models for each impact category. The highest similarities (within 5 percentage points of the maximum) at each station are highlighted. Highest numbers represent probable type of impact. See Appendix 5 text for further explanation. * Note: Similarities less than 50% are less conclusive.

Harbor Brook	**STATION**								
	Site 1 Velasko Road			**Site 2 Hiawatha Blvd.**			**Site 3 Rt. 690**		
Community Type	**2000**	**2002**	**2004**	**2000**	**2002**	**2004**	**2000**	**2002**	**2004**
Natural: minimal human impacts	12	50	28	5	26	7	-	-	-
Nutrient additions; mostly nonpoint, agricultural	18	46	26	5	31	22	-	-	-
Toxic: industrial, municipal, or urban run-off	23	42	28	20	45	25	-	-	-
Organic: sewage effluent, animal wastes	47	45	19	53	56	49	-	-	-
Complex: municipal/industrial	**69**	**67**	**53**	**70**	**76**	**74**	-	-	-
Siltation	25	42	23	20	36	22	-	-	-
Impoundment	53	**64**	**57**	40	57	54	-	-	-

Table A5-9. Impact Source Determination, Ley Creek in 2000, 2002, and 2004. No data for Site 2 and Site 3 because ISD is only applicable to kick samples in riffle habitats and this site is sampled with jab nets. No data for Site 1 in 2000 and 2002 because this site was sampled with jab nets in those years, subsequent changes in sediment composition allowed for kick sampling in 2004. Numbers represent similarity to macroinvertebrate community type models for each impact category. The highest similarities (within 5 percentage points of the maximum) at each station are highlighted. Highest numbers represent probable type of impact. See Appendix 5 text for further explanation. * Note: Similarities less than 50% are less conclusive.

Ley Creek	**STATION**								
	Site 1 Townline Road			**Site 2 7th North Street**			**Site 3 Park Street**		
Community Type	**2000**	**2002**	**2004**	**2000**	**2002**	**2004**	**2000**	**2002**	**2004**
Natural: minimal human impacts	-	-	13	-	-	-	-	-	-
Nutrient additions; mostly nonpoint, agricultural	-	-	37	-	-	-	-	-	-
Toxic: industrial, municipal, or urban run-off	-	-	34	-	-	-	-	-	-
Organic: sewage effluent, animal wastes	-	-	**67**	-	-	-	-	-	-
Complex: municipal/industrial	-	-	57	-	-	-	-	-	-
Siltation	-	-	32	-	-	-	-	-	-
Impoundment	-	-	53	-	-	-	-	-	-

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Appendix 5

2004 Tributary Macroinvertebrate Physical Habitat Field Sheets

Discharge Calculation Field Form

Name(s) of data recorder(s): K. O'Brien **Date:** 7/20/04

Stream name/ ID#: Onondaga Creek **Station/location:** Webster Rd. Bridge | Site 2

Current weather conditions: clear, 70-80F **Past 2-5 days:** periods of rain, mostly clear, humid

Vert #	Distance "b" (ft.)	Depth "d" (ft.)	Meas # #	Velocity "v"(ft/s)	at depth : (ft.)	Avg. velocity "Vi"(ft/s)	X-sec. Area $(b_{i+1}-b_{i-1})/_2)*d$.	Discharge "Q_i"(CFS)
1	1ft	0.2	1	0.56		SAME AS "V"	0.1 ~~0.2~~	0.056 ~~0.112~~
			2					
2	2ft	0.6	1	1.92			0.6	1.152
			2					
3	3ft	0.6	1	2.60			0.6	1.56
			2					
4	4ft	0.6	1	2.42			0.6	1.452
			2					
5	5ft	0.7	1	1.42			0.7	0.994
			2					
6	6ft	0.8	1	2.33			0.8	1.864
			2					
7	7ft	0.8	1	2.64			0.8	2.112
			2					
8	8ft	0.8	1	2.62			0.8	2.096
			2					
9	9ft	0.8	1	2.47			0.8	1.976
			2					
10	10ft	0.9	1	2.59			0.9	2.331
			2					
11	11ft	0.8	1	2.60			0.8	2.08
			2					
12	12ft	0.8	1	2.62			0.8	2.96
			2					
13	13ft	0.8	1	2.77			0.8	2.216
			2					
14	14ft	0.9	1	2.78			0.9	2.502
			2					
15	15ft	0.9	1	2.62			0.9	2.358
			2					
16	16ft	0.6	1	2.70			0.6	1.62
			2					
	Total width					Avg. Velocity	Total X-sec.	Total Disch.
	21ft.					2.32 ft/s	13.45 ft² ~~13.8 ft²~~	~~34.26 cfs~~

33.82 cfs

	"b"	"d"	"v"		
17	17ft	0.6	2.57	0.6	1.542
18	18ft	0.6	2.51	0.6	1.506
19	19ft	0.5	2.11	0.5	1.055
20	20ft	0.5	1.55	~~0.5~~ .25	~~0.775~~ 0.3875

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Onondaga Creek	LOCATION Dorwin Ave (Site 3)
STATION #________ RIVERMILE________	STREAM CLASS —
LAT 44° 59.78 LONG 076° 08.85	RIVER BASIN Seneca, Oneida, Oswego
STORET # —	AGENCY OCDWEP
INVESTIGATORS Ko, CG, BR	
FORM COMPLETED BY KO	DATE 7/20/04 TIME 1400 AM [✓ PM]
	REASON FOR SURVEY Amp

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____%☐	%cloud cover	☐____%
☑	clear/sunny	☑

clear, sunny, humid

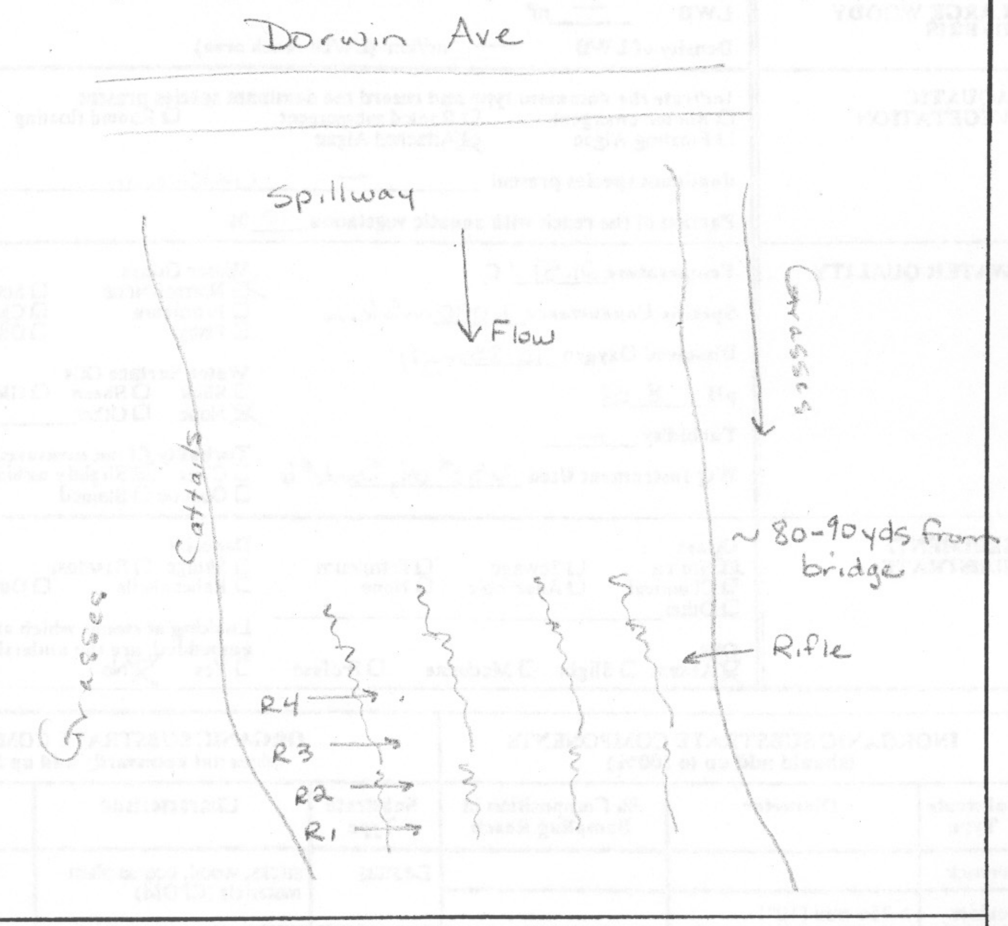
Has there been a heavy rain in the last 7 days?
☑ Yes ☐ No

Air Temperature ~27 °C

Other________________

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other________

Stream Type
☒ Coldwater ☐ Warmwater

Catchment Area — km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☒ Field/Pasture 20% ☐ Industrial
☐ Agricultural ☐ Other ____
☒ Residential 80%

Local Watershed NPS Pollution
☒ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☒ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☐ Shrubs ☒ Grasses ☐ Herbaceous

dominant species present grass, some cattails

INSTREAM FEATURES

Estimated Reach Length 6 m

Estimated Stream Width 15 m

Sampling Reach Area — m²

Area in km² (m²x1000) — km²

Estimated Stream Depth 0.3 m (~1ft)

Surface Velocity ~ 3.0 m/sec (at thalweg)

Canopy Cover
☒ Partly open ☐ Partly shaded ☐ Shaded
mostly open

High Water Mark 1-2 m

Proportion of Reach Represented by Stream Morphology Types
☒ Riffle 45 % ☒ Run 55 %
☐ Pool ____ %

Channelized ☐ Yes ☒ No

Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD — m²

Density of LWD — m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☒ Attached Algae

dominant species present — unknown

Portion of the reach with aquatic vegetation 10 %

WATER QUALITY

Temperature 21.51 °C

Specific Conductance 1.080 mS/cm

Dissolved Oxygen 10.85 mg/l

pH 8.08

Turbidity —

WQ Instrument Used 650# 04, Sonde #6

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other ____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other ____

Turbidity (if not measured)
☐ Clear ☒ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other ____

SEDIMENT/ SUBSTRATE

Odors
☒ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other ____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand/ silt
☐ Relict shells ☐ Other ____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	10%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	20-25%	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	50%			
Sand	0.06-2mm (gritty)	25%	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

Discharge Calculation Field Form

Name(s) of data recorder(s): K. O'Brien **Date:** 7/20/04

Stream name/ ID#: Onondaga Creek **Station/location:** Dorwin Ave

Current weather conditions: Sunny, clear, 80F **Past 2-5 days:** periods of rain, hot

Vert #	Distance "b" (ft.)	Depth "d" (ft.)	Meas #	Velocity "v"(ft/s)	at depth : (ft.)	Avg. velocity "Vi"(ft/s)	X-sec. Area $(b_{i+1}-b_{i-1})/_2)*d.$	Discharge "Q_i"(CFS)
1	2ft.	0.5	1	0.54		SAME AS	0.5 ~~1.0~~	0.27 ~~0.54~~
			2					
2	4ft	0.5	1	0.65		"V"	1.0	0.65
			2					
3	6ft	0.6	1	0.97			1.2	1.164
			2					
4	8 ft	0.6	1	1.24			1.2	1.488
			2					
5	10ft	0.6	1	1.42			1.2	1.704
			2					
6	12ft.	0.8	1	1.34			1.6	2.144
			2					
7	14ft	0.9	1	1.62			1.8	2.916
			2					
8	16ft.	0.9	1	1.83			1.8	3.294
			2					
9	18ft	0.9	1	0.80 (behind rock)			1.8	1.44
			2					
10	20ft	1.0	1	1.89			2.0	3.78
			2					
11	22 ft	1.0	1	2.13			2.0	6.26
			2					
12	24ft	1.0	1	2.25			2.0	4.5
			2					
13	26ft	1.0	1	2.38			2.0	4.76
			2					
14	28ft	1.0	1	2.47			2.0	4.94
			2					
15	30ft	1.0	1	2.00			2.0	4.0
			2					
16	32ft	1.0	1	2.30			2.0	4.6
			2					

Total width	Avg. Velocity	Total X-sec	Total Disch.
48 ft.	1.664ft/s	37.9 ~~39.0~~ft2	~~67.6cfs~~

66.9cfs

	"b"	"d" ft	"V"(ft/s)		
17	34ft	1.0	2.24	2.0	4.48
18	36ft	1.0	2.27	2.0	4.54
19	38ft	1.0	2.04	2.0	4.08
20	40ft	0.8	1.74	1.6	2.784
21	42ft	0.8	1.42	1.6	2.272
22	44	[illegible]	1.08	[illegible]	~~1.294~~ 0.648

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Onondaga Creek
LOCATION Dorwin Ave (Site 3)
STATION # — RIVERMILE —
STREAM CLASS —
LAT 44° 51.78 LONG 076° 08.85
RIVER BASIN Seneca, Oneida, Oswego
STORET # —
AGENCY OCDWEP
INVESTIGATORS KO, BR, CG
FORM COMPLETED BY KO
DATE 7/20/04
TIME 1400 AM [✓ PM]
REASON FOR SURVEY AMP

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 15	20 19 18 17 16	[✓ 15] 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 11	20 19 18 17 16	15 14 13 12 [✓ 11]	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 16	20 19 18 17 [✓ 16]	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 18	20 19 [✓ 18] 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 11	20 19 18 17 16	15 14 13 12 [✓ 11]	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 15	20 19 18 17 16	[✓ 15] 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 [✓ 3] 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 8 (LB)	Left Bank 10 9	[✓ 8] 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	[✓ 8] 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	[✓ 5] 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	[✓ 5] 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 [✓ 3]	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 [✓ 3]	2 1 0

Total Score 121

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Onon. CK	**LOCATION** Spencer St. Upstream
STATION # — **RIVERMILE** —	**STREAM CLASS** —
LAT 43°03.36 **LONG** 73 09.70	**RIVER BASIN** —
STORET # —	**AGENCY** OCDWEP

INVESTIGATORS EW, BR, VM, SS

FORM COMPLETED BY ZW	**DATE** 7/21/04 **TIME** 1120 [✓ AM] PM	**REASON FOR SURVEY** Macroinvertebrate Collection

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☑
____%☐	%cloud cover	☐____%
☑	clear/sunny	☑

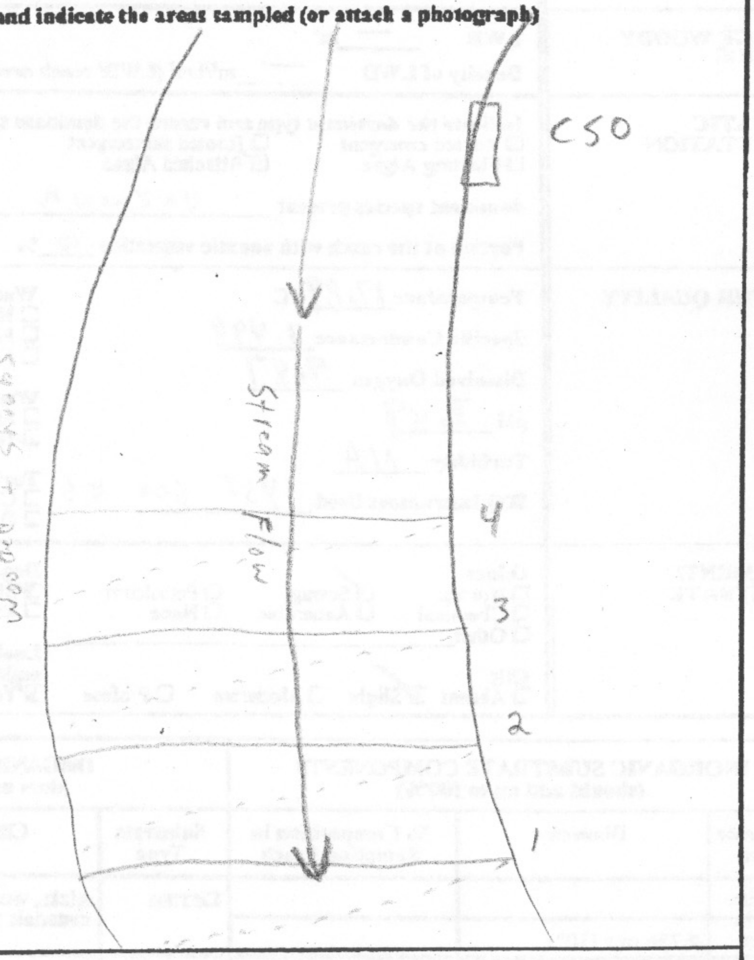
Has there been a heavy rain in the last 7 days?
☑ Yes ☐ No

Air Temperature 85 °C

Other____________________

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☑ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☐ Other__________

Catchment Area__________km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☑ Industrial
☐ Agricultural ☐ Other ______
☑ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☑ Obvious sources CSO

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Box Alder

INSTREAM FEATURES

Estimated Reach Length 37' ~~m~~

Estimated Stream Width ~35' ~~m~~ ft

Sampling Reach Area — m²

Area in km² (m²x1000) — km²

Estimated Stream Depth 1.5' ~~m~~

Surface Velocity (at thalweg) ______ m/sec

Canopy Cover
☐ Partly open ☑ Partly shaded ☐ Shaded

High Water Mark 42 ~~m~~

Proportion of Reach Represented by Stream Morphology Types
☑ Riffle 40 % ☑ Run 60 %
☐ Pool ______ %

Channelized ☑ Yes ☐ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD — m²

Density of LWD — m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☑ Attached Algae

dominant species present Unknown

Portion of the reach with aquatic vegetation 10 %

WATER QUALITY

Temperature 17.89 ° C

Specific Conductance 1.498

Dissolved Oxygen 9.87

pH 7.89

Turbidity NA

WQ Instrument Used YSI 600 #6

Water Odors
☐ Normal/None ☑ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other ______

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other ______

Turbidity (if not measured)
☐ Clear ☑ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other ______

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☑ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other ______

Oils
☐ Absent ☑ Slight ☐ Moderate ☐ Profuse

Deposits
☑ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other ______

Looking at stones which are not deeply embedded, are the undersides black in color?
☑ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	30
Gravel	2-64 mm (0.1"-2.5")	30
Sand	0.06-2mm (gritty)	10
Silt	0.004-0.06 mm	30
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	40
Muck-Mud	black, very fine organic (FPOM)	20
Marl	grey, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Onon CK
LOCATION Spencer St.
STATION # —— RIVERMILE ——
STREAM CLASS ——
LAT 43.03.36 LONG 73.09.70
RIVER BASIN ——
STORET # ——
AGENCY OCDWEP
INVESTIGATORS BR, EW, VM, SS
FORM COMPLETED BY ZW
DATE 7/21/04
TIME 1120 [✓ AM] PM
REASON FOR SURVEY Macro Invertebrate Collection

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 [✓ 9] 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 [✓ 6]	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 13	20 19 18 17 16	15 14 [✓ 13] 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 [✓ 7] 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 14	20 19 18 17 16	15 [✓ 14] 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 [✓ 6]	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 [✓ 8] 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable, many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 **(LB)**	Left Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
SCORE 7 **(RB)**	Right Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) **Note: determine left or right side by facing downstream.**	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation, disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 **(LB)**	Left Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
SCORE 7 **(RB)**	Right Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 4 **(LB)**	Left Bank 10 9	8 7 6	5 [✓ 4] 3	2 1 0
SCORE 4 **(RB)**	Right Bank 10 9	8 7 6	5 [✓ 4] 3	2 1 0

Total Score 99

Discharge Calculation Field Form

Name(s) of data recorder(s): ZW, EW, BR, VM Date: 7/21/04

Stream name/ ID#: Onon. CK Station/location: Spencer St. (upstream)

Current weather conditions: Clear, Hot, Hazy Past 2-5 days: Same with spotty T-Storms

3rd

Vert #	Distance	Depth	Meas #	Velocity	at depth :	Avg. velocity	X-sec. Area	Discharge
	"b" (ft.)	"d" (ft.)	#	"v"(ft/s)	(ft.)	"Vi"(ft/s)	$(b_{i+1}-b_{i-1})/_2)$*d.	"Q_i"(CFS)
1	1.0	0.3	1	0.18		SAME AS	0.45	0.081
			2					
2	3.0	0.5	1	1.74		"V"	1.0	1.74
			2					
3	5.6	0.7	1	2.85			1.4	3.99
			2					
4	7.0	0.8	1	3.40			1.6	5.44
			2					
5	9.0	1.1	1	2.68			2.2	5.896
			2					
6	11.0	1.0	1	3.82			2.0	7.64
			2					
7	13.0	1.3	1	3.27			2.6	8.502
			2					
8	15.0	1.3	1	3.87			2.6	10.062
			2					
9	17.0	1.4	1	3.53			2.8	9.884
			2					
10	19.0	0.9	1	4.55			1.8	8.19
			2					
11	21.0	1.2	1	3.11			2.4	7.464
			2					
12	23.0	1.0	1	0.13			2.0	0.26
			2					
13	25	0.9	1	3.82			1.8	6.876
			2					
14	27	0.5	1	0.59			1.0	0.59
			2					
15	29	0.6	1	1.42			1.2	1.704
			2					
16	31	0.5	1	0.26		↓	1.0	0.26
			2					
	Total width					Avg. Velocity	Total X-sec	Total Disch.
	35'					2.3 ft/s	28.85	78.879 cfs
17	33	0.5		0.30		↓	1.0	0.30

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

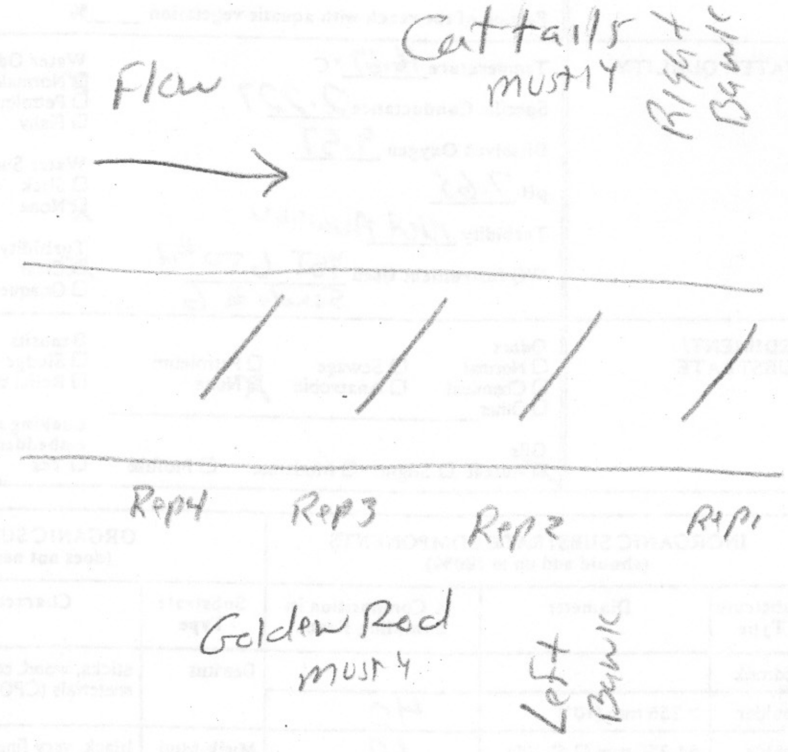
STREAM NAME Harbor BROOK	LOCATION Harbor BROOK Site 1 Velasko
STATION # — RIVERMILE —	STREAM CLASS 3
LAT 4303.15 LONG 7511.48	RIVER BASIN Seneca / Oswego
STORET # —	AGENCY Onondaga County
INVESTIGATORS SS, KO, CJG, VM, EW	
FORM COMPLETED BY CHRIS Candino K O'Brien	DATE 7-19-04 TIME 1300 AM [✓ PM]
	REASON FOR SURVEY AMP

WEATHER CONDITIONS

Now	Past 24 hours		Has there been a heavy rain in the last 7 days?
☐	☐	storm (heavy rain)	☒ Yes ☐ No
☐	☐	rain (steady rain)	Air Temperature 85F °C
☐	☒	showers (intermittent)	Other ______
☐ ____ %	☐ ____	%cloud cover	
☒	☐	clear/sunny	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photgraph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☒ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other______

Catchment Area — km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☒ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other: ______
☐ Residential

Local Watershed NPS Pollution
☒ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☒ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☐ Shrubs ☒ Grasses ☐ Herbaceous
dominant species present Cattail (some trees)(KO)

INSTREAM FEATURES

Estimated Stream Width 3.1 m
Estimated Stream Depth ~0.1-0.2 m (KO)
Surface Velocity — m/sec See flows
(at thalweg)
Estimated Reach Length 30 m
Canopy Cover
☐ Partly open ☐ Partly shaded ☐ Shaded

No canopy

High Water Mark .5 m
Proportion of Reach Represented by Stream Morphology Types
☒ Riffle 100 % ☐ Run ____ %
☐ Pool ____ %
Channelized ☒ Yes ☐ No
Dam Present ☐ Yes ☒ No

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free Floating
☐ Floating Algae ☒ Attached Algae
dominant species present Green Algae (not sure of spp)
Portion of the reach with aquatic vegetation ____ %

WATER QUALITY

Temperature 16.67 °C
Specific Conductance 2.227
Dissolved Oxygen 9.57
pH 7.65
Turbidity Not Available
WQ Instrument Used YSI 650 #4 Sonde #6

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other ______

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other ______

Turbidity (if not measured)
☒ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other ______

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☒ None
☐ Other ______

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☒ Other none

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	40
Cobble	64-256 mm (2.5"-10")	10
Gravel	2-64 mm (0.1"-2.5")	50
Sand	0.06-2mm (gritty)	
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	50%
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Harbor Brook	LOCATION Velasko Rd Site #1
STATION # — RIVERMILE —	STREAM CLASS
LAT 43 03.15 LONG 75 11.48	RIVER BASIN Seneca, Oswego, Oneida
STORET # —	AGENCY OCDWEP
INVESTIGATORS KO	
FORM COMPLETED BY K O'Brien	DATE 7/20/04 TIME 1300 AM [✓ PM]
	REASON FOR SURVEY AMP

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 16	20 19 18 17 [✓ 16]	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 16	20 19 18 17 [✓ 16]	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 [✓ 7] 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 14	20 19 18 17 16	15 [✓ 14] 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 [✓ 9] 8 7 6	5 4 3 2 1 0

Low gradient

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line	Channel straight; waterway has been channelized for a long distance.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 [✓ 1] 0
7. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 18 17 [✓ 16]	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation: disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 10 (LB)	Left Bank [✓ 10] 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank [✓ 10] 9	8 7 6	5 4 3	2 1 0
9. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	[✓ 8] 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 1 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 [✓ 1] 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	[✓ 2] 1 0
Total Score 117	200 - 166	153 - 113	100 - 60	47 - 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Discharge Calculation Field Form

Name(s) of data recorder(s): ChRIS Carolino Date: 7-19-04

Stream name/ ID#: Harbor BRook Station/location: Site1 Velasko Rd

Current weather conditions: Sunny ≈ 85 °F Past 2-5 days: Showers / thunder StoRMS

Vert #	Distance	Depth	Meas #	Velocity	at depth :	Avg. velocity	X-sec. Area	Discharge
	"b" (ft.)	"d" (ft.)	#	"v"(ft/s)	(ft.)	"Vi"(ft/s)	$(b_{i+1}-b_{i-1})/_2)$*d.	"Q_i"(CFS)
1	1	.4	1	.79		SAME AS	0.2	0.158
			2					
2	2	.4	1	1.05		"V"	0.4	0.42
			2					
3	3	.5	1	1.15		↓	0.5	0.575
			2					
4	4	.5	1	.05			0.5	0.025
			2					
5	5	.4	1	1.12			0.4	0.448
			2					
6	6	.5	1	1.08			0.5	0.54
			2					
7	7	.3	1	.35			0.3	0.105
			2					
8	8	.2	1	.15			0.3	0.045
			2					
9			1					
			2					
10			1					
			2					
11			1					
			2					
12			1					
			2					
13			1					
			2					
14			1					
			2					
15			1					
			2					
16			1					
			2					

ROCK INFRONT

Total width		Avg. Velocity	Total X-sec	Total Disch.
10 Feet		0.7175 ft/s	3.1	2.316 cfs

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Harbor BK. (Hiaw.)	LOCATION Hiawatha BlvD
STATION # — RIVERMILE —	STREAM CLASS —
LAT N 44 03.39 LONG W 76.11.18	RIVER BASIN Seneca Oneida, Oswego
STORET # —	AGENCY OCDWEP

INVESTIGATORS BR, UM, EW, SS

FORM COMPLETED BY ZW	DATE 7/21/04 TIME 0930 [✓ AM] PM	REASON FOR SURVEY Macro invertebrate Collection

WEATHER CONDITIONS

clear, Hot
Hazy

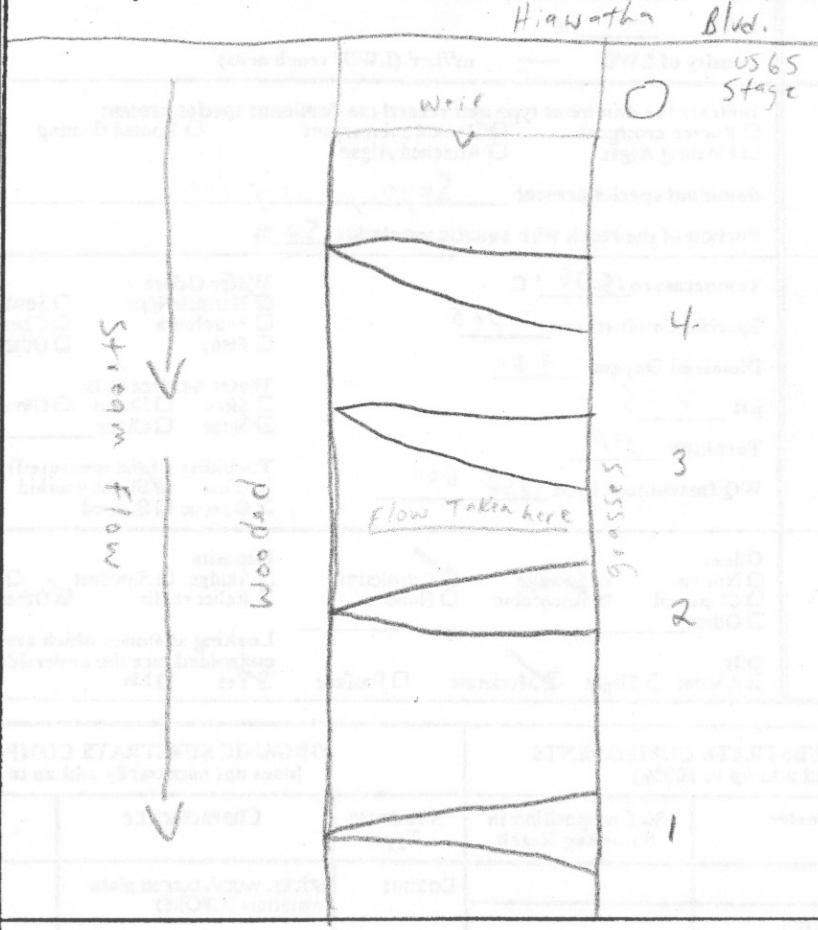
Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
___%☐	%cloud cover	☐___%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days?
☑ Yes ☐ No

Air Temperature 85 ° C

Other ____________

SITE LOCATION/MAP Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☐ Other__________

Catchment Area________km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☑ Commercial
☐ Field/Pasture ☑ Industrial
☐ Agricultural ☐ Other ______
☑ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☑ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☑ Grasses ☐ Herbaceous

dominant species present Box Alder, Sumac

INSTREAM FEATURES

Estimated Reach Length ~9 m
Estimated Stream Width ~13' m
Sampling Reach Area ~28 m^2 '
Area in km^2 (m^{2}x1000) — km^2
Estimated Stream Depth 2' m
Surface Velocity (at thalweg) — m/sec

Canopy Cover
☐ Partly open ☑ Partly shaded ☐ Shaded

High Water Mark 15' m Depth ~ 3.0'

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle ___% ☑ Run 100 %
☐ Pool ___%

Channelized ☑ Yes ☐ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD — m^2
Density of LWD — m^2/km^2 (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☑ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present Sego, Curly leaf

Portion of the reach with aquatic vegetation 50 %

WATER QUALITY

Temperature 15.36 °C
Specific Conductance 2,203
Dissolved Oxygen 8.60
pH 7.85
Turbidity NA
WQ Instrument Used YSI 600

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other ______

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other ______

Turbidity (if not measured)
☐ Clear ☑ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☑ Other Milky

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☑ Petroleum
☐ Chemical ☑ Anaerobic ☐ None
☐ Other ______

Oils
☐ Absent ☐ Slight ☑ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☑ Other garbage

Looking at stones which are not deeply embedded, are the undersides black in color?
☑ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	
Sand	0.06-2mm (gritty)	
Silt	0.004-0.06 mm	80
Clay	< 0.004 mm (slick)	20

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	20
Muck-Mud	black, very fine organic (FPOM)	80
Marl	grey, shell fragments	

* many tires in sediment.

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Harbor BK.	LOCATION Hiawatha Blvd.
STATION # — RIVERMILE —	STREAM CLASS —
LAT 44 03.39 LONG 76.11.18	RIVER BASIN Seneca, Oswego, Oneida
STORET # —	AGENCY OCDWEP
INVESTIGATORS BP, EW, SS, VM	
FORM COMPLETED BY ZW	DATE 7/21/04 TIME 0930 [✓ AM] PM REASON FOR SURVEY Macroinvertebrate Collection

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 10	20 19 18 17 16	15 14 13 12 11	[✓ 10] 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 13	20 19 18 17 16	15 14 [✓ 13] 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 [✓ 4] 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 15	20 19 18 17 16	[✓ 15] 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 12	20 19 18 17 16	15 [✓ 14] 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 [✓ 3] 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 [✓ 3] 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 [✓ 9]	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 [✓ 9]	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	[✓ 5] 4 3	2 1 0
SCORE 1 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 [✓ 1] 0

Total Score 98

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Onondaga Creek	LOCATION Tully Farms Road (Site 1)
STATION # — RIVERMILE —	STREAM CLASS —
LAT ______ LONG ______	RIVER BASIN Seneca, Oswego, Oneida
STORET # —	AGENCY OCDWEP
INVESTIGATORS KO, CG, BR	
FORM COMPLETED BY KO	DATE 7/20/04 TIME 1230 AM [✓ PM] — REASON FOR SURVEY AMP

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 17	20 19 18 [✓ 17] 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 17	20 19 18 [✓ 17] 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 [✓ 3] 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 [✓ 8] 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 [✓ 8] 7 6	5 4 3 2 1 0

Discharge Calculation Field Form

Name(s) of data recorder(s): ZW, VM, SS Date: 7/21/04

Stream name/ ID#: Harbor BK, Station/location: Hiawatha Blvd.

Current weather conditions: Clear, Hot, Humid Past 2-5 days:

Vert #	Distance	Depth	Meas #	Velocity	at depth :	Avg. velocity	X-sec. Area	Discharge
	"b" (ft.)	"d" (ft.)		"v"(ft/s)	(ft.)	"Vi"(ft/s)	$(b_{i+1}-b_{i-1})/_2)$*d.	"Q_i"(CFS)
1	1.0'	0.6	1	0.08		SAME AS "V"	0.3	0.24
			2					
2	2.0	1.5'	1	0.20			1.5	0.30
			2					
3	3.0	1.4'	1	0.21			1.4	0.294
			2					
4	4.0	1.4'	1	0.21			1.4	0.294
			2					
5	5.0	1.3'	1	0.09			1.3	0.117
			2					
6	6.0	1.5'	1	0.28			1.5	0.42
			2					
7	7.0	1.2'	1	0.19			1.2	0.228
			2					
8	8.0	1.1'	1	0.39			1.1	0.429
			2					
9	9.0	1.1'	1	0.39			1.1	0.429
			2					
10	10.0	1.1'	1	0.29			1.1	0.319
			2					
11	11.0	0.5'	1	0.80			0.5	0.40
			2					
12	12.0	0.2'	1	0.50			0.1	0.050
			2					
13			1					
			2					
14			1					
			2					
15			1					
			2					
16			1					
			2					

Total width	Avg. Velocity	Total X-sec	Total Disch.
13'	0.303 ft/s	12.5 ft²	3.52 cfs

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Harbor Brook	LOCATION @ Rt 690
STATION # — RIVERMILE	STREAM CLASS —
LAT 043° 03.73 LONG 076° 11.29	RIVER BASIN Seneca, Oneida, Oswego
STORET # —	AGENCY OCDWEP
INVESTIGATORS KO, EW, CG, SS	
FORM COMPLETED BY KO	DATE 7/22/04 TIME 1145 [✓ AM] PM REASON FOR SURVEY AMP

WEATHER CONDITIONS

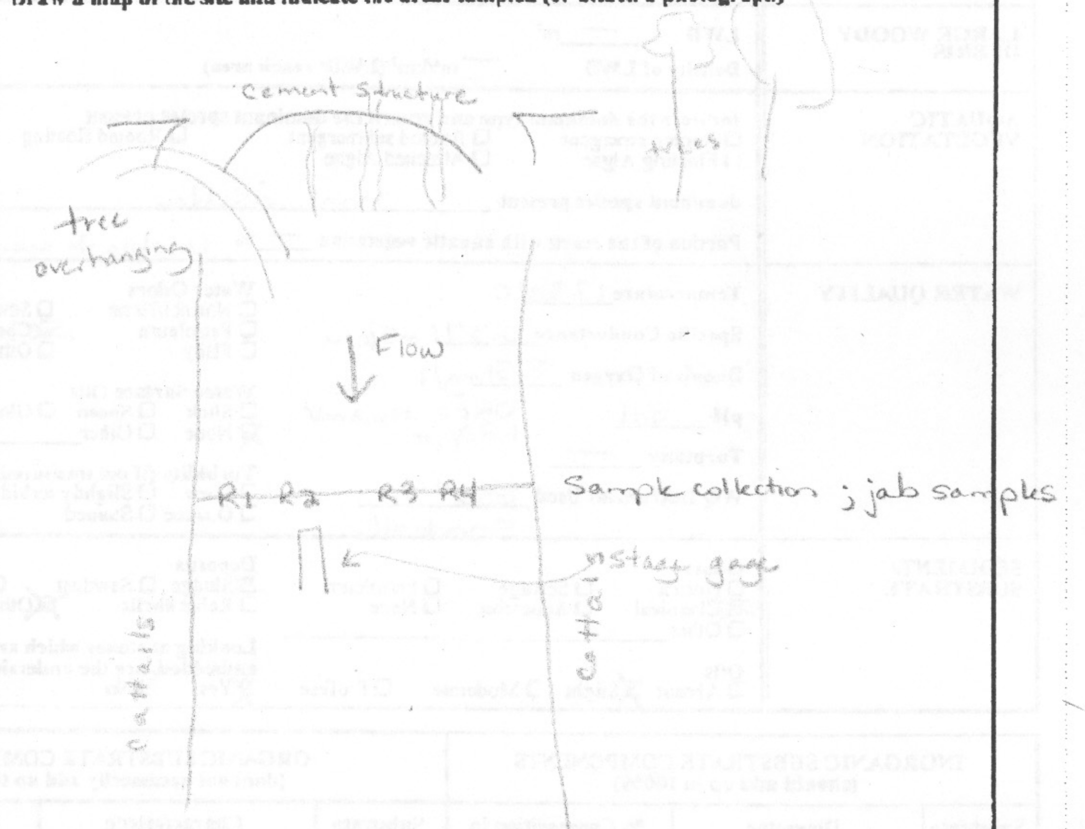
Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____%☐	%cloud cover	☐____%
☒	clear/sunny	☒

Has there been a heavy rain in the last 7 days?
☒ Yes ☐ No

Air Temperature 84F °C humid

Other ____________________

SITE LOCATION/MAP Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other ________

Stream Type
☐ Coldwater ☒ Warmwater

Catchment Area ________km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☑ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other ______
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☒ Obvious sources

Local Watershed Erosion
☐ None ☒ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☒ Trees ☐ Shrubs ☐ Grasses ☒ Herbaceous

dominant species present cattails, phragmites, some trees

INSTREAM FEATURES

Estimated Reach Length 1.0 m
Estimated Stream Width ~9.5 m (30ft)
Sampling Reach Area — m²
Area in km² (m²x1000) — km²
Estimated Stream Depth ~0.7 m
Surface Velocity (at thalweg) 0. m/sec

Canopy Cover
☒ Partly open ☐ Partly shaded ☐ Shaded
open

High Water Mark 1.2 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle ____ % ☒ Run 90 %
☒ Pool 10 %

Channelized ☒ Yes ☐ No

Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD — m²
Density of LWD — m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present none visable

Portion of the reach with aquatic vegetation — % unable to see ; turbid

WATER QUALITY

Temperature 17.30 °C
Specific Conductance 2.371 mS/cm
Dissolved Oxygen 8.51 mg/l
pH 8.11 ORP= 146.8mV
1.22ppt
Turbidity —
WQ Instrument Used 650 #4
Sonde #1

Water Odors
☐ Normal/None ☐ Sewage
☐ Petroleum ☒ Chemical
☐ Fishy ☐ Other ______

Water Surface Oils
☐ Slick ☐ Sheen ☐ Gloss ☐ Flecks
☒ None ☐ Other ______

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☒ Turbid
☐ Opaque ☐ Stained ☐ Other ______

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☒ Chemical ☐ Anaerobic ☐ None
☐ Other ______

Oils
☐ Absent ☒ Slight ☐ Moderate ☐ Profuse

Deposits
☒ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☒ Other Calcium

Looking at stones which are not deeply embedded, are the undersides black in color?
☒ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	5%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	80%
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm	85%			
Clay	< 0.004 mm (slick)				
Grit/Calcium		15%			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Harbor Brook
LOCATION @ Rt 690 Site 3
STATION # — RIVERMILE —
STREAM CLASS —
LAT 43° 03.73 LONG 076° 11.29
RIVER BASIN Seneca, Oswego, Oneida
STORET # —
AGENCY OCDWEP
INVESTIGATORS KO, SS, CG, EW
FORM COMPLETED BY KO'Brien
DATE 7/22/04
TIME 11:45 [✓ AM] PM
REASON FOR SURVEY AMP

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 [✓ 6]	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 [✓ 7] 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 13	20 19 18 17 16	15 14 [✓ 13] 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 18	20 19 [✓ 18] 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 15	20 19 18 17 16	[✓ 15] 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 14	20 19 18 17 16	15 [✓ 14] 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 [✓ 3] 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 **(LB)**	Left Bank 10 9	8 7 [✓ 6]	5 4 3	2 1 0
SCORE 6 **(RB)**	Right Bank 10 9	8 7 [✓ 6]	5 4 3	2 1 0
9. Vegetative Protection (score each bank) **Note: determine left or right side by facing downstream.**	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 9 (LB)	Left Bank 10 [✓ 9]	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 [✓ 9]	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	[✓ 8] 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	[✓ 8] 7 6	5 4 3	2 1 0

Total Score 122

Discharge Calculation Field Form

Name(s) of data recorder(s): K. O'Bom **Date:** 7/22/04

Stream name/ ID#: Harbor Brook **Station/location:** @ Rt 690 Site 3

Current weather conditions: Sunny Humid, 80'sF **Past 2-5 days:** periods of rain, hot/humid

31 ft. across

Vert #	Distance "b" (ft.)	Depth "d" (ft.)	Meas #	Velocity "v"(ft/s)	at depth : (ft.)	Avg. velocity "Vi"(ft/s)	X-sec. Area $(b_{i+1}-b_{i-1})/_2)$*d.	Discharge "Q_i"(CFS)
1	2 ft.	1.4	1	-0.08		-.08	1.4	-0.112
			2					
2	4 ft.	1.4	1	-0.05		-.05	2.8	-0.14
			2					
3	6 ft.	1.7	1	-0.05		-.05	3.4	-0.17
			2					
4	8 ft.	2.2	1	0.02	~~4.4~~	0.015	4.4	0.066
			2	0.01				
5	10 ft.	2.5	1	-0.04	~~5.0~~	-0.02	5.0	-0.10
			2	0.0	~~1.25~~			
6	12 ft	2.1	1	0.09	~~4.2~~	0.045	4.2	0.189
			2	0.0	~~1.05~~			
7	14 ft.	2.5	1	0.13	~~5.0~~	0.095	5.0	0.475
			2	0.06	~~1.25~~			
8	16 ft.	2.6	1	0.07	~~5.2~~	0.05	5.2	0.26
			2	0.03	~~1.3~~			
9	18 ft	2.5	1	0.08	~~5.0~~	0.07	5.0	0.35
			2	0.06	~~1.25~~			
10	20 ft.	2.9	1	0.05	~~5.8~~	0.04	5.8	0.232
			2	0.03	~~1.45~~			
11	22 ft	2.6	1	0.18	~~5.2~~	0.10	5.2	0.52
			2	0.02	~~1.3~~			
12	24	2.6	1	0.06	~~5.2~~	0.015	5.2	0.078
			2	-0.03	~~1.3~~			
13	26	2.6	1	0.12	~~5.2~~	0.035	5.2	0.182
			2	-0.05	~~1.3~~			
14	28	2.6	1	-0.09	~~5.2~~	-0.06	6.5	-0.39
			2	-0.03	~~1.3~~			
15			1					
			2					
16			1					
			2					

Total width		Avg. Velocity	Total X-sec	Total Disch.
~31 ft		0.015 ft/s	64.8 ft²	1.44 cfs

Almost all negative readings (Ko)

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Ley Creek
LOCATION Town Line Rd.
STATION # ________ RIVERMILE ________
STREAM CLASS 3
LAT 4305.45 LONG 7507.00
RIVER BASIN Ley Creek
STORET # ________
AGENCY Onondaga County
INVESTIGATORS DS, KO, MA, CJG, VM, EL, SS
FORM COMPLETED BY KO'Brien, CG
DATE 7/19/04
TIME 1030 [✓ AM] PM
REASON FOR SURVEY Trib macroinvertebrate Kick Screens

WEATHER CONDITIONS

Overcast, 70F
humid

Now	Past 24 hours
☐	☐ storm (heavy rain)
☐	☐ rain (steady rain)
☐	☑ showers (intermittent)
☒ 10 % cloud	☐ ____ %cloud cover
☐	☐ clear/sunny

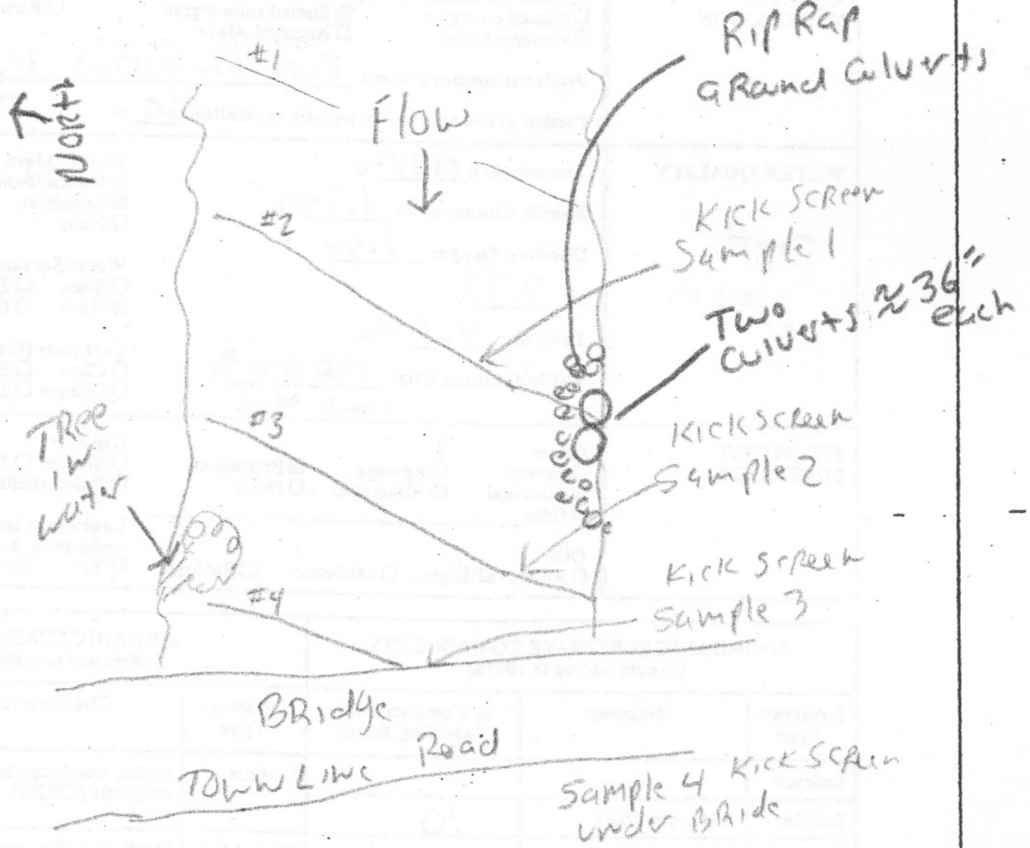
Has there been a heavy rain in the last 7 days?
☒ Yes ☐ No

Air Temperature 80F °C

Other ____________

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photgraph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☒ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other________

Catchment Area ——— km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☒ Commercial
☐ Field/Pasture ☒ Industrial
☐ Agricultural ☐ Other: ______
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☒ Obvious sources

Local Watershed Erosion
☐ None ☐ Moderate ☒ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☐ Shrubs ☒ Grasses ☒ Herbaceous

dominant species present Phragmites

INSTREAM FEATURES

Estimated Stream Width 8.4 m

Estimated Stream Depth ~0.2-0.4m m

Surface Velocity (at thalweg) .50 m/sec

Estimated Reach Length 20 m

Canopy Cover 10%
☐ Partly open ☒ Partly shaded ☐ Shaded

High Water Mark 1 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle ___ % ☒ Run 100 % → Slow moving water
☐ Pool ___ %

Channelized ☑ Yes ☐ No

Dam Present ☐ Yes ☒ No

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☒ Rooted submergent ☐ Rooted floating ☐ Free Floating
☐ Floating Algae ☐ Attached Algae

dominant species present Eurasian milful lesser amounts of Curly Pondweed

Portion of the reach with aquatic vegetation 60 %

WATER QUALITY

Depth .334 m

Temperature 19.15 °C

Specific Conductance 1.390

Dissolved Oxygen 7.54

pH 7.73

Turbidity No DAta

WQ Instrument Used YSI 650 #4 Sonde #6

Water Odors
☐ Normal/None ☐ Sewage
☑ Petroleum ☐ Chemical
☐ Fishy ☐ Other ______

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other ______

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☑ Turbid
☐ Opaque ☐ Stained ☐ Other ______

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☑ Petroleum
☑ Chemical ☑ Anaerobic ☐ None
☐ Other ______

Oils
☐ Absent ☑ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand
☐ Relict shells ☑ Other mud

Looking at stones which are not deeply embedded, are the undersides black in color?
☒ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	10
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	
Sand	0.06-2mm (gritty)	45
Silt	0.004-0.06 mm	45
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	25
Muck-Mud	black, very fine organic (FPOM)	75
Marl	grey, shell fragments	

Low gradient front sheet had been missing during initial investigation
KO filled out sheet following day 7/20/04

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Ley Creek	LOCATION Townline Rd
STATION # — RIVERMILE —	STREAM CLASS
LAT 43 05.45 LONG 75 07.00	RIVER BASIN Seneca, Oneida, Oswego
STORET # —	AGENCY OCDWEP
INVESTIGATORS KO, CG, SS, EW, VM	
FORM COMPLETED BY KO	DATE 7/20/04 TIME 1200 AM [✓ PM] REASON FOR SURVEY AMP

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 [✓ 6]	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 13	20 19 18 17 16	15 14 [✓ 13] 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 [✓ 7] 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 11	20 19 18 17 16	15 14 13 12 [✓ 11]	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 14	20 19 18 17 16	15 [✓ 14] 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Low gradient

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line	Channel straight; waterway has been channelized for a long distance.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 [✓ 2] 1 0
7. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 14	20 19 18 17 16	15 [✓ 14] 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation: disruption of streambank vegetation is very high: vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 8 (LB)	Left Bank 10 9	[✓ 8] 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 [✓ 4] 3	2 1 0
9. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	[✓ 8] 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 [✓ 9]	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	[✓ 5] 4 3	2 1 0
	200 - 166	153 - 113	100 - 60	47 - 0

PHRagmites

Total Score 108

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

See back for flows

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 19	20 [✓ 19] 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance
SCORE 12	20 19 18 17 16	15 14 13 [✓ 12] 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 **(LB)**	Left Bank 10 [✓ 9]	8 7 6	5 4 3	2 1 0
SCORE 9 **(RB)**	Right Bank 10 [✓ 9]	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 10 **(LB)**	Left Bank [✓ 10] 9	8 7 6	5 4 3	2 1 0
SCORE 10 **(RB)**	Right Bank [✓ 10] 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 5 **(LB)**	Left Bank 10 9	8 7 6	[✓ 5] 4 3	2 1 0
SCORE 5 **(RB)**	Right Bank 10 9	8 7 6	[✓ 5] 4 3	2 1 0

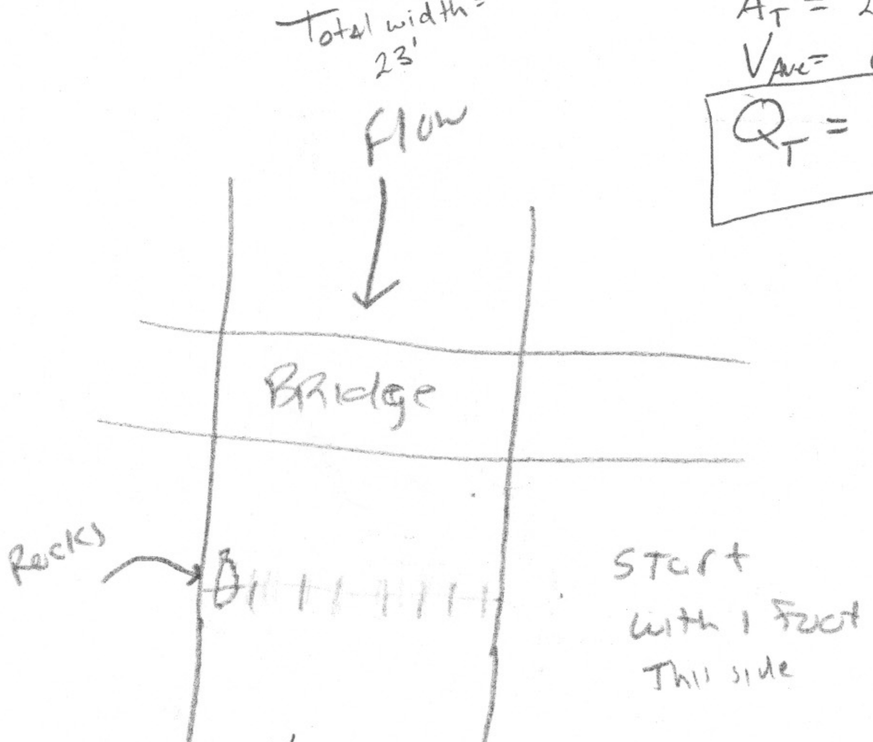
Total Score 132

InStream Flow Measurments

A_T = 20.45 ft²

V_{Ave} = 0.279 ft/s

$\boxed{Q_T = 7.106 \text{cfs}}$



Reading #	Depth	V_i Flow (velocity)	~~Qcfs~~ A_i	Q_i
1	.7	.02	0.35	.007
2	.9	.05	0.9	0.045
3	1.2	.65	1.2	0.78
4	1.2	.12	1.2	0.144
5	1.4	.20	1.4	0.28
6	1.3	0.08	1.3	0.104
7	1.3	.08	1.3	0.104
8	1.2	.23	1.2	0.276
9	1.2	.09	1.2	0.108
10	1.4	.14	1.4	0.196
11	1.4	.44	1.4	0.616
12	1.5	.63	1.5	0.945

Reading #	Depth	Flow	A_i	Q_i
13	1.2	.60	1.2	.72
14	1.3	.44	1.3	0.57
15	1.0	.60	1.0	0.6
16	1.0	.70	1.0	0.7
17	.8	.63	.8	0.50
18	.7	.60	.7	0.42
19	ROCK	no Flow	0	0
20	Rock	no Flow	0	0
21	.2	-.15	.1	-0.015
22	Rocks	no Flow	0	0
23				

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Ley Creek
LOCATION (Site 2) 7th North St.
STATION # — RIVERMILE
STREAM CLASS —
LAT 43° 03.36 LONG 076° 09.70
RIVER BASIN Seneca, Oswego, Oneida
STOREET # —
AGENCY OCDWEP
INVESTIGATORS SS, CG, EW, KO
FORM COMPLETED BY K O'Brien
DATE 7/22/04
TIME 0900 [✓ AM] PM
REASON FOR SURVEY Amp

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____%☐	%cloud cover	☐____%
☑	clear/sunny	☑

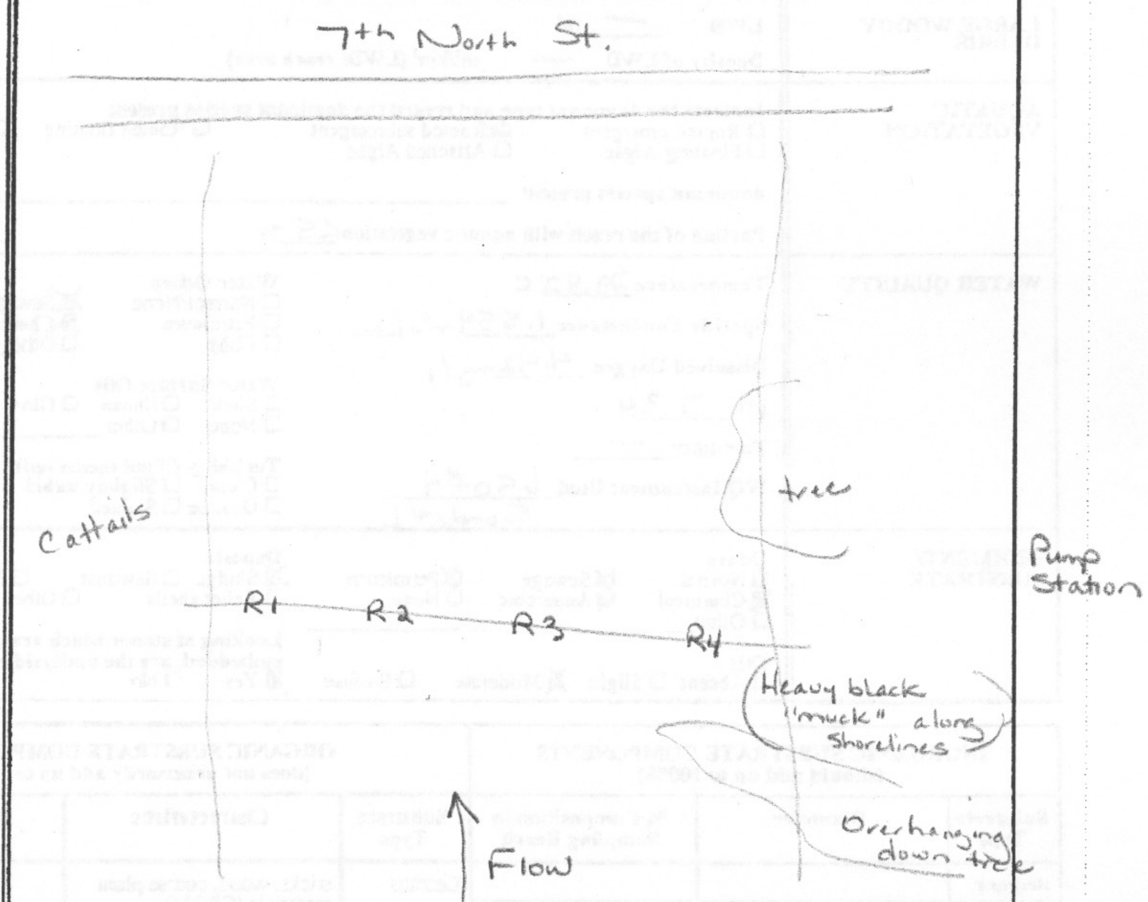
clear, humid

Has there been a heavy rain in the last 7 days? ☑ Yes ☐ No

Air Temperature____° C ~80F

Other humid

SITE LOCATION/MAP Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☒ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other ______

Catchment Area — km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☒ Industrial
☐ Agricultural ☐ Other ______
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☒ Obvious sources

Local Watershed Erosion
☐ None ☒ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☒ Trees ☐ Shrubs ☐ Grasses ☒ Herbaceous

dominant species present cattails, phragmites

INSTREAM FEATURES

Estimated Reach Length 1 m

Estimated Stream Width ~14-15 m

Sampling Reach Area — m²

Area in km² (m²x1000) — km²

Estimated Stream Depth ~1.5 m

Surface Velocity (at thalweg) — m/sec

Canopy Cover
☐ Partly open ☒ Partly shaded ☐ Shaded

High Water Mark 1-2 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle ____% ☐ Run 100 %
☐ Pool ____%

Channelized ☒ Yes ☐ No

Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD — m²

Density of LWD — m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☒ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present ______

Portion of the reach with aquatic vegetation <5 %

WATER QUALITY

Temperature 23.82° C

Specific Conductance 1.554 mS/cm

Dissolved Oxygen 4.42 mg/l

pH 7.34

Turbidity —

WQ Instrument Used 650 #4 Sonde #1

Water Odors
☐ Normal/None ☒ Sewage
☐ Petroleum ☒ Chemical
☐ Fishy ☐ Other ______

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☒ Flecks
☐ None ☐ Other ______

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☒ Turbid
☐ Opaque ☐ Stained ☐ Other ______

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☒ Sewage ☒ Petroleum
☒ Chemical ☒ Anaerobic ☐ None
☐ Other ______

Oils
☐ Absent ☐ Slight ☒ Moderate ☐ Profuse

Deposits
☒ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other ______

Looking at stones which are not deeply embedded, are the undersides black in color?
☒ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	
Sand	0.06-2mm (gritty)	10%
Silt	0.004-0.06 mm	60%
Clay	< 0.004 mm (slick)	30%

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	
Muck-Mud	black, very fine organic (FPOM)	95%
Marl	grey, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Ley Creek	LOCATION (Site 2) 7th North Street
STATION # — RIVERMILE —	STREAM CLASS —
LAT 43° 03.36 LONG 076° 04.70	RIVER BASIN Seneca, Oswego, Oneida
STORET # —	AGENCY OCDWEP
INVESTIGATORS KOSS, CG, EW	
FORM COMPLETED BY K O'Brien	DATE 7/22/04 TIME 0900 [✓ AM] PM REASON FOR SURVEY AMP

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 [✓ 9] 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	[✓ 10] 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 11	20 19 18 17 16	15 14 13 12 [✓ 11]	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 14	20 19 18 17 16	15 [✓ 14] 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 11	20 19 18 17 16	15 14 13 12 [✓ 11]	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 12	20 19 18 17 16	15 14 13 [✓ 12] 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 [✓ 7] 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 [✓ 9]	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 [✓ 9]	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	[✓ 5] 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	[✓ 2] 1 0

Total Score 113

(
Lt. Bank
→ Flow
Rt. Bank
)

Discharge Calculation Field Form

Name(s) of data recorder(s): K O'Brien **Date:** 7/22/04

Stream name/ ID#: Ley Creek **Station/location:** 7th North St.

Current weather conditions: hot, humid Sunny 80F **Past 2-5 days:** periods of rain, hot, humid

Vert #	Distance "b" (ft.)	Depth "d" (ft.)	Meas #	Velocity "v"(ft/s)	at depth : (ft.)	Avg. velocity "Vi"(ft/s)	X-sec. Area $(b_{i+1}-b_{i-1})/2)*d$.	Discharge "Q_i"(CFS)
1	3ft	0.6	1	-0.06				
			2					
2	6ft	1.5	1	-0.0				
			2					
3	9ft	1.9	1	-0.08				
			2					
4	12ft	3.6	1	0.0	1.8			
			2	-0.09	7.2			
5	15ft	too deep	1					
			2					
6	18-27ft.	too deep	1					
			2					
7	28ft.	2.4	1	-0.05	1.2			
			2	-0.05	4.8			
8		1.1	1	-0.07				
			2					
9		1.0	1	-0.04				
			2					
10		1.0	1	0.14				
			2					
11		0.8	1	-0.13				
			2					
12		0.8	1	-0.04				
			2					
13			1					
			2					
14			1					
			2					
15			1					
			2					
16			1					
			2					
	Total width					Avg. Velocity	Total X-sec	Total Disch.
	48 ft.							

negative readings (Ko)

No flow CALCULATED
>> incomplete.

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Ley Creek	LOCATION Park St (Site 3)
STATION # — RIVERMILE —	STREAM CLASS
LAT 44 03 77 LONG 076 11.29	RIVER BASIN Seneca, Oswego, Oneida
STORET # —	AGENCY OCDWEP
INVESTIGATORS KO, SS, CG, EW	
FORM COMPLETED BY KO	DATE 7/22/04 TIME 1245 AM [✓ PM]
	REASON FOR SURVEY AMP

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
___%☐	%cloud cover	☐___%
☒	clear/sunny	☒

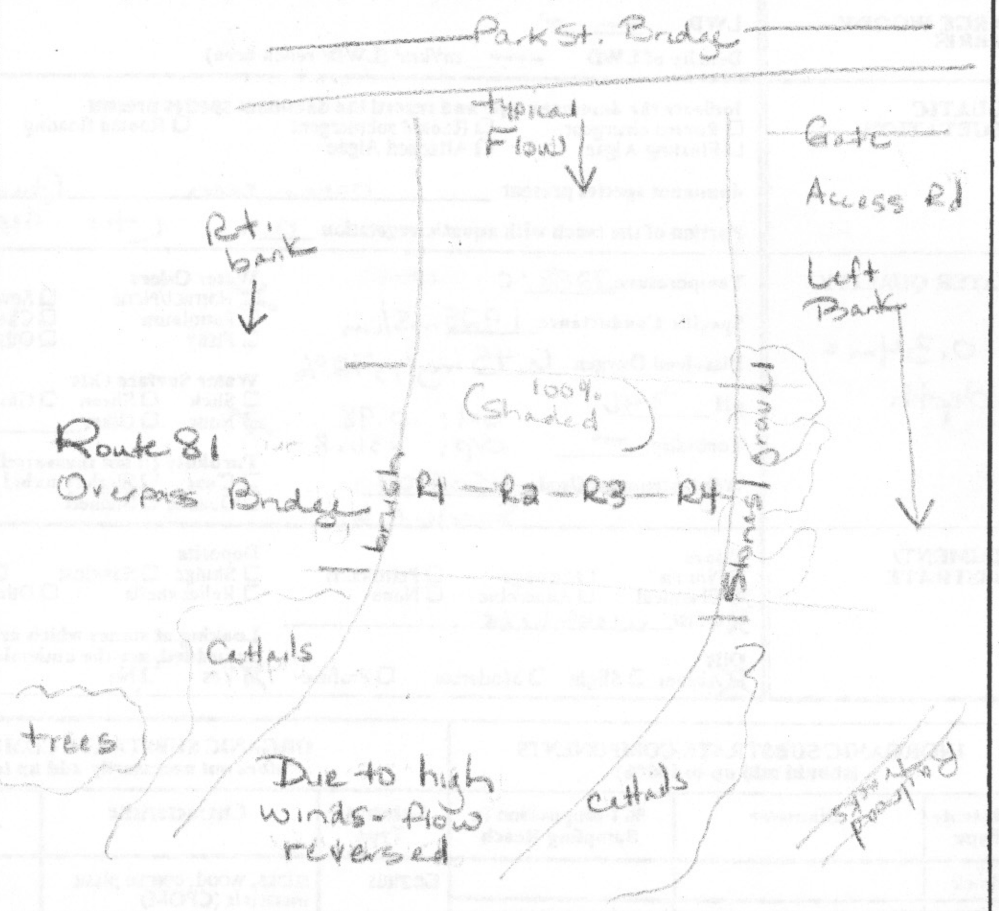
clear/sunny hot

Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No

Air Temperature_____° C ~85F

Other_______________

SITE LOCATION/MAP Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☒ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other ________

Catchment Area________km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☒ Industrial
☐ Agricultural ☒ Other Railroad tracks, Access roads
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources (CSO upstream)
☒ Obvious sources

Local Watershed Erosion
☒ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☒ Trees ☐ Shrubs ☐ Grasses ☒ Herbaceous

dominant species present ______

INSTREAM FEATURES

Estimated Reach Length 1 m
Estimated Stream Width ~12 m (40ft)
Sampling Reach Area — m²
Area in km² (m²x1000) — km²
Estimated Stream Depth ~1.5 m (4-5ft)
Surface Velocity (at thalweg) (0) m/sec

Canopy Cover
☐ Partly open ☐ Partly shaded ☒ Shaded Overpass

High Water Mark ______ m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle ______ % ☒ Run 100 %
☐ Pool ______ %

Channelized ☒ Yes ☐ No
Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD — m²
Density of LWD — m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present none seen (turbid) (too deep)
Portion of the reach with aquatic vegetation 0 %

WATER QUALITY

0.34m = depth

Temperature 22.58 °C
Specific Conductance 1.925 mS/cm
Dissolved Oxygen 6.45 mg/l; 72%
pH 7.46
Turbidity —
Sal: 0.98
Orp: 236.8
WQ Instrument Used 650 #04
Sonde #6

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other ______

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other ______

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☒ Turbid
☐ Opaque ☐ Stained ☐ Other ______

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☒ Chemical ☐ Anaerobic ☐ None
☒ Other wastebeds

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other ______

Looking at stones which are not deeply embedded, are the undersides black in color?
☒ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	60%
Cobble	64-256 mm (2.5"-10")	30%
Gravel	2-64 mm (0.1"-2.5")	10%
Sand	0.06-2mm (gritty)	
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	1-5%
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Ley Creek	LOCATION (Site 3) Park St.
STATION #______ RIVERMILE______	STREAM CLASS —
LAT 44° 03.72 LONG 076° 11.29	RIVER BASIN Seneca, Oswego, Oneida
STORET #	AGENCY OCDWEP
INVESTIGATORS SS, EW, CG, KO	
FORM COMPLETED BY KO Bren	DATE 7/22/04 TIME 1300 AM [✓ PM]
	REASON FOR SURVEY AMP

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 [✓ 4] 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 [✓ 3] 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 13	20 19 18 17 16	15 14 [✓ 13] 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 18	20 19 [✓ 18] 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 11	20 19 18 17 16	15 14 13 12 [✓ 11]	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 [✓ 8] 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 [✓ 7] 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	[✓ 8] 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 [✓ 4] 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 [✓ 4] 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	[✓ 2] 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	[✓ 2] 1 0

Total Score 91

Discharge Calculation Field Form

Name(s) of data recorder(s): K O Brien **Date:** 7/20/04

Stream name/ ID#: Onondaga Creek **Station/location:** Tully Farms Rd Site #1

Current weather conditions: Sunny, 80F **Past 2-5 days:** periods of rain, humid

Vert #	Distance "b" (ft.)	Depth "d" (ft.)	Meas #	Velocity "v"(ft/s)	at depth : (ft.)	Avg. velocity "Vi"(ft/s)	X-sec. Area $(b_{i+1}-b_{i-1})/_2)$*d.	Discharge "Q_i"(CFS)
1	2ft	0.1	1	0.40		.40	0.1 ~~0.2~~	0.04 ~~0.08~~
			2					
2	4ft	0.2	1	0.65		.65	0.4	0.26
			2					
3	6ft	0.2	1	0.52		0.52	0.4	0.208
			2					
4	8ft	0.3	1	0.48		0.48	0.6	0.288
			2					
5	10ft	0.4	1	0.90		0.90	0.8	0.72
			2					
6	12ft	0.4	1	0.96		0.96	0.8	0.768
			2					
7	14ft	0.4	1	0.46		0.46	0.8	0.368
			2					
8	16ft	0.3	1	0.60		0.60	0.6	0.36~~8~~
			2					
9	18ft	0.1	1	0.36		0.36	0.2	0.072
			2					
10	20ft	0.1	1	0.20		0.20	0.1 ~~0.2~~	0.02 ~~0.04~~
			2					
11			1					
			2					
12			1					
			2					
13			1					
			2					
14			1					
			2					
15			1					
			2					
16			1					
			2					

Total width	Avg. Velocity	Total X-sec	Total Disch.
22 ft.	0.553 ft/s	~~5.0~~ ft² 4.8 ft²	3.10 cfs

Discharge Calculation Field Form

Name(s) of data recorder(s): K O'Brien **Date:** 7/22/04

Stream name/ ID#: Ley Creek **Station/location:** Park Street (Site 3)

Current weather conditions: windy, sunny, humid **Past 2-5 days:** hot, humid, some periods of rain

~40ft. across

Vert #	Distance "b" (ft.)	Depth "d" (ft.)	Meas #	Velocity "v"(ft/s)	at depth : (ft.)	Avg. velocity "Vi"(ft/s)	X-sec. Area $(b_{i+1}-b_{i-1})/2)*d$	Discharge "Q_i"(CFS)
1	2ft	1.6	1	-0.08				
			2					
2	4ft.	2.7	1	-0.09	54			
			2	-0.08	1.35			
3	6 ft.	3.6	1	0.09	7.2			
			2	0.06	1.8			
4	8ft - 26ft.	too deep	1					
			2					
5	30ft.	4.0	1	-0.11	8.0			
			2	-0.07	2.0			
6	32ft.	3.5	1	-0.09	7.0			
			2	-0.07	1.75			
7	36ft	1.3	1	-0.04				
			2					
8			1					
			2					
9			1					
			2					
10			1					
			2					
11			1					
			2					
12			1					
			2					
13			1					
			2					
14			1					
			2					
15			1					
			2					
16			1					
			2					

Total width	Avg. Velocity	Total X-sec	Total Disch.
~40ft.			

Negative readings; flow was going in reverse due to high winds

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME Onondaga Creek

LOCATION Webster Road (Site 2)

STATION # — RIVERMILE —

STREAM CLASS —

LAT 42° 52.95 LONG 075° 09.24

RIVER BASIN Seneca, Oneida, Oswego

STORET # —

AGENCY OCDWEP

INVESTIGATORS Ko, CG, BR

FORM COMPLETED BY Ko

DATE 7/20/04
TIME 1045 [✓ AM] PM

REASON FOR SURVEY AmP

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____% ☐	%cloud cover	☐____%
☒	clear/sunny	☐

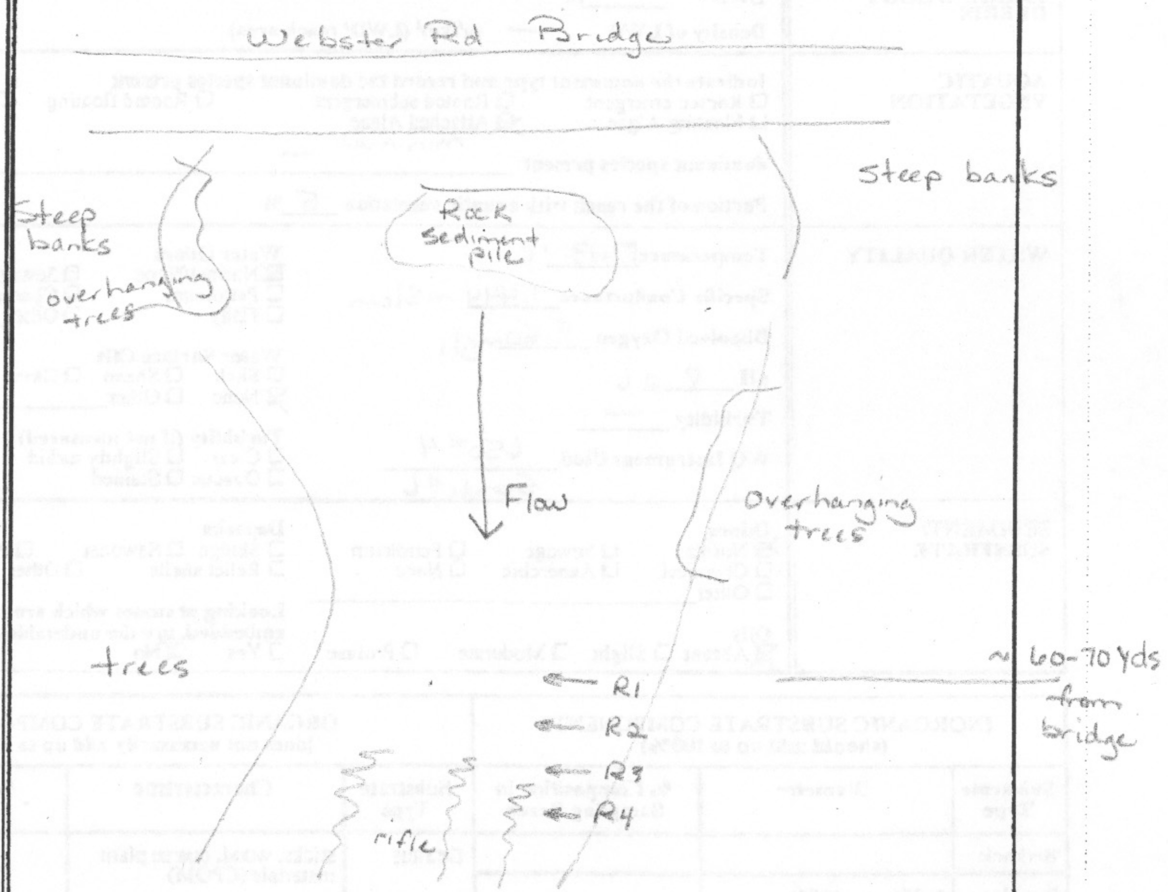
clear/sunny

Has there been a heavy rain in the last 7 days?
☒ Yes ☐ No

Air Temperature ~25 °C

Other ____________

SITE LOCATION/MAP Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☒ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other ____________

Catchment Area ________ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☒ Field/Pasture 50%, ☐ Industrial
☒ Agricultural 45% ☐ Other ____
☒ Residential 5%

Local Watershed NPS Pollution
☐ No evidence ☒ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☒ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☒ Trees ☒ Shrubs ☒ Grasses ☐ Herbaceous
dominant species present Dogwoods

INSTREAM FEATURES

Estimated Reach Length 20 m
Estimated Stream Width 6-7 m
Sampling Reach Area — m²
Area in km² (m²x1000) — km²
Estimated Stream Depth 0,25 m
Surface Velocity (at thalweg) 2.0 m/sec

Canopy Cover
☐ Partly open ☒ Partly shaded ☐ Shaded
High Water Mark 3 (mostly) m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 40 % ☐ Run 40 %
☐ Pool 20 %

Channelized ☐ Yes ☒ No
Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD — m²
Density of LWD — m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☒ Attached Algae
dominant species present minimal —
Portion of the reach with aquatic vegetation 5 %

WATER QUALITY

Temperature 17.13 °C
Specific Conductance 1.444 mS/cm
Dissolved Oxygen 9.50mg/l
pH 8.06
Turbidity —
WQ Instrument Used 650#4 Sonde#6

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other ____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other ____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☒ Turbid
☐ Opaque ☐ Stained ☐ Other ____

SEDIMENT/ SUBSTRATE

Odors
☒ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other ____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand
☐ Relict shells ☐ Other silt

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	10%
Sand	0.06-2mm (gritty)	45%
Silt	0.004-0.06 mm	45%
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, course plant materials (CPOM)	25%
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Onondaga Creek
LOCATION Webster Rd (Site 2)
STATION # ________ RIVERMILE ________
STREAM CLASS —
LAT 42° 52.95 LONG 075° 09.24
RIVER BASIN Seneca, Oneida, Oswego
STORET #
AGENCY OCDWEP
INVESTIGATORS KO, CG, BR
FORM COMPLETED BY KO
DATE 7/20/04
TIME 1045 [✓ AM] PM
REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 16	20 19 18 17 [✓ 16]	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 15	20 19 18 17 16	[✓ 15] 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 10	20 19 18 17 16	15 14 13 12 11	[✓ 10] 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 13	20 19 18 17 16	15 14 [✓ 13] 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 [✓ 8] 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 18	20 19 [✓ 18] 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 12	20 19 18 17 16	15 14 13 [✓ 12] 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 [✓ 6]	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 [✓ 6]	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 8 (LB)	Left Bank 10 9	[✓ 8] 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	[✓ 8] 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 7 (LB)	Left Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 [✓ 6]	5 4 3	2 1 0

Total Score 133

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☒ Forest ☐ Commercial
☒ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other ______
☒ Residential

Local Watershed NPS Pollution
☒ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☒ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION
(18 meter buffer)

Indicate the dominant type and record the dominant species present
☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present ______

INSTREAM FEATURES

Estimated Reach Length 10 m

Estimated Stream Width 7 m

Sampling Reach Area — m²

Area in km² (m²x1000) — km²

Estimated Stream Depth 0.1 m

Surface Velocity (at thalweg) ______ m/sec

Canopy Cover
☐ Partly open ☒ Partly shaded ☐ Shaded (a lot of trees)

High Water Mark 1 cm

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 60 % ☐ Run 40 %
☐ Pool ______ %

Channelized ☐ Yes ☒ No

Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD ______ m²

Density of LWD ______ m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☒ Attached Algae

dominant species present ______

Portion of the reach with aquatic vegetation 10 %

WATER QUALITY

Temperature 19.17 °C

Specific Conductance 0.489 mS/cm

Dissolved Oxygen 9.84 mg/l ; 106.6%

pH 9.84

Turbidity —

WQ Instrument Used 650#4
Sonde#1

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other ______

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other ______

Turbidity (if not measured)
☒ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other ______

SEDIMENT/ SUBSTRATE

Odors
☒ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other ______

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand
☐ Relict shells ☐ Other ______

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	30%
Gravel	2-64 mm (0.1"-2.5")	40%
Sand	0.06-2mm (gritty)	15%
Silt	0.004-0.06 mm	15%
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	5%
Muck-Mud	black, very fine organic (FPOM)	
Marl	grey, shell fragments	

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Onondaga Creek	LOCATION Tully Farms Rd (Site 1)
STATION # — RIVERMILE —	STREAM CLASS
LAT 42° 49.49 LONG 76° 08.20	RIVER BASIN Seneca, Oswego, Onondaga
STORET # —	AGENCY OCDWEP
INVESTIGATORS KO, CG, BR	
FORM COMPLETED BY KO	DATE 7/20/04 TIME 1230 AM [✓ PM]
	REASON FOR SURVEY AMP

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____% ☐	%cloud cover	☐____%
☑	clear/sunny	☑

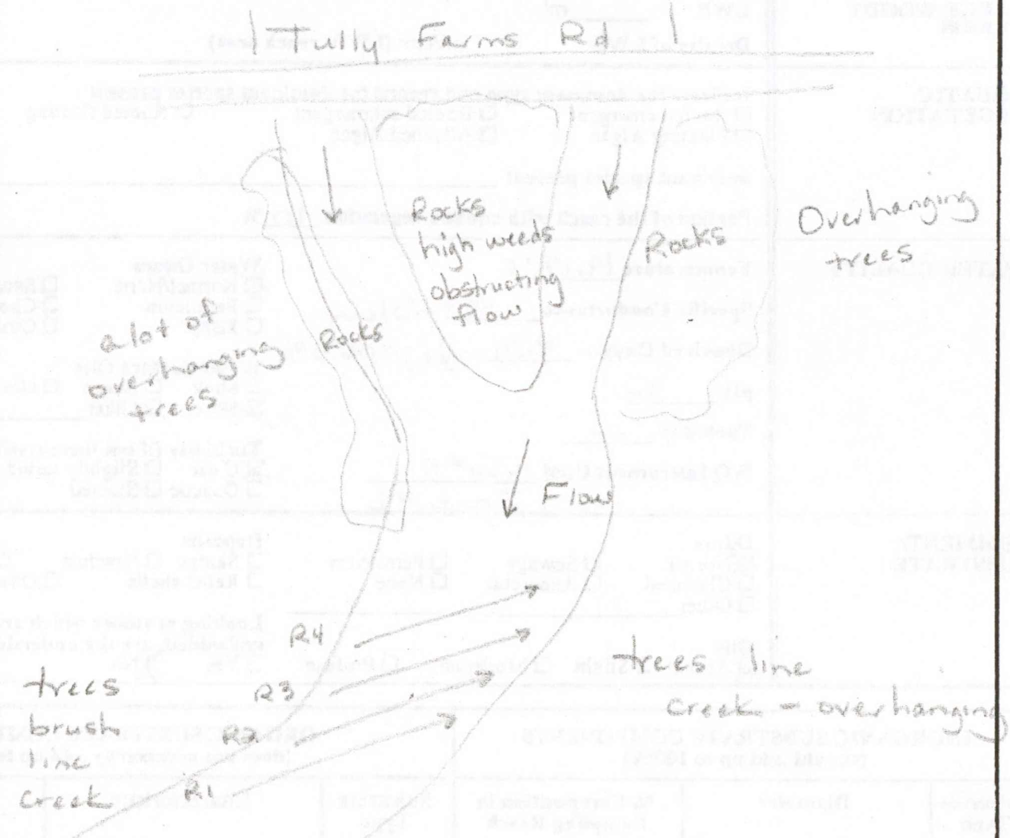
clear & sunny

Has there been a heavy rain in the last 7 days?
☒ Yes ☐ No

Air Temperature ~26-27° C

Other________________

SITE LOCATION/MAP Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other________

Stream Type
☒ Coldwater ☐ Warmwater

Catchment Area__________km²

APPENDIX 6: 2003-2004
ZEBRA MUSSEL ASSESSMENT REPORT

APPENDIX 6

2003-2004 OCDWEP SENECA RIVER ZEBRA MUSSEL ASSESSMENT REPORT

February 2005

Prepared For:
Onondaga County
Dept. of Water Environment Protection

Prepared By:
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Onondaga County Department of Water Environment Protection
2003-2004 OCDWEP Seneca River Zebra Mussel Assessment Report

A6-1. Background

In 1999, the Onondaga County Department of Water Environment Protection (OCDWEP) contracted Beak Consultants Inc. (presently Stantec Consulting Services Inc.) to conduct an assessment of the dreissenid mussel population in the Seneca River system as part of the Onondaga Lake Ambient Monitoring Program (AMP). The primary objective of this mussel survey was to provide data needed to support a mathematical model that will assist the County in making future management decisions concerning the discharge of treated wastewater into Onondaga Lake and the Seneca River system. The secondary objective of the 1999 assessment was to provide a baseline for determining changes in mussel population over time. The assessment documented and identified the location of dreissenid mussel habitat. This was accomplished utilizing sonar and a petite ponar dredge. Following the habitat assessment, the river was divided into 19 habitat zones. Scuba techniques were employed to collect mussel samples within the habitat zones. The collected samples were processed for length frequency distribution and mussel density estimates were calculated.

A peer review of the Three Rivers Water Quality Model (TRWQM) resulted in the following recommendations with respect to zebra mussels:

1. Collect more habitat data to refine density estimates.
2. Collect length vs. dry weight data in spring and summer to validate the relation between these variables used in the zebra mussel sub-model.
3. Resample the zebra mussel population in Spring, Summer and Fall to assess density and size distribution.

The 2003/2004 assessment was developed to meet these recommendations and will provide updated density distribution data, habitat data, as well as zebra mussel dry tissue weights for the final calibration of the TRWQM. This report summarizes the field and laboratory methods employed and presents results of these seasonal assessments.

A6-2. Fall 2003 Assessment

A6-2.1 Fall 2003 Methods

The primary objective of the fall 2003 sampling was to collect and estimate mussel densities from the following four (4) habitat zones:

Zone III – State Ditch Cut – 3 Transects, 3 samples per transect
Zone X – Buoy Marker 334– 3 Transects, 3 samples per transect
Zone XIV – Onondaga Lake Outlet– 3 Transects, 3 samples per transect
Zone XIII – Buoy Marker 260 – 5 Transects, 3 samples per transect

Appendix A, Figure A-1 provides the location of these zones for the fall 2003 sampling.

SCUBA techniques employed during the 1999 Seneca River assessment and in 2002, were used during this survey. A dive team led by Mr. John Long, who conducted the previous surveys, conducted the work. Stantec scientists and OCDWEP personnel were present during all field collections.

Sampling took place on November 3 and 5, 2003. Each transect was randomly selected and its location recorded using an OCDWEP owned GPS. Three samples were collected along each transect; one about mid-channel, and one between the marker buoy and shore on each side of the river. At each sampling location, the diver carefully placed a 12-inches on a side square (i.e., $0.0929m^2$) open center sampler on a random location on the bottom. All substrate within the sampler, including zebra mussels, was carefully removed and placed into a macroinvertebrate wash bucket fitted with 583-micron mesh. After collection was complete, the bucket was returned to the surface. The water depth at each sampling location was determined and recorded. The substrate type in each sample was determined using the modified Wentworth scale as described in Bode et al. (1990) and used during the 1999 Seneca River assessment (Beak 2000). Substrate type was determined by visual examination of the percentage of each particle type (nearest 10 percent). Throughout the study the same scientist determined substrate composition. Any dead zebra mussel shells were characterized as gravel, due to their size and functionality as an attachment site.

To numerically describe the substrate results, a phi value was assigned to each sample. The phi value for each substrate class is provided in Appendix A, Table A-1. The phi value is determined by transforming the mean particle size of the substrate type to the negative log base 2 of the particle size in millimeters (Hakanson and Jansson 1993). The percentage of each substrate type in each sample (nearest 10 percent) was determined. The sample phi value was calculated by multiplying the percentage that each substrate present represented in the sample by its corresponding phi value and summing the results.

Fine sediment was then rinsed through the wash bucket. For each sample, all zebra mussels in the remaining material were placed into labeled plastic bags. If attached to large substrates (e.g. large cobble), the mussels were carefully removed from the substrate with a dry wall seamer before being placed into the bag. The plastic bags were carefully placed into coolers with ice and transported to Stantec's Lancaster New York Biological Laboratory for further processing. The fieldwork was conducted over two days, because the cold water limited the amount of time that the divers could spend in the water and the need to transport the boat overland, since the locks were closed for the season.

At each collection location, a probing technique was used to generally characterize the sediment type from the boat. Stantec has previously used probing to determine whether soft, hard or gravel/sand substrate exits. The probe used consisted of a small mushroom anchor attached to a moderately sized steel link chain. The anchor was lowered to the bottom and then bounced up and down a number of times so it would re-strike the substrate. The variations in the vibration along the chain were used to differentiate the substrate type. This method was selected over using a pole or gaffe since it is only limited by the chain length, which could be readily increased. The water depth in places in this reach of the Seneca River exceeds 30 feet. The probing results were placed into three major descriptive classes (hard substrate, sand/gravel and soft substrate). If possible further refining descriptors such as hard packed fines, cobbles, or substrate mixes were also recorded. Probing to determine substrate type was done without knowledge of the actual substrate composition. These results were used to "calibrate" the results of the more rigorous probing study conducted in summer 2004 (see Section 4) by comparing sediment type with particle size classification and zebra mussel densities measured as part of the collection. The primary goal of this activity was to develop probing classes that correlate with presence/absence of zebra mussels.

At a number of locations Stantec tested an underwater camera as another means of remotely determining substrate and presence of mussels. This technique worked very well and took little time to complete, however, the river water clarity was good during this sampling event, so whether this technique would work under more typical water clarity conditions is not known.

When the laboratory received the zebra mussel samples, they were checked in and refrigerated until processed. To process, initially all mussels in a sample were carefully removed from the substrate material. The mussels were blotted dry with paper towels and the first 100 randomly selected mussels were measured (nearest 1 mm). All of the measured mussels were placed onto an electronic top loading balance and a batch weight was measured (nearest 0.1 gram). All of the remaining mussels were added to the measured group and a total batch weight was measured. In most cases the mussels were still alive when measured. After completing a sample, the other two samples from the same transect were sequentially processed. If, when using this procedure, a total of less than 150 mussels in a particular transect were measured, additional mussels from any sample that was sub-sampled, would be measured to provide a total of 150 measured mussels per transect.

The total number of mussels per sample was estimated by multiplying the number of mussels counted by the total weight of mussels in the sample divided by the weight of the subsample of mussels measured. The estimated total number of mussels in each sample was converted to the number of mussels per square meter of bottom. A simple mean density of mussels was calculated for each habitat zone.

A6-2.2 Fall 2003 Results

All 42 scheduled samples were successfully collected and processed. Of these 59 percent contained mussels. The mean number of mussels ranged from 10,628 per square meter in Zone III to 50 per square meter in Zone X (Appendix A, Table A-2). The mean weight of the mussels was greatest in Zone XIV (1502 grams per square meter) and least in Zone X (37 grams per square meter).

Comparing data collected in fall sampling conducted by the OCDWEP in prior years, the greatest density of mussels was present in Zone III, the Cut, in 1999, 2002, and 2003, when compared to the other three zones sampled. The density of mussels in Zone X was appreciably different among years and ranged from 2,435 mussels per square meter in 2002 to 50 per square meter in 2003. The density of mussels in Zone XIII was about three times greater in 2003 than in the other two years. In Zone XIV, the density of mussels was consistent in all three years.

The relative accuracy of the probing method using a mushroom anchor and chain was high. Determinations were made at 36 sample locations. A number of other sites were too deep to probe with the available length of chain. Over 94 percent of the probing determinations were rated to be good or fair (Appendix A, Table A-3). Of the two determinations rated as poor, one was determined to be soft, but was predominately sand and the other was determined to be hard pack, but was actually muck. There were no instances where large, hard substrates (cobble/boulder/ledge) were called soft or soft substrate was called hard.

A6-3. Spring 2004 Assessment

A6-3.1 Spring 2004 Methods

The primary objective of the spring sampling was to collect and estimate mussel densities from each of the 19 habitat zones sampled in 1999. The goal to accomplish this objective was to collect samples at one half the number of transects sampled in 1999.

Prior to the initiation of field sampling, a kick off meeting was held on May 11, 2004 at OCDWEP offices in Syracuse, New York. Stantec, OCDWEP, and Quantitative Environmental Analysis, LLC (QEA) were represented. Field and laboratory procedures and the proposed level of effort were discussed. QEA indicated that the level of effort for the spring sampling exceeded their data needs. It was agreed to lower the level of effort somewhat by reducing the number of sampled transects from 33 to 28, allowing flexibility to sample additional transects in the fall, during the full sampling effort. Transects were eliminated in zones where mussels were found in low densities in 1999.

Transects were established in 18 of the 19 Habitat Zones used for the 1999 study. Habitat Zone I and the back channel to the State Ditch Cut were not sampled. In each of the other Habitat Zones, one transect was sampled except in Zones VI, X, XII, XIV, XVI and XIX where two transects were sampled, and Zones IV, and XIII where three transects were located. Appendix B, Figure B-1 provides the location of the transect locations.

SCUBA techniques developed during the 1999 Seneca River assessment and also used in 2002, and fall 2003 were employed during this survey. A dive team led by Mr. John Long, who conducted the previous surveys, conducted the work. Stantec scientists were present during all field collections. Field sampling took place from May 11 through 14, 2004. Sampling was conducted as described in Section 2.1.

At each collection location, a probing technique was used from the boat to generally characterize the sediment type. Stantec has previously used probing to determine whether soft, hard or gravel/sand substrate exists. The methods used are described in greater detail in Section 2.1. These results were used to “calibrate” the future results of the more rigorous probing study conducted in Summer 2004 (see Section 4) by comparing sediment type with particle size classification and zebra mussel densities measured as part of the collection. The primary goal of this activity is to develop probing classes that correlate with presence/absence of zebra mussels.

Zebra mussel samples received by Stantec’s laboratory were processed as described in Section 2.1.

For the zebra mussel tissue dry weight determination, one hundred zebra mussels were sub-sampled from the whole collection based upon their length. Mussels were selected so that approximately one-third of the mussels were within each of the following categories; less than 10mm, between 10 and 20mm, and greater than 20mm. Within each category, as many sizes that were available were selected for this determination.

The selected mussels were measured for length, width, and height to the nearest mm. The mussels were then blotted dry and weighed to four decimal places using a Mettler Model H33 balance. Each mussel was placed in an individually numbered vial with approximately twice it’s volume of 10% HNO_3. After the calcified shell was dissolved, the byssal threads and periostracum were removed and the tissue was rinsed in water. The soft tissue was then placed in individually numbered foil “boats” and placed in a drying oven at 60^0C for 48 hours. They were removed in small batches, weighed and returned to the drying oven. The dry weights were measured at intervals of at least 24 hours until successive readings were within five percent of each other. The length versus dry soft tissue weight and whole wet weight versus dry soft tissue weight regressions were calculated.

A6-3.2 Spring 2004 Results

Distribution Study

All 84 scheduled samples were successfully collected and processed. Of these, 64 percent contained live mussels. Mussels were present in 17 of the 18 Habitat Zones sampled, with only Zone II samples devoid of mussels. Mussels were present in all samples collected in Habitat Zones III, V, XI, XII, XIV, XVI, XVII, and XVIII. The greatest density of mussels collected was 493,000/square meter, which was collected in the State Ditch Cut (Habitat Zone III) (Appendix B, Table B-1). The greatest mean density (263,189 mussels per square meter) of mussels in any Habitat Zone also occurred in Zone III. The mean density of mussels exceeded 2,500 mussels per square meter in four Habitat Zones (III, V, XIV, and XVI). The mean weight of mussels was greatest in Habitat Zone III (6,254 grams per square meter).

The relative accuracy of the probing method using a mushroom anchor and chain was high. Determinations were made at 84 sample locations. Over 85 percent of the probing determinations were rated to be good or fair (Appendix B, Table B-2). Of the determinations rated poor, differences were often associated with areas where hardpan clay existed. Results of both the spring study and the Fall 2003 study were combined, which resulted in a total of 120 determinations. Of these, 106 or 88 percent were rated as either good or fair.

Tissue Dry Weight Study

For the dry weight determination, 28 mussels were less than 10 mm, 36 ranged from 10 mm to 20 mm, and 33 were measured to be greater than 20 mm. Results for two mussels (both less than 2 mm) were voided due to the likelihood that they were dead before initiation of the test, based on a degradation of the soft tissue observed after they were removed from the acid.

The mean soft tissue dry weight of mussels less than 10 mm was 0.0017 grams, the dry weight of 10 mm to 20 mm mussels was 0.0223 grams, and mussels greater than 20 mm was 0.0795 grams Appendix B, Table B-3). This compared closely to the Fall 2001 results. In that study, the mean dry weights were: 0.0020 grams for mussels less than 10 mm, 0.018 grams for mussels that ranged from 10 mm to 20 mm, and 0.1128 grams for mussels greater than 20 mm.

The regressions of length versus dry weight and whole wet weight versus dry weight were both highly significant with the fit improving when the data were transformed (log transformation) (Appendix B, Figures B-2 through B-5).

A6-4. Summer 2004 Assessment

A6-4.1 Summer 2004 Methods

A primary objective of the summer sampling was to collect samples to develop mussel length frequency information from each of the 19 habitat zones sampled in 1999. The goal to accomplish this objective was to collect samples along one transect in each of the 19 habitat zones. The other major objective of the summer effort was to conduct an intensive determination of substrate types at five locations along 250 transects set along the entire study reach of the Seneca River, Oneida River and Oswego River.

Prior to the initiation of field sampling, Stantec scientists reviewed the program with Quantitative Environmental Analysis, LLC (QEA) staff, who also accompanied Stantec during the first day of field sampling, to insure that collected data would best serve QEA's goals. Field and laboratory procedures and the proposed level of effort were discussed. Maps with the proposed transects for substrate data collections were supplied for review and approval. QEA recommended that approximately 50 percent of the transects that were proposed for the Oneida River portion of the study reach be reapportioned to the Oswego River between the Three Rivers confluence and the Phoenix Dam. Eleven transects were set up in the Oswego River. Also it was agreed that the location of the five samples along each transect would be evenly spaced from shore to shore and that a GPS measurement only was needed for the mid river location. Stantec recommended that water depth be recorded at each location since it required no additional effort and would provide useful information.

One transect to collect zebra mussel sample to be used for development of length frequency information was established in each of the 19 Habitat Zones used for the 1999 study. Sampling took place from July 19 through 22, 2004. Each transect was randomly selected and its location recorded using a GPS. Three samples were collected along each transect, one about mid-channel, and one between the marker buoy and shore on each side of the river. SCUBA techniques developed during the 1999 Seneca River assessment and also used in 2002, fall 2003, and spring 2004 were not employed during this survey. Alternatively, a grab sample was collected at each location using a petit ponar dredge that sampled an area of 35 square inches (226 square cm). All substrate within the sampler, including zebra mussels, was carefully lifted to the surface and placed into a macroinvertebrate wash bucket fitted with 583-micron mesh. The water depth at each sampling location was recorded. Field and laboratory sample processing was conducted as described in Section 2.1.

A probing technique was used from the boat to generally characterize the sediment type along 250 transects located throughout the study reach. Two different techniques were used. Where water depths exceeded 8 ft. the probe used consisted of a small mushroom anchor attached to a moderately sized steel link chain. The anchor was lowered to the bottom and then bounced up and down a number of times so it would re-strike the substrate. The variations in the vibration along the chain were used to differentiate the substrate type. This method was selected over using a pole or gaffe since it was only limited by the chain length, which could be readily increased. The water depth in places in this reach of the Seneca River exceeds 30 feet. The probing results were placed into the following major descriptive classes; Muck/Silt (M), Sand/Gravel (SG), Hard Pan Clay (HC), Cobble/Boulder (CB), and Bedrock (BR). If possible, further refining descriptors such as hard packed fines, cobbles, or substrate mixes were also recorded. In waters that were 8 ft or less the substrate type was determined by probing with a long PVC rod where substrate was determined by the vibrations felt through the rod. In locations where ponar samples were collected, the substrate results from the ponar were used to verify the probing results.

A6-4.2 Summer 2004 Results

Distribution Study

All 57 scheduled samples were successfully collected and processed. Of these, 52 percent contained live mussels. Mussels were present in 15 of the 19 Habitat Zones sampled. Mussels were not collected in Zones I, II, IV, and XI. Mussels were collected in all samples in Zones III, VI, X, XIV, and XVII. The greatest density of mussels collected in any sample was 15,338/square meter, which was collected in the State Ditch Cut (Habitat Zone III) (Appendix C, Table C-1). The greatest mean density (8,294 mussels per square meter) of mussels in any Habitat Zone occurred in Zone VII. The mean density of mussels exceeded 2,500 mussels per square meter in four Habitat Zones (III, VI, VII, and XIV). The mean weight of mussels was greatest in Habitat Zone VII (2,260 grams per square meter). Since collection technique for the summer 2004 survey were different from those used in the fall 2003 and spring 2004 efforts direct comparisons to those results should not be made.

Substrate Determination Study

A total of 249 of the 250 transects were successfully sampled. One transect was in a construction area near the Rte 31 Bridge, so could not be safely sampled. All data collected is presented in Appendix C-2. The locations of each of the transects have been recorded on Appendix C, Figure C-1, a modification of the Nautical Charts for the study reach. The substrate locations are configured so that Substrate 1 is located on the side of the river where the red (nun) buoys are located and Substrate 5 is located on the side of the channel where the green (can) buoys are present. The buoy numbers are provided for each transect so they can be readily referenced to Nautical Charts. If the transect is located between two buoys, both numbers are provided. At intervals throughout the reach GPS location data was collected at permanent channel markers. These are recorded in the comments section of Appendix C, Table C-2.

A6-5. Fall 2004 Assessment

A6-5.1 Fall 2004 Methods

The primary objective of the fall 2004 sampling was to collect mussel samples and estimate mussel densities from each of the habitat zones sampled in 1999 and spring 2004. The goal to accomplish this objective was to collect samples using a level of effort comparable to that used in 1999.

Prior to the initiation of field sampling, a kick off meeting was held at OCDWEP offices in Syracuse, New York. Stantec, OCDWEP, and Quantitative Environmental Analysis, LLC (QEA) were represented. Field and laboratory procedures and the proposed level of effort were discussed. It was decided to reapportion the level of effort (i.e. number of transects sampled) among the habitat zones. This reapportionment was requested by QEA to fill in a number of data gaps for the river model that resulted from the detailed substrate survey conducted in summer 2004.

Transects were established in 18 of the 19 Habitat Zones used for the 1999 study. Habitat Zone I, which is the back channel to the State Ditch Cut, was not sampled. A new Habitat Zone (XX) was established in the Oswego River upstream of the Phoenix Dam in Phoenix, New York. A total of 69 transects were establish and sampled in fall 2004. Appendix D, Figure D-1 provides the location of the transects sampled.

SCUBA techniques developed during previous Seneca River assessment including in fall 2003 and spring 2004 were employed during this survey. A dive team led by Mr. John Long, who conducted the previous surveys, conducted the work. Stantec scientists were present during all field collections.

Sampling took place from October 4 through 7, 2004. All field sampling was conducted as described in Section 2.1, except that the probing study was not conducted.

Zebra mussel samples received by Stantec's laboratory were processed as described in Section 2.1.

For the zebra mussel tissue dry weight determination, one hundred zebra mussels were sub-sampled from the whole collection based upon their length. Mussels were selected so that approximately one-third of the mussels were within each of the following categories; less than 10mm, between 10 and 20mm, and greater than 20mm. Within each category, as many sizes that were available were selected for this determination. Laboratory methods used were described in Section 3.1.

A6-5.2 Fall 2004 Results

Distribution Study

All 207 scheduled samples were successfully collected and processed. Of these, 63 percent contained live mussels. Mussels were present in each of the 19 Habitat Zones sampled. Mussels were present in all samples collected in Habitat Zones III, and XX. The greatest density of mussels collected was 75,000/square meter, which was collected in Habitat Zone IV (Appendix D, Table D-1). The greatest mean density (13,179 mussels per square meter) of mussels in any Habitat Zone also occurred in Zone III. The mean density of mussels exceeded 2,500 mussels per square meter in four Habitat Zones (III, IV, VIII, XIV, XVI, and XVII). The mean weight of mussels was greatest in Habitat Zone XIV (2,787 grams per square meter).

Tissue Dry Weight Study

For the dry weight determination, 28 mussels were less than 10 mm, 38 ranged from 10 mm to 20 mm, and 34 were measured to be greater than 20 mm. Two of the 100 mussels sampled were the quagga mussel*, Dreissena bugensis*.

The mean soft tissue dry weight of mussels less than 10 mm was 0.0065 grams, the dry weight of 10 mm to 20 mm mussels was 0.0123 grams, and mussels greater than 20 mm was 0.0513 grams (Appendix D, Table D-2). The mean dry weight of mussels less than 10mm collected in fall 2004 was significantly higher than in spring. The mean dry weights of mussels between 10mm and 20mm as well as those greater than 20mm were significantly lower in fall than in spring. These differences could be attributed to the sizes of the individuals sampled, although the number of mussels evaluated in each size range was high. The increase in dry weight in small mussels over the summer could be attributable to an increased condition, whereas the loss of body tissue weight in the larger, mature mussels could be related to loss off reproductive tissue through spawning. Reproductive tissue can account for greater than 50 percent of the soft tissue weight of mollusks.

The regressions of length versus dry weight and whole wet weight versus dry weight were both highly significant with the fit improving when the data were transformed (log transformation) (Appendix D, Figures D-2 through D-5).

A6-6. References

Beak Consultants Incorporated. 2000. 1999 Seneca River Dreissenid Mussel Assessment Program-Distribution of Zebra Mussels Along a Selected Reach of the Seneca River. Report prepared for Onondaga County Department of Drainage and Sanitation, September 2000.

Bode, R. W., M. A. Novak, and L. E. Abele. 1990. Biological Impairment Criteria for Flowing Waters in New York State. Stream Biomonitoring Unit, Bureau of Monitoring and Assessment, Division of Water, Albany, New York. 110pp.

Hakanson, L. and M. Janson. 1983. Principles of Lake Sedimentology. Springer-Verlag. Berlin. 316pp.

APPENDIX A

Fall 2003 Assessment

Table A6 A-1. Substrate particle size and phi values.

Type	Particle Size Range	Phi Value
Ledge/Bedrock	--	-9.97
Boulder	Greater Than 256mm (10in.)	-8.00
Cobble	64mm-256mm (2.5in-10in)	-6.50
Gravel	2mm-64mm (0.008in-2.5in)	-3.00
Sand	0.06mm-2.0mm	2.00
Silt	0.004mm-0.06mm	6.50
Clay	Less than 0.004mm	9.00

Table A6 A- 2. Length and Weight Data, Seneca River Dreissenid Assessment Program, 2003.

HABITAT ZONE	TRANSECT	SAMPLE	DEPTH (m)	SAMPLE MEDIAN PARTICLE SIZE	ZONE MEAN PARTICLE SIZE	NUMBERS PER SUBSAMPLE	WEIGHT PER SUBSAMPLE g/M^2	WEIGHT PER SAMPLE g/M^2	TOTAL WEIGHT g/M2	ZONE MEAN WEIGHT g/M2	TOTAL NUMBER Per Sample	TOTAL NUMBER PER M2	MEAN NUMBER PER M^2 ZONE
III	A	R	3.2	-5.30	**-4.50**	100	25	54	581.04	**1,433.47**	216	2,324.16	**10,628**
III	A	M	4.2	-0.20		100	2	13	139.88		650	6,994.00	
III	A	G	4.2	-0.20		100	27	108	1,162.08		400	4,304.00	
III	B	R	4.2	-5.80		100	19	31	333.56	**Standard**	163	1,755.58	**Standard**
III	B	M	4.2	-5.80		100	13	112	1,205.12	**Deviation**	862	9,270.15	**Deviation**
III	B	G	4.2	-5.80		100	19	180	1,936.80	**1,087.74**	947	10,193.68	**9,152**
III	C	R	4.2	-5.80		100	7	195	2,098.20		2786	29,974.29	
III	C	M	4.2	-5.80		100	17	167	1,796.92		982	10,570.12	
III	C	G	4.2	-5.80		100	18	339	3,647.64		1883	20,264.67	
X	A	R	3.8	6.50	**4.38**	2	0.05	0.05	0.54	**37.12**	2	21.52	**50**
X	A	M	4.7	6.50		0	0	0	0.00		0	0.00	
X	A	G	3.8	3.25		0	0	0	0.00		0	0.00	
X	B	R	3.8	6.05		0	0	0	0.00	**Standard**	0	0.00	**Standard**
X	B	M	4.7	-3.55		0	0	0	0.00	**Deviation**	0	0.00	**Deviation**
X	B	G	3.8	3.90		40	31	31	333.56	**111.16**	40	430.40	**143**
X	C	R	3.8	6.05		0	0	0	0.00		0	0.00	
X	C	M	4.1	6.05		0	0	0	0.00		0	0.00	
X	C	G	3.9	4.65		0	0	0	0.00		0	0.00	
XIII	A	R	2.1	6.50	**5.26**	0	0	0	0.00	**1,483.09**	0	0.00	**2,792**
XIII	A	M	5	6.50		0	0	0	0.00		0	0.00	
XIII	A	G	3.8	6.50		0	0	0	0.00		0	0.00	
XIII	B	R	7.5	6.50		0	0	0	0.00	**Standard**	0	0.00	**Standard**
XIII	B	M	6.3	6.50		0	0	0	0.00	**Deviation**	0	0.00	**Deviation**
XIII	B	G	1.4	3.85		23	0.5	0.5	5.38	**4,301.02**	23	247.48	**6,964**
XIII	C	R	1.9	6.50		0	0	0	0.00		0	0.00	
XIII	C	M	4.4	6.50		0	0	0	0.00		0	0.00	
XIII	C	G	4.2	6.50		100	7	27	290.52		386	4,150.29	
XIII	D	R	4.9	6.50		0	0	0	0.00		0	0.00	
XIII	D	M	7.8	9.00		89	33	33	355.08		89	957.64	
XIII	D	G	4.4	2.00		5	1	1	10.76		5	53.80	
XIII	E	R	2.1	5.90		100	50	499	5,369.24		998	10,738.48	
XIII	E	M	6.3	7.60		0	0	0	0.00		0	0.00	
XIII	E	G	6.4	-8.00		100	63	1507	16,215.32		2392	25,738.60	
XIV	A	R	4	-0.50	**-3.16**	100	38	368	3,959.68	**1,501.62**	968	10,420.21	**3,208**
XIV	A	M	5.2	0.50		0	0	0	0.00		0	0.00	
XIV	A	G	4.7	1.00		2	0.5	0.5	5.38		2	21.52	
XIV	B	R	2.9	-3.00		100	56	357	3,841.32	**Standard**	638	6,859.50	**Standard**
XIV	B	M	5.6	-5.13		77	53	53	570.28	**Deviation**	77	828.52	**Deviation**
XIV	B	G	1.2	-5.63		58	8	8	86.08	**1,921.89**	58	624.08	**3,898**
XIV	C	R	2.3	-5.80		100	27	69	742.44		256	2,749.78	
XIV	C	M	5.2	-5.80		100	61	400	4,304.00		656	7,055.74	
XIV	C	G	2.8	-4.05		29	0.5	0.5	5.38		29	312.04	

Table A6 A-3. Preliminary Comparison of Probing (Mushroom Anchor and Chain) and Actual Substrate Determination, Fall 2003.

Sample #	Actual Substrate Composition	Probing Determination	Relative Accuracy	Location
1	25% cobble, 75% silty muck	soft	Fair	X AG
2	100% silt	soft	Good	XAM
3	75% boulder, 25%cobble	hard/cobbles	Good	--
4	100% muck	soft	Good	--
5	75% boulder, 25% sand	cobble, soft	Fair	--
6	100% muck	soft	Good	--
7	50% boulder, 50% cobble	hard	Good	--
8	40% muck,10% sand, 50% cobble	hard	Fair	--
9	10% gravel, 90% silt	soft	Good	--
10	60% muck, 20% cobble, 20% gravel	soft	Fair	XIII DG
11	100% muck	soft	Good	XIII DR
12	100% hard packed silt	hard packed fines	Good	XIIICG
13	100% muck	hard packed fines	Poor	XIIICM
14	100% muck	soft	Good	XIIICR
15	70% sand, 10% silt, 20% clay	soft	Poor	XIIIBG
16	100% muck	soft	Good	XIIIBR
17	100% muck	soft	Good	XIIIAG
18	80% hard clay, 20% cobble	hard packed fines	Fair	XIIIER
19	30% cobble, 70% gravel	mix sand/cobble/gravel	Fair	X1VCG
20	80% cobble, 20% gravel	hard	Good	XIVCR
21	75% cobble, 25% gravel	boulders/cobble	Fair	XIVBG
22	100% gravel	mix sand/gravel	Fair	XIVBR
23	80% sand 20%gravel	mixed sand/gravel	Good	XIVAG
24	80% cobble, 20% gravel	cobble, hard	Good	IIICG
25	80% cobble, 20% gravel	cobble, hard	Good	IIICM
26	80% cobble, 20% gravel	cobble	Good	IIICR
27	80% cobble, 20% gravel	cobble	Good	IIIBG
28	80% cobble, 20% gravel	cobble/hard	Good	IIIBM
29	80% cobble, 20% gravel	cobble	Good	IIIBR
30	70% sand, 20% cobble, 10% gravel	sand	Good	IIIAG
31	80% cobble, 10% sand, 10% gravel	cobble/hard	Good	IIIAR
32	80% muck, 20%cobble	soft	Good	XBG
33	90% muck, 10%sand	soft	Good	XBM
34	90% muck, 10%sand	soft	Good	XCM
35	70% muck, 20% sand, 10% gravel	semi-soft, sand	Fair	XCG
36	90% muck, 10%sand	soft	Good	XCR

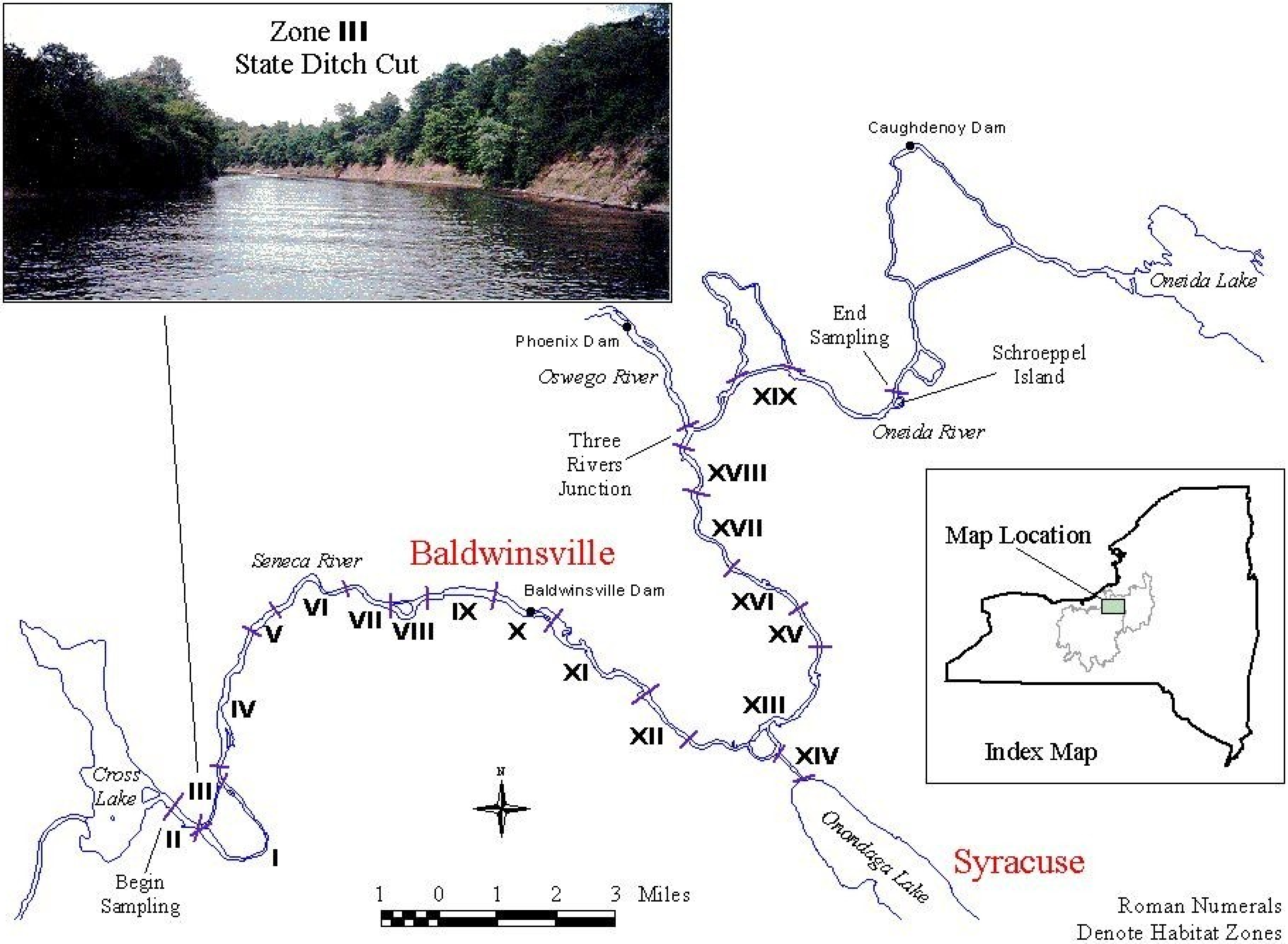

Figure A6 A-1. Substrate particle size and phi value

Appendix A6 A. Onondaga County Zebra Mussel Survey, Fall 2003
Length Data

Sample	Lengths (up to 100 mussels) in mm																																									
ID Number >	AR	AM	AG	BR	BM	BG	CR	CM	CG	AR	AM	AG	BR	BG	BM	CR	CG	CM	AR	AM	AG	BR	BM	BG	CR	CM	CG	DR	DM	DG	ER	EM	EG	AR	AM	AG	BR	BM	BG	CR	CM	CG
	ZONE III									ZONE X									ZONE XIII															ZONE XIV								
1	25	20	9	4	22	14	17	20	12	11				29										4			19		19	8	31		17	12		8	27	27	20	28	23	9
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3	15	12	18	5	17	15	10	11	11					15										4			18		19	5	25		17	5			22	16	21	26	22	10
4	17	10	25	5	22	12	14	12	6					17										3			4		17	8	14		11	4			15	17	21	22	27	6
5	6	7	18	4	9	15	12	3	8					26										4			7		5	6	25		15	14			5	21	17	21	28	4
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Appendix A6 A. Onondaga County Zebra Mussel Survey, Fall 2003
Length Data

Sample	Lengths (up to 100 mussels) in mm																																									
ID Number >	AR	AM	AG	BR	BM	BG	CR	CM	CG	AR	AM	AG	BR	BG	BM	CR	CG	CM	AR	AM	AG	BR	BM	BG	CR	CM	CG	DR	DM	DG	ER	EM	EG	AR	AM	AG	BR	BM	BG	CR	CM	CG
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APPENDIX B

Spring 2004 Assessment

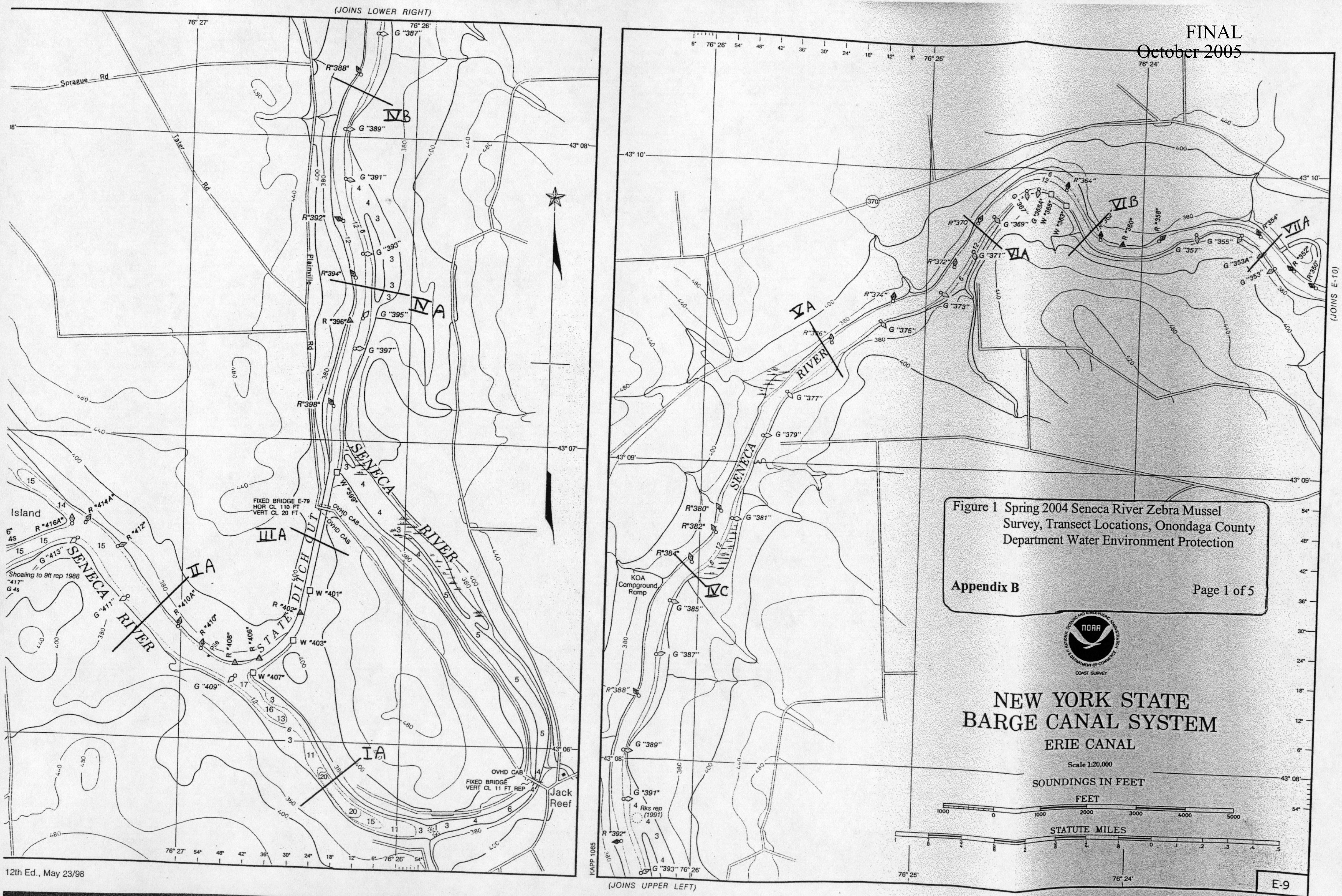

Figure 1 Spring 2004 Seneca River Zebra Mussel Survey, Transect Locations, Onondaga County Department Water Environment Protection

Appendix B

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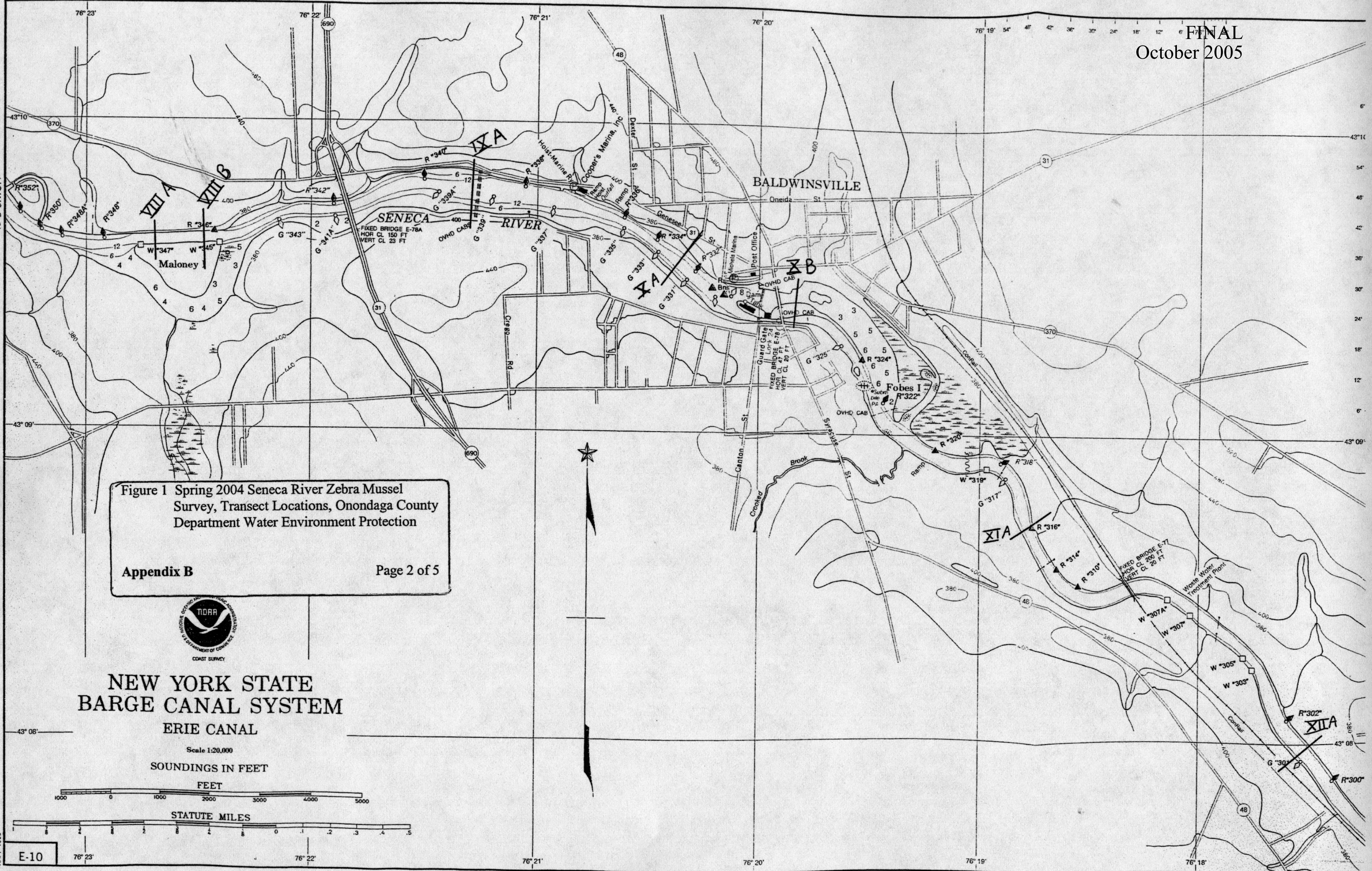

Figure 1 Spring 2004 Seneca River Zebra Mussel Survey, Transect Locations, Onondaga County Department Water Environment Protection

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FINAL
October 2005

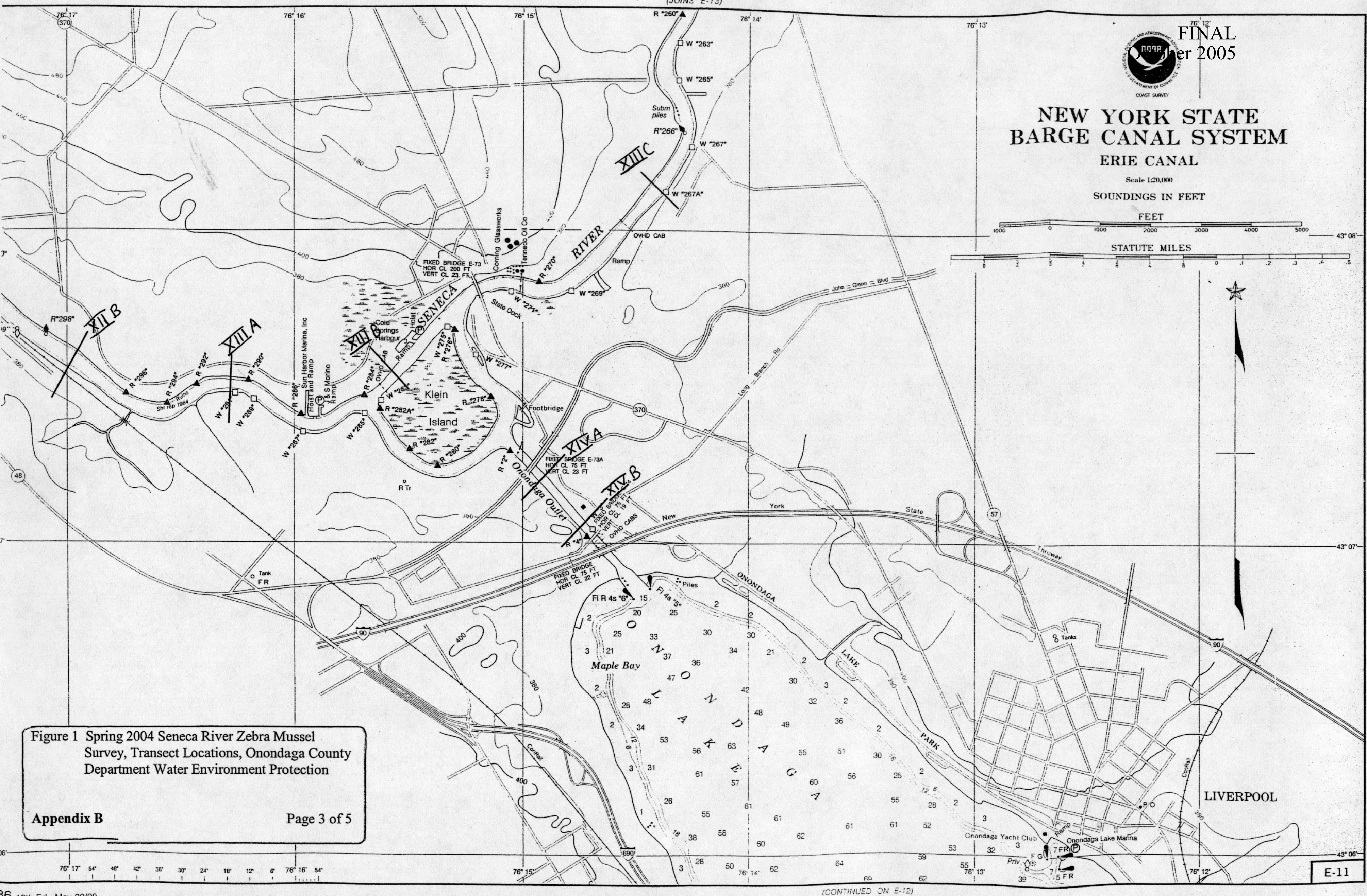

Figure 1 Spring 2004 Seneca River Zebra Mussel Survey, Transect Locations, Onondaga County Department Water Environment Protection

FINAL
ctober 2005

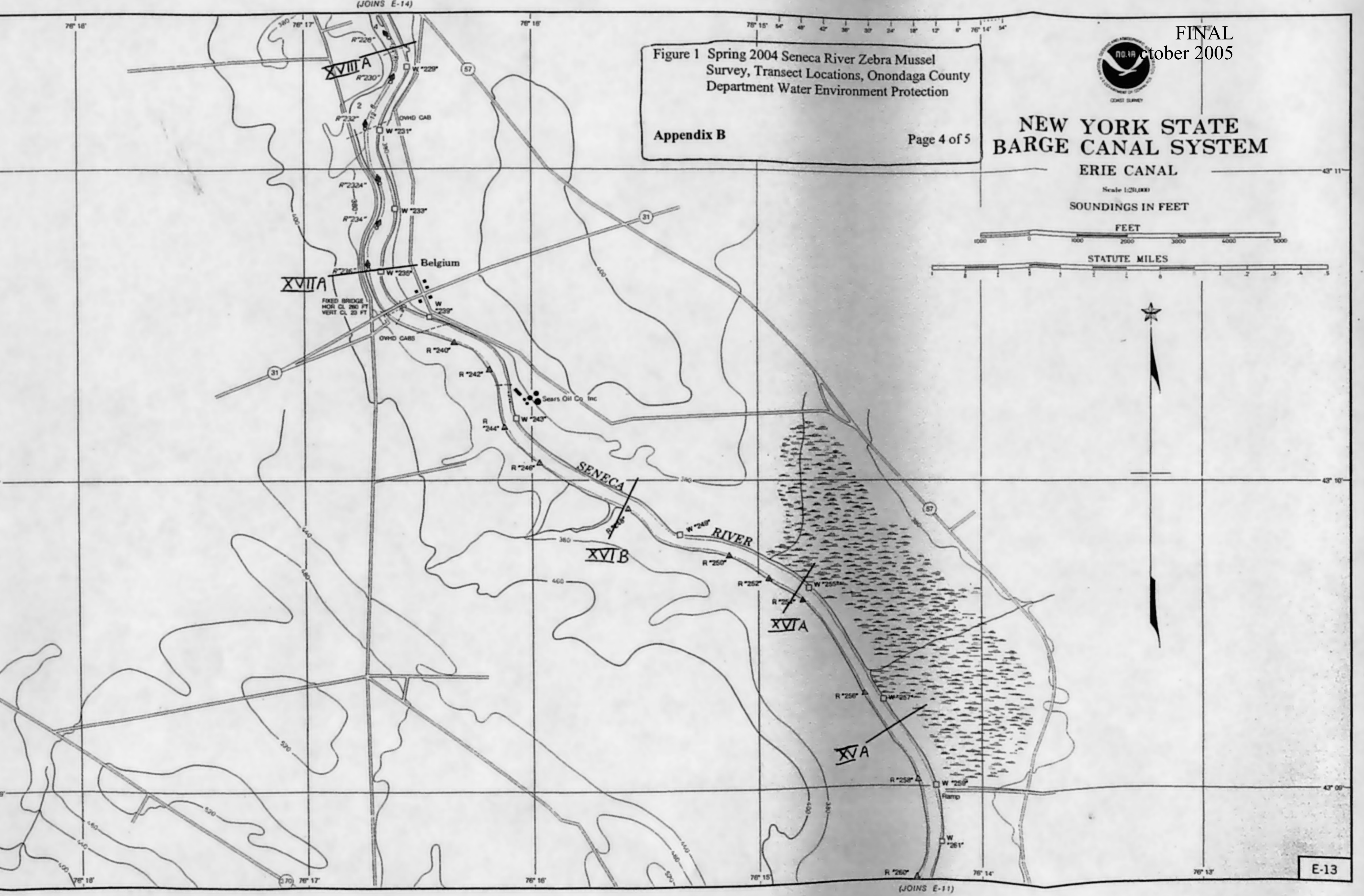

Figure 1 Spring 2004 Seneca River Zebra Mussel Survey, Transect Locations, Onondaga County Department Water Environment Protection

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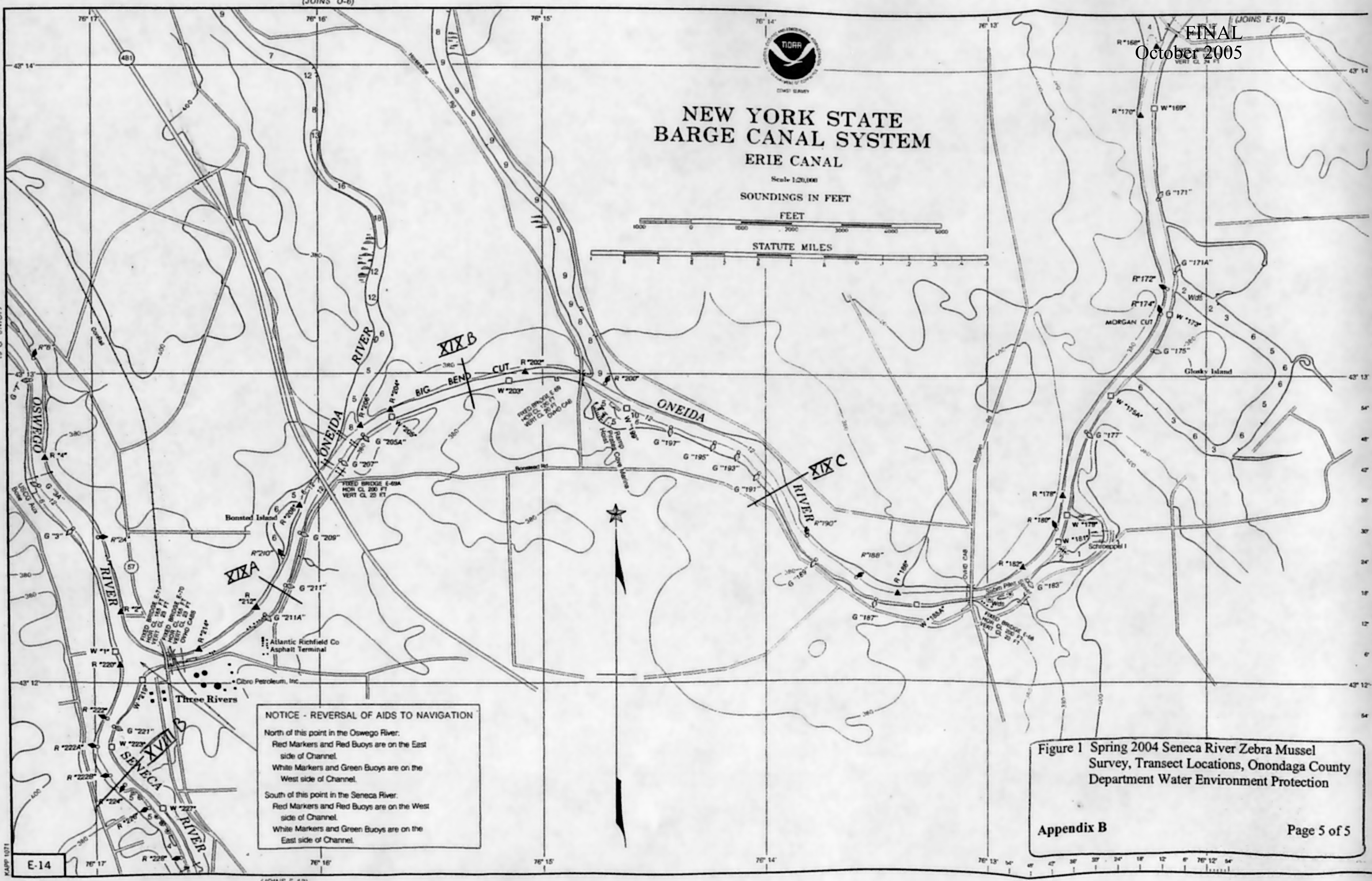

NOTICE - REVERSAL OF AIDS TO NAVIGATION

North of this point in the Oswego River:
Red Markers and Red Buoys are on the East side of Channel.
White Markers and Green Buoys are on the West side of Channel.

South of this point in the Seneca River:
Red Markers and Red Buoys are on the West side of Channel.
White Markers and Green Buoys are on the East side of Channel.

Figure 1 Spring 2004 Seneca River Zebra Mussel Survey, Transect Locations, Onondaga County Department Water Environment Protection

Appendix B

Figure A6 B-2. Length vs. dry tissue weight regression results of Seneca River zebra mussel tissue study.

Regression Statistics	
Multiple R	0.858764795
R Square	0.737476973
Adjusted R Square	0.734713573
Standard Error	0.020530977
Observations	97

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.112492583	0.112493	266.873018	2.43743E-29
Residual	95	0.040044496	0.000422		
Total	96	0.152537079			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.024851311	0.004259427	-5.834426	7.44666E-08	-0.033307336	-0.016395286	-0.03330734	-0.016395286
X Variable 1	0.003728842	0.000228256	16.33625	2.43743E-29	0.003275697	0.004181987	0.0032757	0.004181987

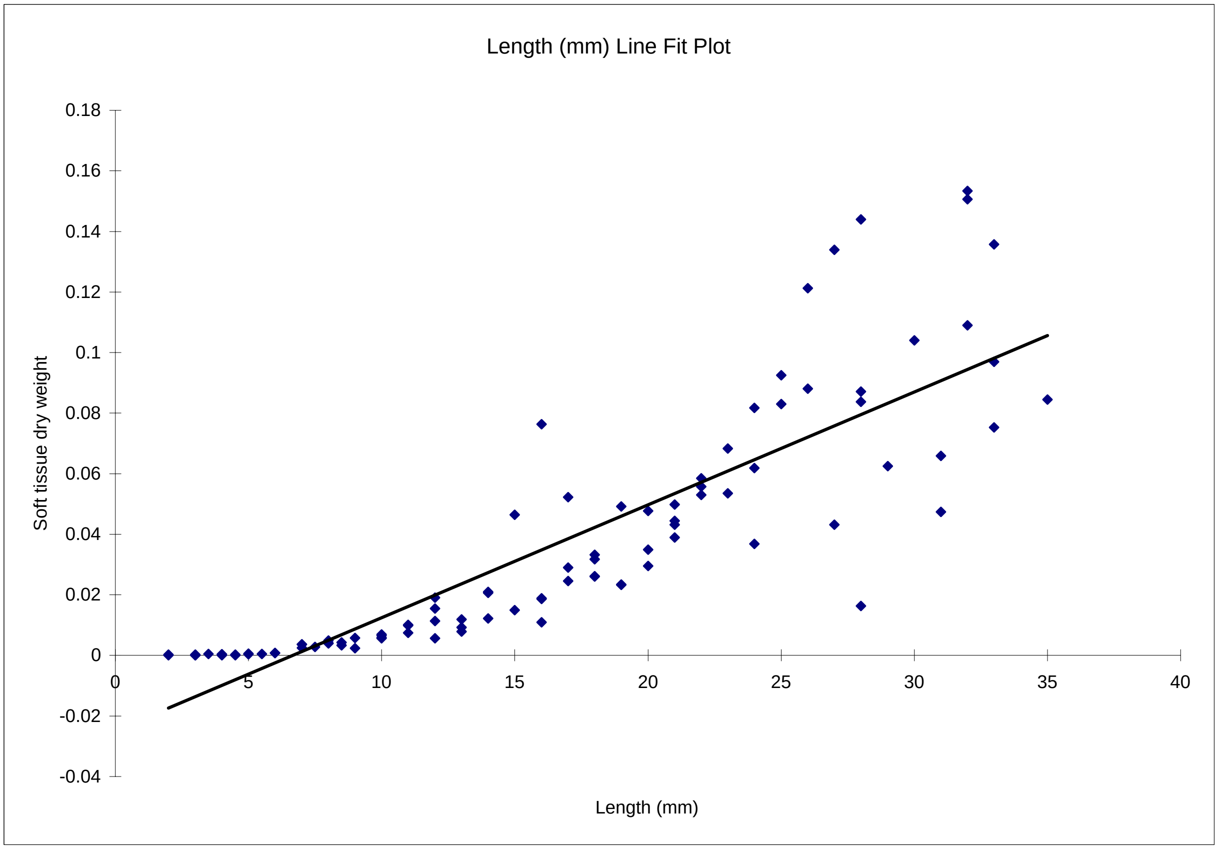

Figure A6 B-3. Log length vs. Log dry tissue weight regression results of Seneca River zebra mussel tissue study.

Regression Statistics	
Multiple R	0.965831318
R Square	0.932830135
Adjusted R Square	0.932123084
Standard Error	0.231696748
Observations	97

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	70.82581441	70.82581	1319.325	1.65006E-57
Residual	95	5.0999214	0.053683		
Total	96	75.92573581			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-5.003708389	0.087538097	-57.16035	2.21E-75	-5.17749336	-4.829923419	-5.17749336	-4.829923419
X Variable 1	2.735876337	0.075321787	36.32251	1.65E-57	2.586343792	2.885408883	2.586343792	2.885408883

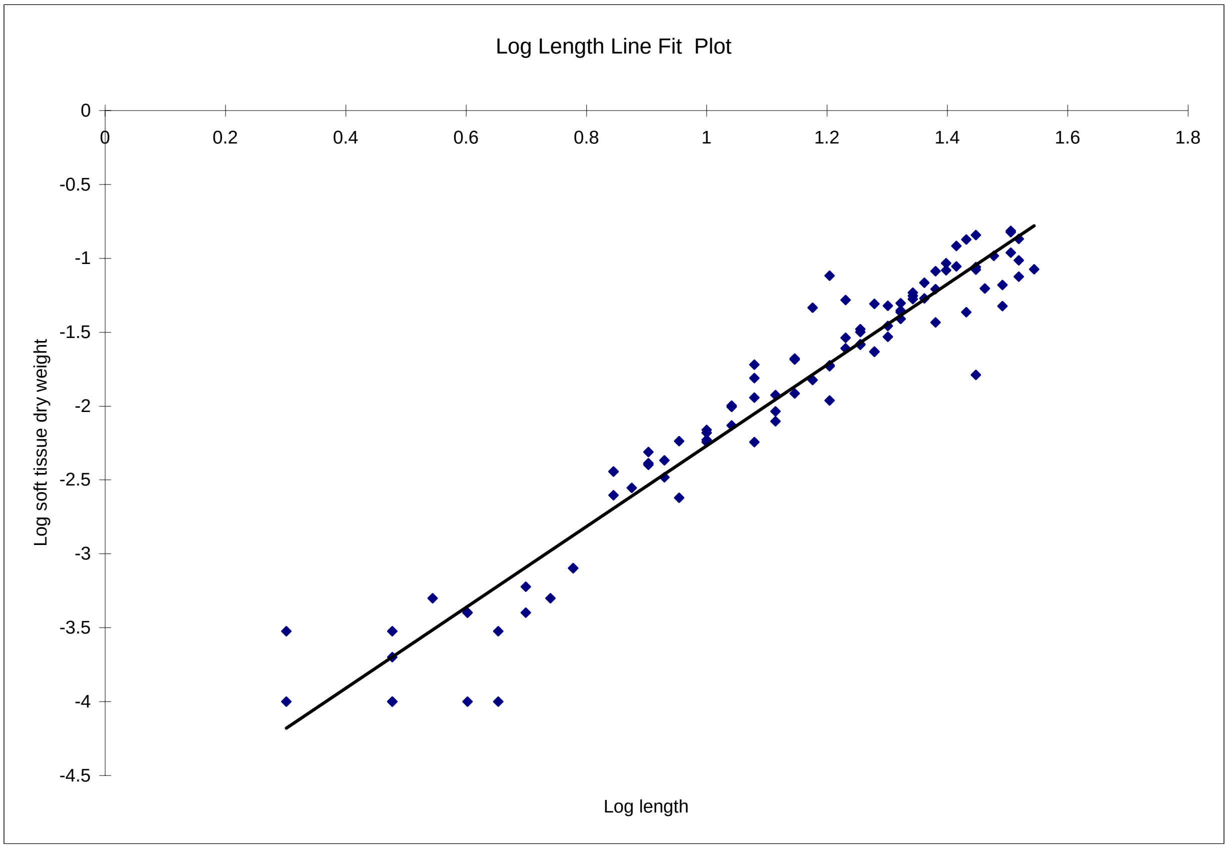

Figure A6 B-4. Whole wet weight vs. dry tissue weight regression results of Seneca River zebra mussel tissue study.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.834327573
R Square	0.6961025
Adjusted R Square	0.692903578
Standard Error	0.022089683
Observations	97

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.106181442	0.106181	217.605401	2.61941E-26
Residual	95	0.046355637	0.000488		
Total	96	0.152537079			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.00924462	0.002877182	3.213081	0.001793695	0.003532696	0.014956545	0.003532696	0.014956545
X Variable 1	0.031950041	0.002165891	14.75145	2.61941E-26	0.027650207	0.036249875	0.027650207	0.036249875

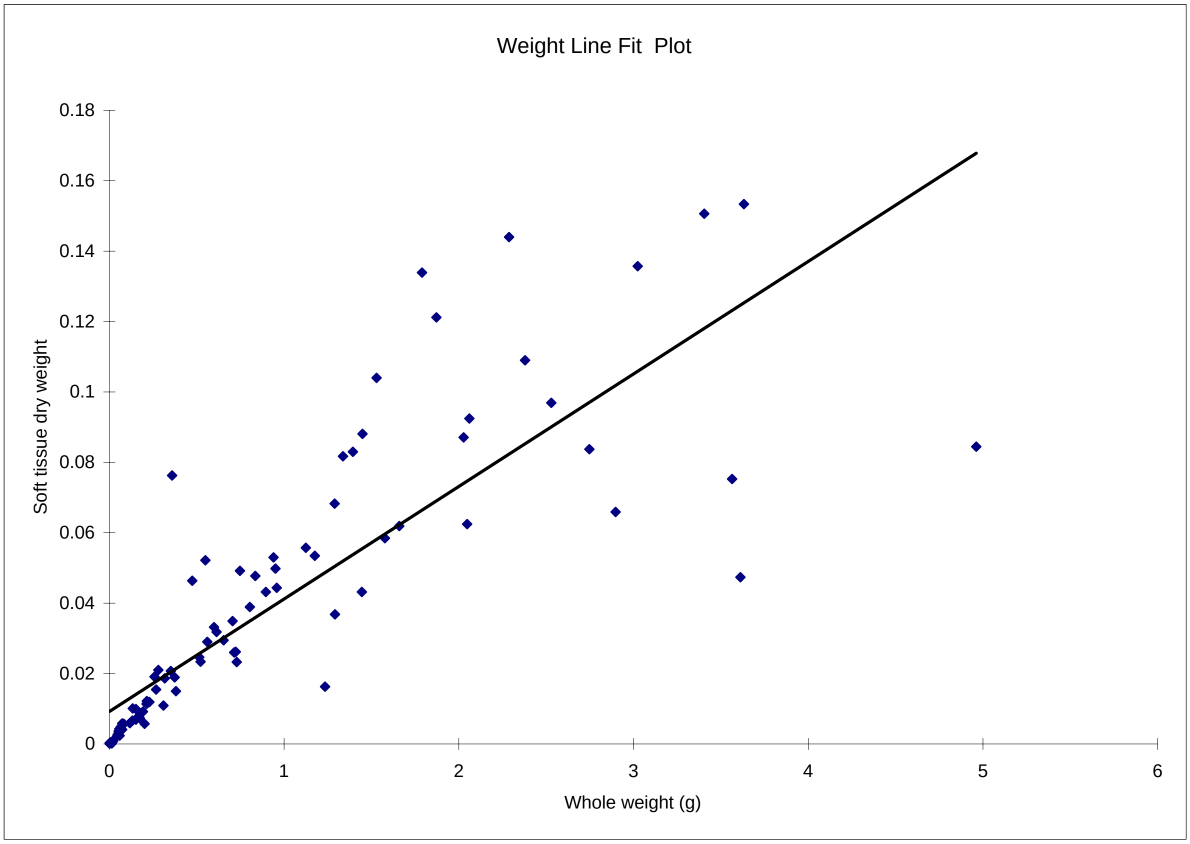

Figure A6 B-5. Log whole wet weight vs. log dry tissue weight regression results of Seneca River zebra mussel tissue study.

Regression Statistics	
Multiple R	0.973307535
R Square	0.947327558
Adjusted R Square	0.946773111
Standard Error	0.205174993
Observations	97

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	71.92654191	71.92654	1708.599696	1.57998E-62
Residual	95	3.9991939	0.042097		
Total	96	75.92573581			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.342807617	0.025366752	-52.93573	2.61202E-72	-1.39316695	-1.29244828	-1.39316695	-1.292448282
X Variable 1	0.980739729	0.023726496	41.33521	1.57998E-62	0.933636712	1.027842745	0.93363671	1.027842745

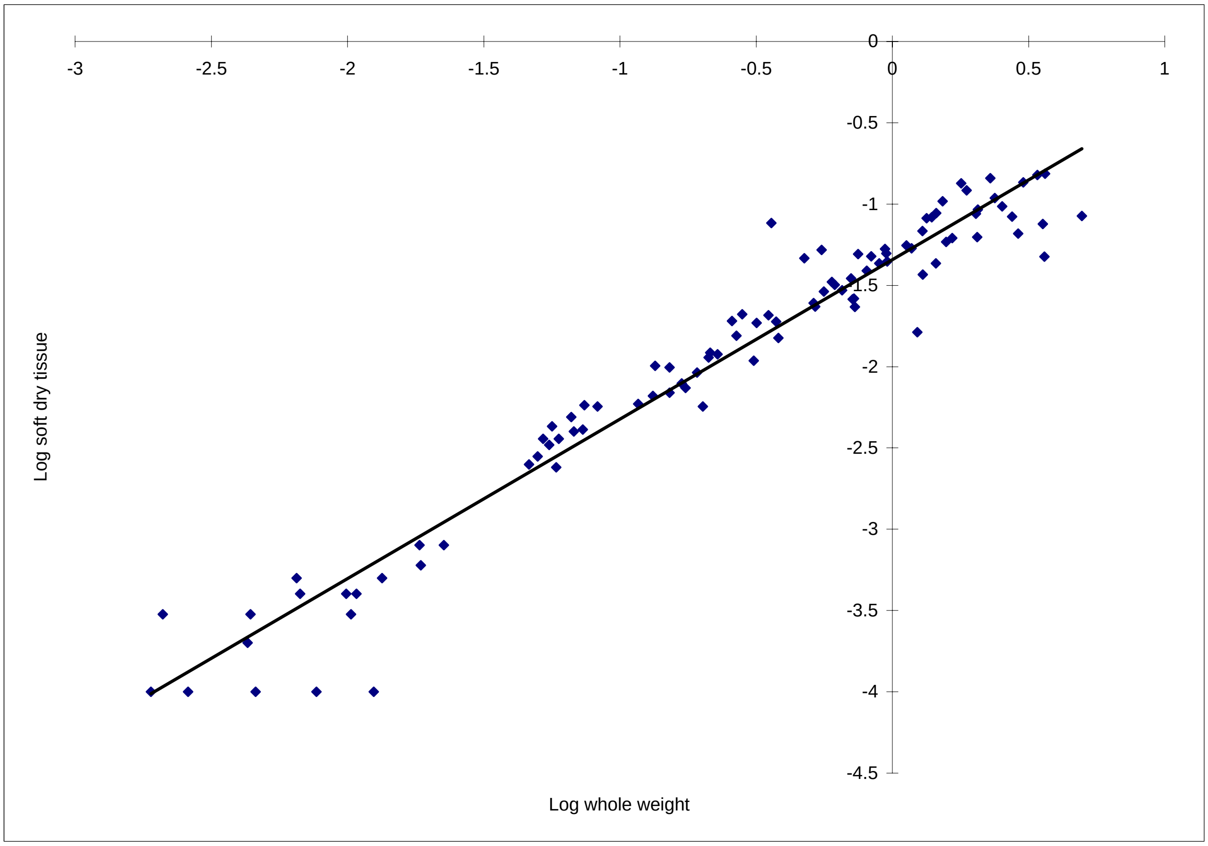

Table A6 B-1. Length and Weight Data, Seneca River Dreissenid Assessment Program, Spring 2004.

Habitat Zone	Transect	Sample	Depth (feet)	Median Particle Size Per Sample	Mean Particle Size Per Zone	Numbers Per Subsample	Weight Per Subsample g	Weight Per Sample g	TOTAL WEIGHT g/M2	MEAN WEIGHT g/M2 PER ZONE	TOTAL NUMBER Per Sample	TOTAL NUMBER PER M2	MEAN NUMBER PER M^2 ZONE
II	A	R	20	4.25	**2.70**	0	0	0	0.0	**0.00**	0	0.0	**0**
II	A	M	25	4.25		0	0	0	0.0		0	0.0	
II	A	G	23	-0.39		0	0	0	0.0		0	0.0	
III	A	R	16	-5.45	**-6.15**	100	2	916	9,860.0	**6,254.00**	45800	493,000.4	**263,189**
III	A	M	16	-6.50		18	1	1	10.8		18	193.8	
III	A	G	16	-6.50		100	3	826	8,891.2		27533	296,374.3	
IV	A	R	16	-5.00	**0.29**	0	0	0	0.0	**17.34**	0	0.0	**73**
IV	A	M	16	2.00		60	14	14	150.7		60	645.9	
IV	A	G	7	3.13		0	0	0	0.0		0	0.0	
IV	B	R	14	-1.50		0	0	0	0.0		0	0.0	
IV	B	M	15	-1.50		0	0	0	0.0		0	0.0	
IV	B	G	12	-1.75		0	0	0	0.0		0	0.0	
IV	C	R	14	-1.75		0	0	0	0.0		0	0.0	
IV	C	M	13	2.50		1	0.5	0.5	5.4		1	10.8	
IV	C	G	7	6.50		0	0	0	0.0		0	0.0	
V	A	R	14	9.00	**9.00**	100	19	298	3,207.7	**1,693.75**	1568	16,882.8	**8,450**
V	A	M	15	9.00		30	0.05	0.05	0.5		30	322.9	
V	A	G	9	9.00		100	23	174	1,873.0		757	8,143.4	
VI	A	R	9	0.75	**1.55**	2	0.5	0.5	5.4	**140.83**	2	21.5	**407**
VI	A	M	14	0.75		3	0.5	0.5	5.4		3	32.3	
VI	A	G	8	-0.50		0	0	0	0.0		0	0.0	
VI	B	R	12	4.13		2	0.5	0.5	5.4		2	21.5	
VI	B	M	16	0.50		0	0	0	0.0		0	0.0	
VI	B	G	15	3.65		100	35	77	828.8		220	2,368.1	
VII	A	R	12	0.75	**0.75**	2	0.5	0.5	5.4	**44.85**	2	21.5	**147**
VII	A	M	15	0.75		0	0	0	0.0		0	0.0	
VII	A	G	16	0.75		39	12	12	129.2		39	419.8	
VIII	A	R	12	1.50	**1.83**	0	0	0	0.0	**247.58**	0	0.0	**774**
VIII	A	M	15	2.00		100	32	69	742.7		216	2,321.0	
VIII	A	G	3	2.00		0	0	0	0.0		0	0.0	
IX	A	R	14	-0.50	**1.83**	0	0	0	0.0	**1.79**	0	0.0	**14**
IX	A	M	15	-0.50		4	0.5	0.5	5.4		4	43.1	
IX	A	G	8	6.50		0	0	0	0.0		0	0.0	
X	A	R	11	0.75	**4.04**	2	2	2	21.5	**61.00**	2	21.5	**203**
X	A	M	13	2.00		100	27	29	312.2		107	1,156.2	
X	A	G	13	2.00		0	0	0	0.0		0	0.0	
X	B	R	12	6.50		0	0	0	0.0		0	0.0	
X	B	M	11	6.50		4	3	3	32.3		4	43.1	
X	B	G	13	6.50		0	0	0	0.0		0	0.0	
XI	A	R	18	4.50	**4.62**	100	36	46	495.2	**168.64**	128	1,375.4	**469**
XI	A	M	21	2.85		2	0.5	0.5	5.4		2	21.5	
XI	A	G	18	6.50		1	0.5	0.5	5.4		1	10.8	
XII	A	R	5	5.50	**3.60**	43	2	2	21.5	**567.81**	43	462.9	**2,056**
XII	A	M	15	0.50		100	37	109	1,173.3		295	3,171.1	
XII	A	G	7	9.00		100	19	92	990.3		484	5,212.1	
XII	B	R	14	1.00		100	31	48	516.7		155	1,666.7	
XII	B	M	14	1.00		100	43	65	699.7		151	1,627.1	
XII	B	G	7	4.60		18	0.5	0.5	5.4		18	193.8	
XIII	A	R	19	4.60	**3.48**	12	1	1	10.8	**209.30**	12	129.2	**943**
XIII	A	M	23	1.00		100	5	5.5	59.2		110	1,184.1	
XIII	A	G	17	0.50		100	32	32	344.5		100	1,076.4	
XIII	B	R	7	6.60		12	0.5	0.5	5.4		12	129.2	
XIII	B	M	15	5.60		0	0	0	0.0		0	0.0	
XIII	B	G	16	0.50		100	19	80	861.1		421	4,532.3	
XIII	C	R	23	6.50		0	0	0	0.0		0	0.0	
XIII	C	M	29	6.05		0	0	0	0.0		0	0.0	
XIII	C	G	27	0.00		100	42	56	602.8		133	1,435.2	
XIV	A	R	14	-2.90	**-0.82**	100	55	831	8,945.1	**3,797.97**	1511	16,263.7	**6,560**
XIV	A	M	18	-3.00		100	62	530	5,705.0		855	9,201.7	
XIV	A	G	10	0.00		100	65	434	4,671.7		668	7,187.2	
XIV	B	R	12	-0.50		100	63	193	2,077.5		306	3,297.6	
XIV	B	M	17	-0.50		100	59	73	785.8		124	1,331.8	
XIV	B	G	8	2.00		100	29	56	602.8		193	2,078.6	
XV	A	R	21	1.75	**4.92**	100	43	161	1,733.0	**581.27**	374	4,030.3	**1,422**
XV	A	M	29	6.50		0	0	0	0.0		0	0.0	
XV	A	G	26	6.50		22	1	1	10.8		22	236.8	
XVI	A	R	23	2.80	**2.45**	100	27	48	516.7	**706.85**	178	1,913.6	**3,566**
XVI	A	M	19	-0.50		100	26	222	2,389.7		854	9,191.0	
XVI	A	G	19	-0.50		100	23	23	247.6		100	1,076.4	
XVI	B	R	14	9.00		100	2	7	75.3		350	3,767.5	
XVI	B	M	23	1.00		61	5	5	53.8		61	656.6	
XVI	B	G	21	2.90		100	20	89	958.0		445	4,790.1	
XVII	A	R	11	5.15	**1.72**	89	14	14	150.7	**495.15**	89	958.0	**1,036**
XVII	A	M	18	0.00		100	64	117	1,259.4		183	1,967.8	
XVII	A	G	16	0.00		17	7	7	75.3		17	183.0	
XVIII	A	R	14	6.05	**7.50**	0	0	0	0.0	**897.02**	0	0.0	**2,137**
XVIII	A	M	15	7.45		100	38	114	1,227.1		300	3,229.3	
XVIII	A	G	15	9.00		100	46	136	1,463.9		296	3,182.5	
XIX	A	R	15	2.00	**2.82**	91	25	25	269.1	**52.03**	91	979.5	**178**
XIX	A	M	17	0.75		0	0	0	0.0		0	0.0	
XIX	A	G	14	1.00		8	4	4	43.1		8	86.1	
XIX	B	R	9	5.15		0	0	0	0.0		0	0.0	
XIX	B	M	15	4.70		0	0	0	0.0		0	0.0	
XIX	B	G	15	3.30		0	0	0	0.0		0	0.0	

Table A6 B-2. Preliminary Comparison of Probing (Mushroom Anchor & Chain) and Actual Substrate Determination, Spring 2004

Sample No.	Actual Substrate Composition	Probing Determination	Relative Accuracy
1	80% sand, 20% hardpan	sand	Good
2	50% sand, 50% silt	sand/silt	Good
3	50% muck, 50% sand	muck, soft	Good
4	100% cobble	cobble	Good
5	75% cobble, 25% gravel	sand, rock	Good
6	70% cobble, 30% gravel	gravel, sand	Poor
7	75% sand, 25% silt	sand, gravel	Fair
8	100% sand	sand	Good
9	50% sand, 50% mussel shells	sand, gravel	Good
10	75% mussel shells, 25% sand	sand, gravel	Good
11	50% sand, 50% shells	sand, gravel	Good
12	50% sand, 50% shells	sand	Fair
13	100% muck	muck, soft	Good
14	90% gravel, 10% sand	gravel	Good
15	75% shells, 25% sand	sand	Poor
16	100% hardpan clay	hard	Good
17	100% hardpan clay	hard	Good
18	100% hardpan clay	muck, sand	Poor
19	50% sand, 50% shells	cobble, sand	Poor
20	75% sand, 25% shells	sand	Good
21	75% sand, 25% shells	cobble, sand	Poor
22	70% silt, 30% shells	sand	Poor
23	70% sand, 20% shells, 10% gravel	sand	Good
24	75% silt, 25% shells	sand, silt	Good
25	75% sand, 25% gravel	sand	Good
26	75% sand, 25% gravel	sand	Good
27	75% sand, 25% gravel	sand	Good
28	100% sand	sand	Good
29	100% sand	sand	Good
30	90% sand, 10% shells	gravel, sand	Fair
31	50% silt, 50% muck	muck, soft	Good
32	50% sand, 50% shells	sand	Fair
33	50% sand, 50% silt	sand	Fair
34	100% sand	sand	Good
35	100% sand	sand	Good
36	75% sand, 25% shells	sand	Good
37	100% muck	soft	Good
38	100% muck	muck	Good
39	100% muck	muck, soft	Good

Table A6 B-2. Preliminary Comparison of Probing (Mushroom Anchor & Chain) and Actual Substrate Determination, Spring 2004

Sample No.	Actual Substrate Composition	Probing Determination	Relative Accuracy
40	100% muck	soft	Good
41	60% sand, 30% muck, 10% shells/g	sand	Good
42	60% hardpan, 20% sand, 20% cobb	sand	Poor
43	100% hardpan clay	hard	Good
44	70% sand, 30% shells	sand	Good
45	50% sand, 50% clay	sand, hard	Fair
46	80% muck, 20% shells	soft	Good
47	80% sand, 20% shells	sand	Good
48	80% sand, 20% shells	sand, semi-hard	Good
49	70% sand, 30% shells	sand	Good
50	80% sand, 20% shells	sand, hard	Good
51	80% muck, 20% shells	muck, soft	Good
52	70% sand, 30% shells/gravel	sand, hard	Good
53	80% muck, 20% sand	soft	Good
54	40% muck, 40% clay, 20% sand	sand, semi-hard	Fair
55	60% sand, 40% shells	sand, semi-hard	Good
56	90% muck, 10% sand	soft	Good
57	100% muck	soft	Good
58	60% sand, 40% shells	semi-hard	Poor
59	100% shells	semi-hard	Fair
60	40% cobble, 30% sand, 30% shells	uneven, hard	Good
61	100% sand	sand	Good
62	50% sand, 50% shells	sand	Fair
63	50% sand, 50% shells	sand	Fair
64	100% muck	soft	Good
65	100% muck	muck	Good
66	50% shells, 50% muck	sand, semi-hard	Poor
67	50% sand, 40% shells, 10% gravel	sand	Fair
68	50% sand, 50% shells	sand, semi-hard	Good
69	40% sand, 40% muck, 20% shells	muck, soft	Fair
70	80% sand, 20% muck	sand	Good
71	80% sand, 20% gravel	sand, semi-hard	Good
72	100% hard clay	sand, hard	Fair
73	60% sand, 40% shells	sand	Fair
74	60% sand, 40% shells	uneven rock, hard	Poor
75	70% silt, 30% sand	muck, soft	Good
76	100% hardpan	hard	Fair
77	90% hardpan, 10% cobble	soft	Poor
78	90% silt, 10% sand	muck, soft	Good

Table A6 B-2. Preliminary Comparison of Probing (Mushroom Anchor & Chain) and Actual Substrate Determination, Spring 2004

Sample No.	Actual Substrate Composition	Probing Determination	Relative Accuracy
79	80% sand, 20% shells	sand, gravel	Good
80	75% sand, 25% gravel	sand	Good
81	100% sand	muck, soft	Poor
82	50% sand, 40% silt, 10% gravel	sand, silt, soft	Good
83	60% silt, 40% sand	muck, soft	Good
84	70% silt, 30% sand	muck	Good

Table A6 B-3. Measurements from zebra mussels used in the soft tissue analysis (Spring 2004).

Length (mm)	Width (mm)	Height (mm)	Whole weight (g)	Dry weight (g)
3	1	1.5	0.0044	0.0003
5	1.5	1.5	0.0099	0.0004
8.5	3	4	0.0563	0.0043
6	2	3	0.0184	0.0008
9	3.5	4	0.0583	0.0024
3.5	1.5	2	0.0065	0.0005
3	1.5	2	0.0043	0.0002
4.5	2	2	0.0125	0.0001
5	2	2.5	0.0186	0.0006
4.5	1.5	2	0.0103	0.0003
6	2	2.5	0.0226	0.0008
5.5	2	2.5	0.0134	0.0005
7	3.5	4	0.0464	0.0025
4	2	2	0.0067	0.0004
4	1.5	2	0.0077	0.0001
4	1	1.5	0.0108	0.0004
3	1	1.5	0.0046	0.0001
3	1	1.5	0.0026	0.0001
8.5	3.5	4	0.0550	0.0033
7.5	3	4	0.0499	0.0028
7	3	4	0.0523	0.0036
8	4	4	0.0662	0.0049
7	3	4	0.0596	0.0036
8	3	4	0.0677	0.0040
2	1	1.5	0.0019	0.0001
2	1	1	0.0021	0.0003
10	4	5	0.1166	0.0059
10	5	6	0.1519	0.0069
10	4.5	5	0.1323	0.0066
9	3	4.5	0.074	0.0058
10	4	4.5	0.0827	0.0057
8	4	4	0.0730	0.0041
12	7	5	0.2681	0.0155
11	5	5	0.1522	0.0099
16	7	8	0.3597	0.0763
15	7	9	0.4746	0.0464
14	7	7	0.3508	0.0207
14	5	7	0.2810	0.0210
13	5	7	0.1921	0.0092
12	6	7	0.2579	0.0191
11	5	5	0.1345	0.0101
17	9	9	0.5142	0.0246
18	9	9	0.7231	0.0262
19	9	9	0.5211	0.0234
12	6	6	0.2116	0.0114
13	6	7	0.2283	0.0119
14	6	7	0.2147	0.0122
13	5	5	0.1686	0.0079
12	5	6	0.2015	0.0057
16	7	8	0.3176	0.0186
16	6	7	0.3097	0.0109
11	5	5	0.1742	0.0074
18	8	8	0.5991	0.0332
19	8	9	0.7282	0.0233
16	7	7	0.3744	0.0189
20	9	9	0.6544	0.0295
18	8	9	0.7141	0.0260
15	7	8	0.3816	0.0150
18	7	8	0.6137	0.0318
17	8	8	0.5499	0.0522
17	7	9	0.5608	0.0290
19	9	8	0.7478	0.0492
20	8	11	0.7054	0.0349
20	10	9	0.8359	0.0477
25	12	11	2.0607	0.0925
32	17	24	2.3790	0.1090
31	15	13	2.8968	0.0659
24	11	10	1.6587	0.0619
28	16	12	2.7476	0.0837
27	11	11	1.4455	0.0432
33	16	14	3.0230	0.1357
29	14	18	2.0477	0.0625
22	12	11	1.5761	0.0585
33	13	14	2.5286	0.0969
22	9	10	0.9399	0.0530
21	9	10	0.8954	0.0432
24	11	11	1.2919	0.0368
23	10	12	1.1767	0.0535
23	11	10	1.2900	0.0683
22	11	10	1.1253	0.0557
21	10	8	0.8043	0.0389
21	10	9	0.9498	0.0498
24	10	11	1.3368	0.0817
32	15	13	3.4052	0.1506
21	10	9	0.9579	0.0444
26	11	12	1.4482	0.0881
28	15	13	2.2870	0.1440
27	14	16	1.7892	0.1339
25	11	10	1.3931	0.0830
26	14	12	1.8720	0.1212
35	20	19	4.9622	0.0845
32	26	12	3.6321	0.1534
31	16	11	3.6123	0.0474
30	11	11	1.5287	0.1040
28	14	11	2.0282	0.0871
33	17	13	3.5647	0.0753
28	14	10	1.2346	0.0163

APPENDIX C

Summer 2004 Assessment

Figure 1. Summer 2004 Seneca River Substrate Study, Transect Locations, Onondaga County Department Water Environment Protection

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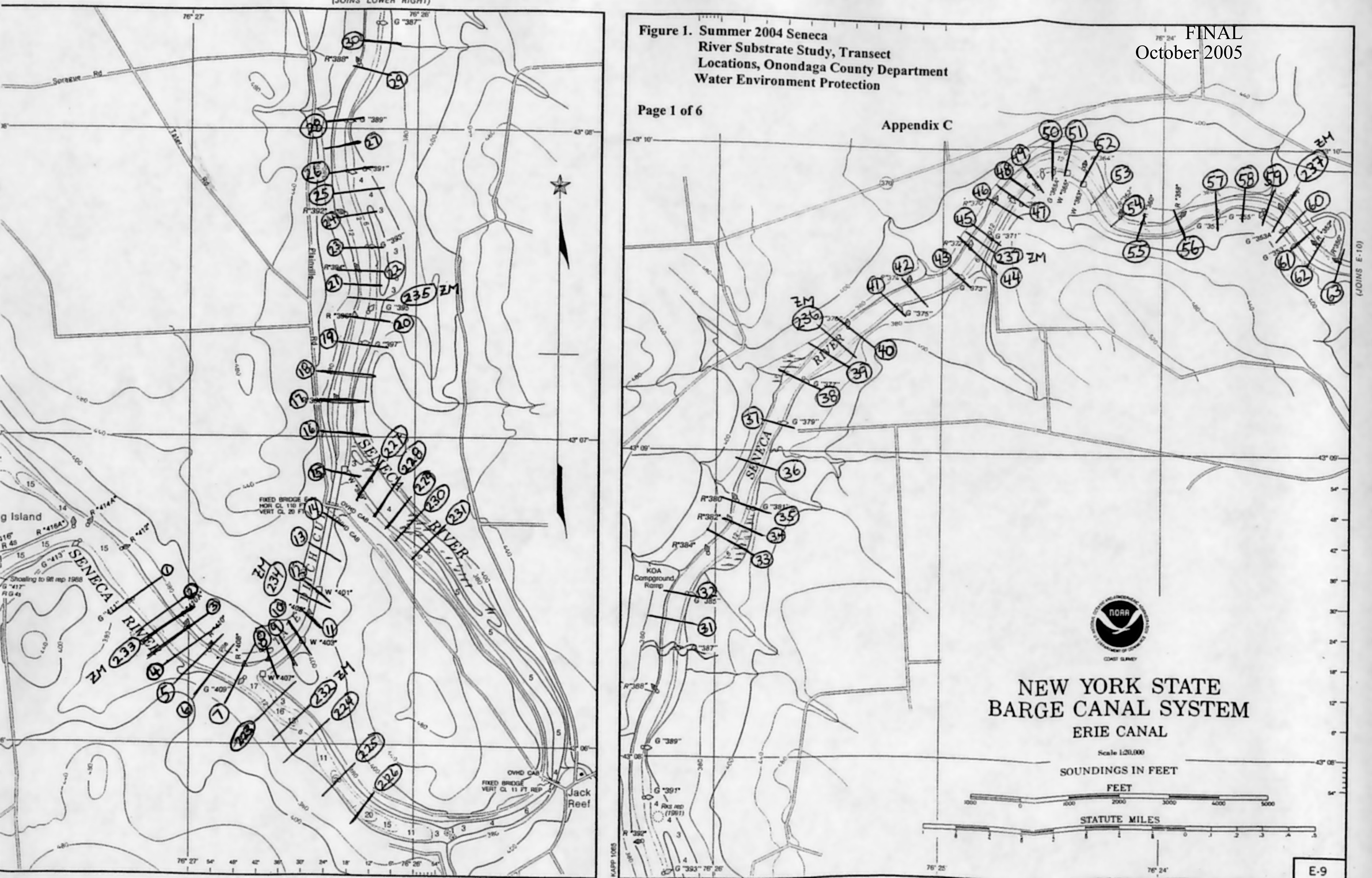

NEW YORK STATE
BARGE CANAL SYSTEM
ERIE CANAL

Scale 1:20,000

SOUNDINGS IN FEET

FEET

STATUTE MILES

E-9

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Figure 1. Summer 2004 Seneca River Substrate Study, Transect Locations, Onondaga County Department Water Environment Protection

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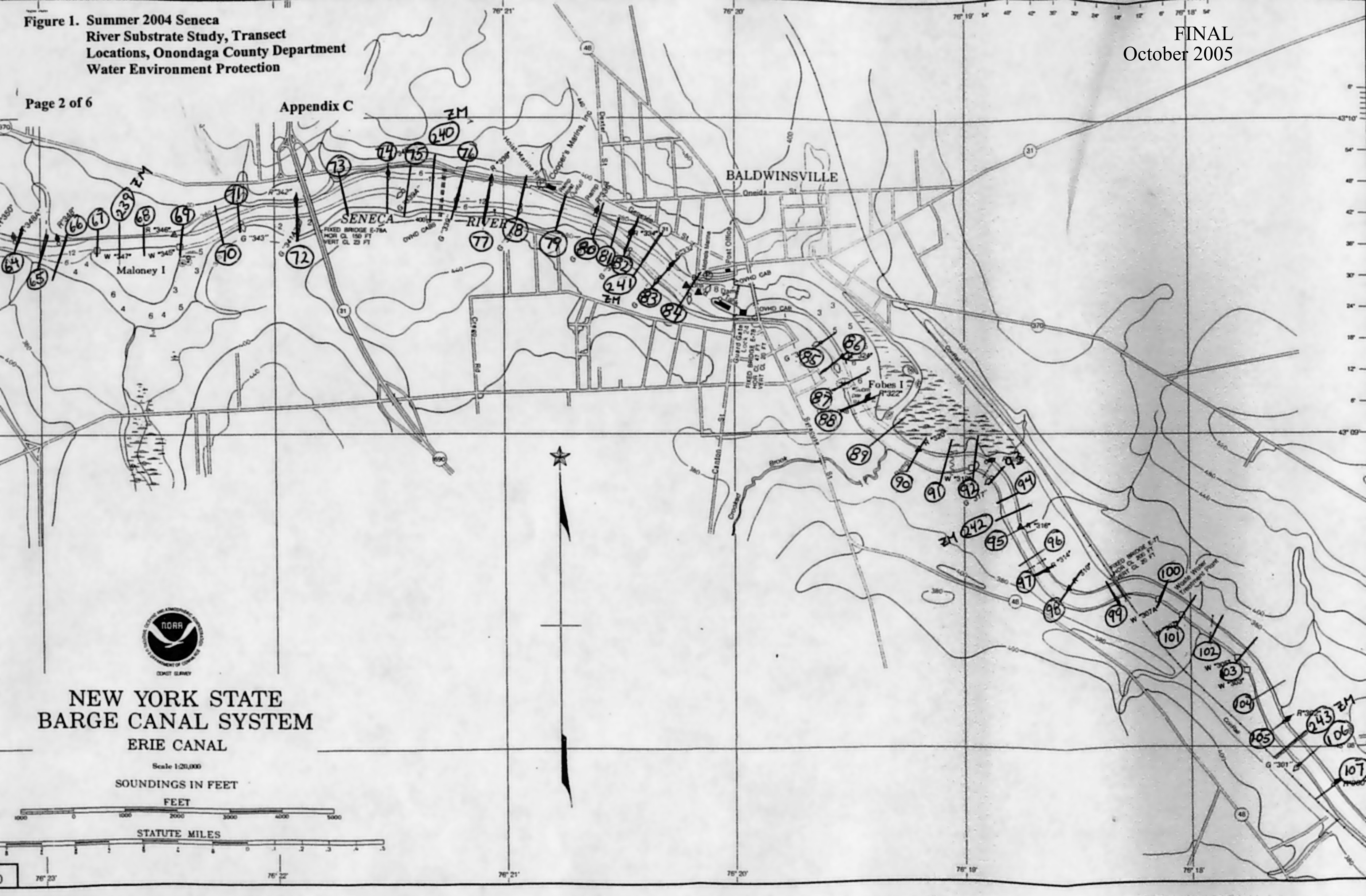
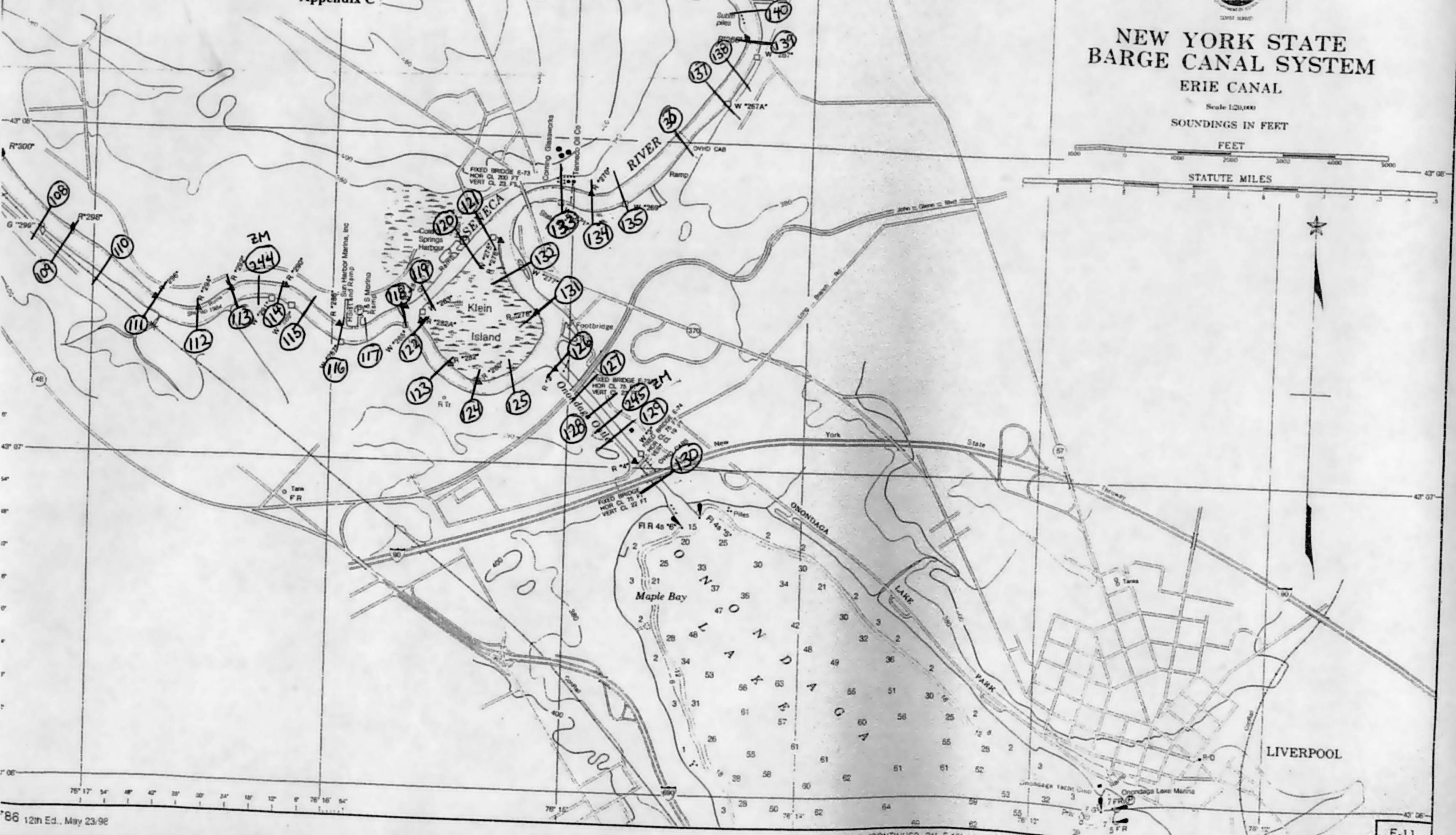


Figure 1. Summer 2004 Seneca River Substrate Study, Transect Locations, Onondaga County Department Water Environment Protection



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igure 1. Summer 2004 Seneca River Substrate Study, Transect Locations, Onondaga County Department Water Environment Protection

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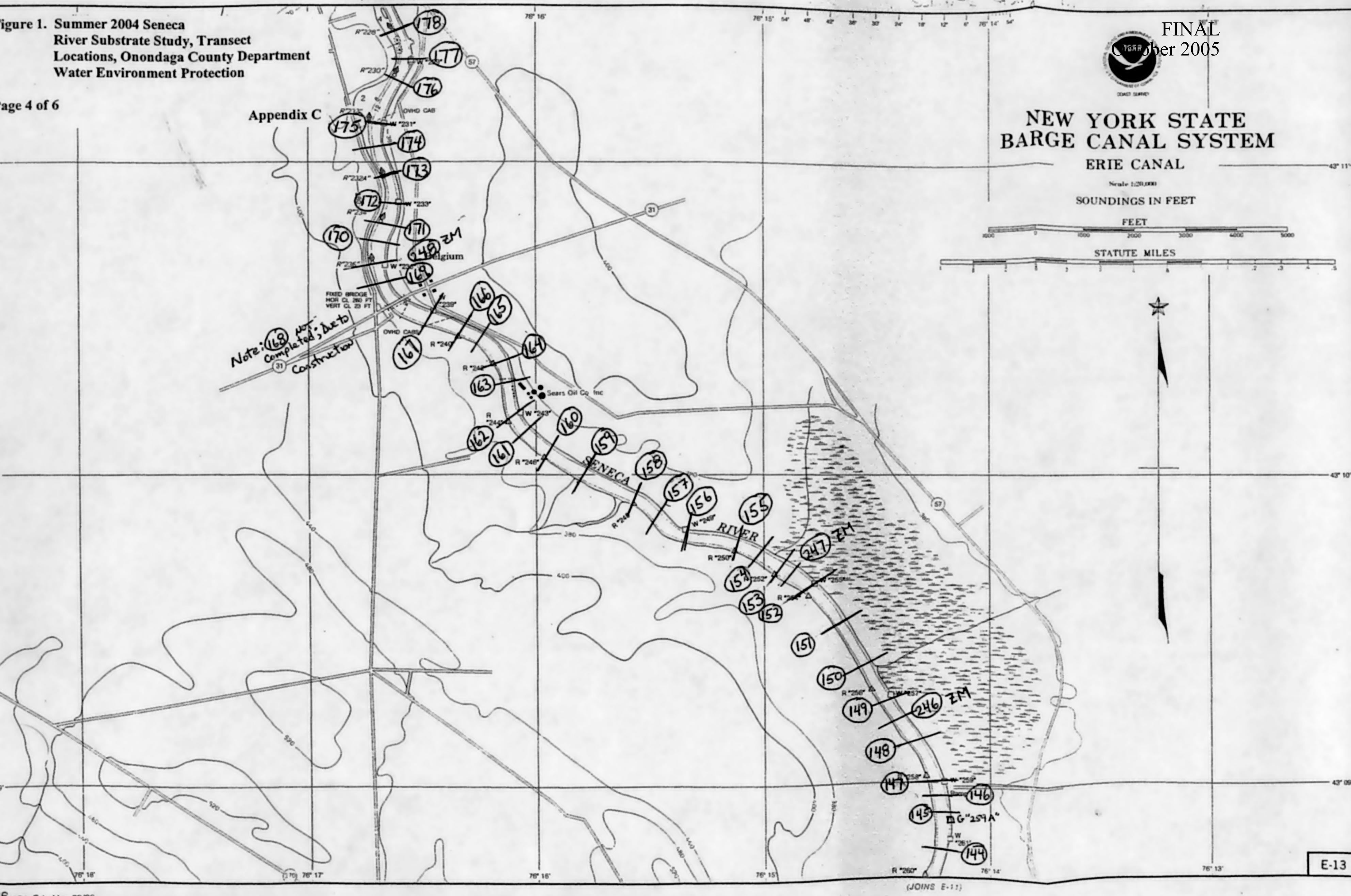

Note: 168 not completed; Due to Construction

6 12th Ed., May 23/98

Figure 1. Summer 2004 Seneca River Substrate Study, Transect Locations, Onondaga County Department Water Environment Protection

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NOTICE - REVERSAL OF AIDS TO NAVIGATION

North of this point in the Oswego River:
Red Markers and Red Buoys are on the East side of Channel.
White Markers and Green Buoys are on the West side of Channel.

South of this point in the Seneca River:
Red Markers and Red Buoys are on the West side of Channel.
White Markers and Green Buoys are on the East side of Channel.

Figure 1. Summer 2004 Seneca River Substrate Study, Transect Locations, Onondaga County Department Water Environment Protection

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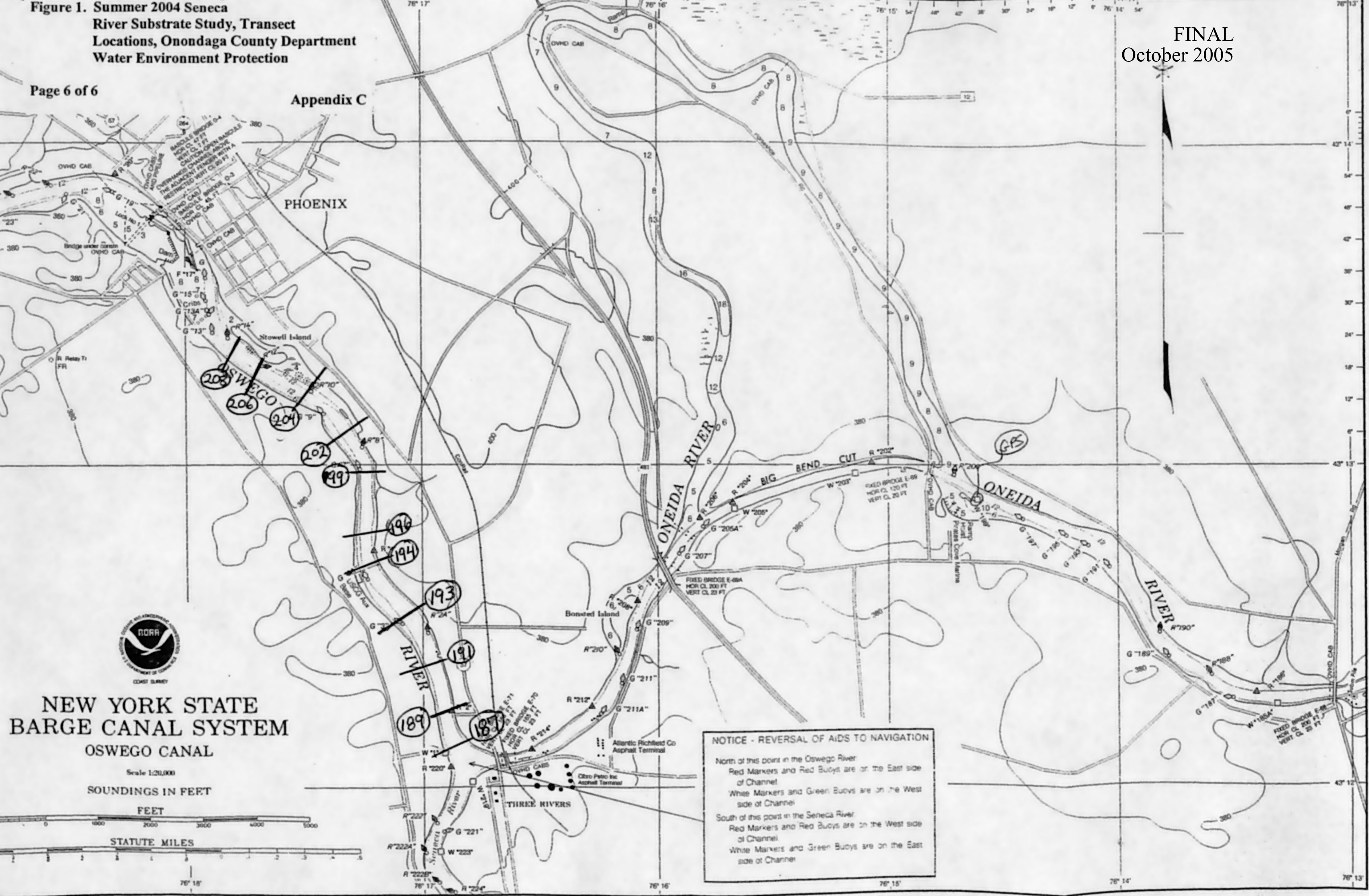
FINAL
October 2005



NOTICE - REVERSAL OF AIDS TO NAVIGATION

North of this point in the Oswego River:
Red Markers and Red Buoys are on the East side of Channel.
White Markers and Green Buoys are on the West side of Channel.

South of this point in the Seneca River:
Red Markers and Red Buoys are on the West side of Channel.
White Markers and Green Buoys are on the East side of Channel.

Table A6 C-1 Length and Weight Data, Seneca River Dreissenid Assessment Program, Summer 2004.

Sample ID Number	Sample Date	Habitat Zone	Transect	Sample	Depth (feet)	Median Particle Size Per Sample	Mean Particle Size Per Zone	Numbers Per Subsample	Weight Per Subsample g	Weight Per Sample g	TOTAL WEIGHT g/M2	MEAN WEIGHT g/M2 PER ZONE	TOTAL NUMBER Per Sample	TOTAL NUMBER PER M2	MEAN NUMBER PER M^2 ZONE
		I	A	R	8.0	6.5	**6.50**	0	0	0	0.0	**0.00**	0	0.0	0
		I	A	M	8.7	6.5		0	0	0	0.0		0	0.0	
		I	A	G	7.8	6.5		0	0	0	0.0		0	0.0	
10	10/26/99	II	A	R	15.0	3.35	**4.70**	0	0	0	0.0	**0.00**	0	0.0	**0**
11	10/26/99	II	A	M	20.0	6.50		0	0	0	0.0		0	0.0	
12	10/26/99	II	A	G	3.0	4.25		0	0	0	0.0		0	0.0	
19	10/26/99	III	A	R	14.0	-8.00	**-7.57**	100	20	95	3,067.6	**2,141.90**	475	15,337.8	**8,106**
20	10/26/99	III	A	M	13.2	-9.97		100	38	100	3,229.0		263	8,497.4	
21	10/26/99	III	A	G	11.1	-4.75		15	4	4	129.2		15	484.4	
28	10/27/99	IV	A	R	14.1	-6.49	**-1.75**	0	0	0	0.0	**0.00**	0	0.0	**0**
29	10/27/99	IV	A	M	13.4	-3.00		0	0	0	0.0		0	0.0	
30	10/27/99	IV	A	G	5.0	4.25		0	0	0	0.0		0	0.0	
43	10/27/99	V	A	R	13.9	-0.49	**4.17**	0	0	0	0.0	**5.38**	0	0.0	**32**
44	10/27/99	V	A	M	13.5	6.50		3	0.5	0.5	16.1		3	96.9	
45	10/27/99	V	A	G	13.5	6.50		0	0	0	0.0		0	0.0	
52	10/28/99	VI	A	R	9.7	-6.49	**-5.16**	100	18	42	1,356.2	**737.29**	233	7,534.3	**3,620**
53	10/28/99	VI	A	M	12.3	-6.49		3	0.5	0.5	16.1		3	96.9	
54	10/28/99	VI	A	G	11.3	-2.49		100	26	26	839.5		100	3,229.0	
61	10/28/99	VII	A	R	12.7	-9.97	**-6.06**	100	31	111	3,584.2	**2,260.30**	358	11,561.9	**8,294**
62	10/28/99	VII	A	M	12.8	-9.97		100	24	99	3,196.7		413	13,319.6	
63	10/28/99	VII	A	G	13.2	1.75		0	0	0	0.0		0	0.0	
70	10/28/99	VIII	A	R	12.3	-9.97	**-6.82**	7	0.5	0.5	16.1	**468.21**	7	226.0	**1,927**
71	10/28/99	VIII	A	M	13.1	-8.24		0	0	0	0.0		0	0.0	
72	10/28/99	VIII	A	G	3.0	-2.25		100	25	43	1,388.5		172	5,553.9	
79	10/28/99	IX	A	R	15.8	6.50	**1.01**	0	0	0	0.0	**10.76**	0	0.0	**97**
80	10/28/99	IX	A	M	13.5	6.50		0	0	0	0.0		0	0.0	
81	10/28/99	IX	A	G	10.2	-9.97		9	1	1	32.3		9	290.6	
88	10/29/99	X	A	R	9.0	-9.97	**-6.06**	57	8	8	258.3	**134.54**	57	1,840.5	**969**
89	10/29/99	X	A	M	12.9	-9.97		24	4	4	129.2		24	775.0	
90	10/29/99	X	A	G	12.7	1.75		9	0.5	0.5	16.1		9	290.6	
97	10/29/99	XI	A	R	18.3	6.50	**6.50**	0	0	0	0.0	**0.00**	0	0.0	**0**
98	10/29/99	XI	A	M	19.0	6.50		0	0	0	0.0		0	0.0	
99	10/29/99	XI	A	G	15.7	6.50		0	0	0	0.0		0	0.0	
106	11/01/99	XII	A	R	14.2	1.75	**-4.32**	100	39	54	1,743.7	**764.20**	138	4,470.9	**2,201**
107	11/01/99	XII	A	M	14.2	-9.97		0	0	0	0.0		0	0.0	
108	11/01/99	XII	A	G	8.9	-4.75		66	17	17	548.9		66	2,131.1	
115	11/01/99	XIII	A	R	19.2	9.00	**1.84**	0	0	0	0.0	**64.58**	0	0.0	**635**
116	11/01/99	XIII	A	M	18.4	-9.97		59	6	6	193.7		59	1,905.1	
117	11/01/99	XIII	A	G	21.3	6.50		0	0	0	0.0		0	0.0	
130	11/01/99	XIV	A	R	12.7	1.75	**2.75**	8	0.5	0.5	16.1	**1,587.59**	8	258.3	**2,731**
131	11/01/99	XIV	A	M	16.1	6.50		14	1	1	32.3		14	452.1	

Table A6 C-1 Length and Weight Data, Seneca River Dreissenid Assessment Program, Summer 2004.

Sample ID Number	Sample Date	Habitat Zone	Transect	Sample	Depth (feet)	Median Particle Size Per Sample	Mean Particle Size Per Zone	Numbers Per Subsample	Weight Per Subsample g	Weight Per Sample g	TOTAL WEIGHT g/M2	MEAN WEIGHT g/M2 PER ZONE	TOTAL NUMBER Per Sample	TOTAL NUMBER PER M2	MEAN NUMBER PER M^2 ZONE
132	11/01/99	XIV	A	G	14.3	0.00		100	63	146	4,714.3		232	7,483.1	
139	11/02/99	XV	A	R	18.8	6.50	**3.33**	0	0	0	0.0	**505.88**	0	0.0	**2,108**
140	11/02/99	XV	A	M	22.3	6.50		0	0	0	0.0		0	0.0	
141	11/02/99	XV	A	G	22.8	-3.00		100	24	47	1,517.6		196	6,323.5	
148	11/02/99	XVI	A	R	22.8	-9.97	**-9.97**	22	0.5	0.5	16.1	**16.15**	22	710.4	**657**
149	11/02/99	XVI	A	M	25.0	-9.97		0	0	0	0.0		0	0.0	
150	11/02/99	XVI	A	G	20.0	-9.97		39	1	1	32.3		39	1,259.3	
157	11/02/99	XVII	A	R	18.2	-9.97	**-9.97**	6	0.5	0.5	16.1	**209.89**	6	193.7	**1,087**
158	11/02/99	XVII	A	M	15.8	-9.97		45	14	14	452.1		45	1,453.1	
159	11/02/99	XVII	A	G	16.9	-9.97		50	5	5	161.5		50	1,614.5	
166	11/03/99	XVIII	A	R	13.5	6.50	**-4.48**	0	0	0	0.0	**1,533.78**	0	0.0	**2,410**
167	11/03/99	XVIII	A	M	15.7	-9.97		2	0.5	0.5	16.1		2	64.6	
168	11/03/99	XVIII	A	G	15.8	-9.97		100	64	142	4,585.2		222	7,164.3	
175	11/08/99	XIX	A	R	16.7	-9.97	**1.01**	6	0.5	0.5	16.1	**5.38**	6	193.7	**65**
176	11/08/99	XIX	A	M	18.5	6.50		0	0	0	0.0		0	0.0	
177	11/08/99	XIX	A	G	12.4	6.50		0	0	0	0.0		0	0.0	

Table A6 C-2. Substrate Probing Data, OCDWEP Summer 2004 Study

Transect	Bouy/Ref.	Zone	Latitude (deg min sec)	Longitude (deg min sec)	Probe- Red to Green										Comments
					1		2		3		4		5		
					Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	
1	G411	II	43 06 28	76 27 10	M	8.5'	M	14.2'	M	18.1'	M	14.8'	SG	8.7'	
2	G411-R410A	II	43 06 25	76 27 07	SG	6.3'	M	16.9'	M	19.7'	M	17.5'	M	9.3'	Verified
3	R410A	II	43 06 22	76 27 00	M	7'	M	14.2'	M	21.6'	M	23'	HC	6.8'	
4	R410A-R410	II	43 06 20	76 27 00	M	6.8'	M	15.9'	M	22.2'	M	18.3'	M	8.3'	
5	R410	II	43 06 18	76 26 55	M	6.8'	M	13.1'	M	20'	M	13.8'	SG	7.9'	
6	R410-R408	II	43 06 18	76 26 51	SG	6.3'	SG,M	14'	M	22.2'	M	13.7'	SG	8'	
7	R408	II	43 06 15	76 26 44	M	8.4'	SG,M	17.9'	SG	21'	M	15'	M	3.7'	POST R 408- 43 06 17 / 76 25 45
8	R406	III	43 06 19	76 26 34	CB	3'	CB	7.8'	CB,SG	13.5'	SG	13.2'	SG,CB	3'	
9	R406-W403	III	43 06 22	76 26 31	CB	3'	CB	10.2'	CB	13.8'	SG	14.2'	CB,SG	3'	
10	W403	III	43 06 23	76 26 29	BR	4'	BR	12.6'	CB,SG	13.7'	BR	14'	SG,BR	3'	
11	R402	III	43 06 27	76 26 28	SG,CB	4'	SG	8'	SG	14'	SG,BR	13.7'	CB	3'	
12	W401	III	43 06 34	76 26 26	SG	3'	CB,SG	6'	SG	14.3'	BR	13.2'	CB,SG	3'	POST W401-43 06 33 / 76 26 25
13	W401-BRDG	III	43 06 39	76 26 24	CB,SG	3'	CB,SG	9.5'	CB,SG	14'	CB,SG	13.7'	CB,SG	3'	
14	BRDG	III	43 06 49	76 26 21	SG,CB	3'	SG,CB	13.5'	SG,CB	13.3'	CB,SG	13.4'	CB,SG	3'	
15	W399	III	43 06 54	76 26 20	SG,BR	3'	SG,BR	10.3'	BR	12.7'	BR	13'	CB	3'	
16	W399-R398	III	43 07 00	76 26 19	BR	3.5'	CB,BR	13.2'	SG,CB	13.5'	CB	13.4'	CB	3.5'	
17	R398	III	43 07 08	76 26 20	SG	4.5'	SG	5.2'	CB	13'	CB,BR	13'	SG	12.6'	
18	R398-G397	IV	43 07 11	76 26 18	SG	3.3'	CB	10.5'	CB	12.9'	CB,SG	13.7'	SG	3'	
19	G397	IV	43 07 16	76 26 15	SG	7'	SG	15.3'	SG	14.7'	SG	3'	SG	3'	
20	R396	IV	43 07 24	76 26 14	SG	3'	SG	7.3'	M	13.2'	SG	13.8'	SG	7'	POST R396- 43 07 23 / 76 26 16
21	G395-R394	IV	43 07 28	76 26 13	SG	3'	M	14'	M	13.3'	SG	6'	SG	5.3'	
22	R394	IV	43 07 30	76 26 12	SG,M	3'	M	14.2'	SG,M	5.5'	SG	4.5'	SG,M	6'	
23	G393	IV	43 07 35	76 26 14	M	3'	M	14.5'	SG	14.1'	M	5.2'	SG,M	4.5'	
24	R392	IV	43 07 39	76 26 16	M	3'	M	12.6'	M	12.9'	M	13.7'	SG	4.9'	
25	R392-G391	IV	43 07 44	76 26 17	M	6'	M	11.2'	M	13.9'	M	13.3'	M,SG	4'	
26	G391	IV	43 07 49	76 26 18	SG,M	11.6'	SG	13.4'	SG	12.4'	M	13.3'	SG	3'	
27	G391-G389	IV	43 07 55	76 26 19	M	12.4'	M	15.1'	M	14'	M	13'	M	5.8'	
28	G389	IV	43 08 00	76 26 19	M	13.5'	M	15.1'	M	16'	M	14.3'	M	4'	
29	R388	IV	43 08 10	76 26 13	M	13.1'	M	11.6'	M	13'	M	12.4'	M	9.6'	
30	R388-G387	IV	43 08 12	76 26 12	M	8.3'	SG	12.1'	SG	11.8'	SG	9.2'	SG	5'	
31	G387-G385	IV	43 08 18	76 26 11	M	9.5	M	13.5	M	12.5'	M	11.7'	HC,M	3'	
32	G385	IV	43 08 27	76 26 10	M	7.9'	M	16.5'	M	16.6'	M	16.6'	M	14.7'	
33	R384-R382	IV	43 08 30	76 26 07	SG,M	8.6'	M	16.7'	M	18.6'	M	16.2'	M	10.9'	
34	R382	IV	43 08 36	76 25 56	SG,M	7'	SG	12.1'	SG,M	8'	M	4'	M	3'	
35	R380	IV	43 08 46	76 25 52	M	7.1'	M	12.7'	HC	12.8'	SG,HC	6.6'	SG,HC	4'	
36	R380-G379	IV	43 08 54	76 25 48	M	17.4'	M	15.9'	M	16.3'	SG	17.7'	M	6'	
37	G379	IV	43 09 02	76 25 44	HC,M	6'	M	14.2'	M	13.8'	M	12.2'	SG,M	8'	
38	G377	V	43 09 10	76 25 39	SG	7'	SG	11.8'	SG	13.3'	M	12.5'	SG	8.8'	
39	G377-R376	V	43 09 13	76 25 34	SG	6'	SG	11.4'	M	16'	M	12.1'	M	10.3	

Substrate Key:
M=Muck/Silt, HC=Hard Pan Clay,
SG=Sand/Gravel, CB=Cobble/Boulder, BR=Bedrock

Table A6 C-2. Substrate Probing Data, OCDWEP Summer 2004 Study

Transect	Bouy/Ref.	Zone	Latitude (deg min sec)	Longitude (deg min sec)	Probe- Red to Green										Comments
					1		2		3		4		5		
					Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	
40	R376	V	43 09 21	76 25 23	SG	6.6'	SG,HC	6.8'	HC	13.1'	SG	15.3'	SG	6.4'	
41	G375	V	43 09 27	76 25 12	M	13.7'	M	14.1'	SG	18.4'	M	19.5'	M	16.3'	
42	R374	VI	43 09 29	76 25 06	M	7'	M	12.7'	M	12.4'	M	16.5'	M	13.9'	
43	G373	VI	43 09 35	76 24 54	SG	3.7'	M	11'	SG	12.5'	SG	5.7'	SG	2.5'	
44	R372	VI	43 09 38	76 24 51	CB,SG	4.2'	CB	10'	SG,CB	11.8'	CB	4.2'	SG,CB	3.3'	
45	G371	VI	43 09 43	76 24 47	SG,CB	6'	SG,M	11.5'	CB,SG	12.1'	SG	9'	SG	4.9'	
46	R370	VI	43 09 47	76 24 45	SG,CB	3.9'	SG	12'	SG	11.9'	SG	7'	CB,SG	6'	
47	G369	VI	43 09 50	76 24 42	M	12.3'	M	12.8'	M	11'	M	9.3'	M	8'	
48	G369-G367	VI	43 09 51	76 24 40	M	11.9'	M	14.6'	HC	16'	M	14'	M	8.4'	
49	G367	VI	43 09 55	76 24 33	HC	10.9'	HC	12.4'	M	13.5'	M	13.5'	HC	3'	
50	G365A	VI	43 09 56	76 24 29	M	8'	M	14'	CB,SG	14.9'	M	11.2'	M	6'	
51	W365	VI	43 09 55	76 24 24	SG,M	6'	M	10.1'	M	14.3'	M	9.5'	M	3.9'	POSTW365- 43 09 53/ 76 24 26
52	W363	VI	43 09 52	76 24 19	SG	4.6'	SG,CB	8.9'	SG,CB	13.4'	SG,M	12.8'	SG.CB	3'	
53	W363-R362	VI	43 09 48	76 24 16	SG,CB	9.4'	CB	13.2'	M	13.5'	SG.CB	14'	CB,SG	3'	
54	R362	VI	43 09 44	76 24 13	SG	3'	SG	12.5'	SG	13.5'	SG	14'	SG	12'	
55	R360	VI	43 09 42	76 24 09	SG	10.8'	SG	13.1'	HC	15.1'	M	15.5'	SG,CB	3'	POST R360- 43 09 44 / 76 24 09
56	R358	VI	43 09 43	76 23 59	SG,M	3'	M	12.7'	CB,SG	13.1'	SG	12.3'	M	11'	
57	G357	VII	43 09 46	76 23 48	M	9.8'	M	12'	M	13'	M	11.9'	SG	3'	
58	G357-G355	VII	43 09 47	76 23 42	SG,M	13.1'	SG,M	13.3'	SG	12.7'	M	11.7'	SG,CB	4.2'	
59	G355	VII	43 09 48	76 23 36	SG,M	6'	SG,M	14.6'	M	15'	M	13.5'	M	12.2'	
60	G353A	VII	43 09 45	76 23 27	SG,BR	4'	SG	11.2'	HC	12.9'	M	11.9'	SG,CB	3'	
61	G353	VII	43 09 41	76 23 23	BR	3'	CB,BR	11.5'	SG	12.8'	BR	12.4'	HC	3'	
62	R352	VII	43 09 38	76 23 19	SG,CB,M	6'	CB	9.9'	CB	13'	M	10.5'	M	3'	
63	R350	VII	43 09 35	76 23 13	M,BR	6'	CB	10.3'	CB	13.1'	SG	8.6'	SG	6'	
64	R348A	VII	43 09 34	76 23 10	M	3'	M	17'	SG	17.8'	CB	18.6'	SG	3'	
65	R348A-R348	VII	43 09 33	76 23 02	SG,M	3'	SG,M	6'	M	17.5'	BR	18.8'	M	9.9'	
66	R348	VII	43 09 32	76 22 54	M	6.9'	M	10.9'	CB,BR	12.8'	M	10.6'	M	8'	
67	W347	VIII	43 09 34	76 22 46	SG	3'	M	12.7'	M	13.4'	SG,CB	12.5'	SG,CB	3'	
68	W347-R346	VIII	43 09 34	76 22 34	CB	3'	CB	12.4'	BR	13.3'	CB	12.8'	CB	3'	
69	W345	VIII	43 09 34	76 22 26	SG	3'	M	13.9'	M	6.6'	M	3'	M	3'	
70	W345-G343	VIII	43 09 36	76 22 18	SG	3'	M	8'	CB	12.5'	SG	6'	SG	6'	
71	G343	VIII	43 09 39	76 22 10	CB,SG	3'	CB	13.4'	SG,M	13.3'	SG	12.9'	M	13.3'	
72	R342	IX	43 09 39	76 21 57	SG OVER HC	3'	M	12.4'	CB,SG	4.8'	CB	3'	CB	3'	
73	R342-R340	IX	43 09 43	76 21 43	M OVER HC	3'	CB	12.3'	CB	12.4'	CB	10.2'	M OVER HC	4'	
74	R340	IX	43 09 44	76 21 37	M	8'	M	13.6'	CB	13.8'	M	8'	M	3'	
75	G339A	IX	43 09 45	76 21 30	SG	4'	SG	12'	CB	12.2'	M	8'	M	3'	
76	G339	IX	43 09 44	76 21 20	SG	5'	SG	11.3'	M	11.4'	SG	7.6'	M	3'	
77	R338	IX	43 09 45	76 21 12	M	3'	M	13.2'	M	12.9'	M	10.1'	M	3'	
78	G337	IX	43 09 43	76 21 00	HC	5'	M	12.1'	M	12.5'	M	7.7'	M	3'	

Substrate Key:
M=Muck/Silt, HC=Hard Pan Clay,
SG=Sand/Gravel, CB=Cobble/Boulder, BR=Bedrock

Table A6 C-2. Substrate Probing Data, OCDWEP Summer 2004 Study

Transect	Bouy/Ref.	Zone	Latitude (deg min sec)	Longitude (deg min sec)	Probe- Red to Green										Comments
					1		2		3		4		5		
					Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	
79	G337-G335	IX	43 09 41	76 20 49	M	5'	M	10.2'	CB	11.8'	M	5'	M	3'	
80	G335	X	43 09 40	76 20 42	M	3'	CB	8'	BR	12.9'	SG,CB	7.5'	CB	8'	
81	G335-R334	X	43 09 38	76 20 37	SG	5'	SG	12.1'	M	12.4'	M	8'	SG	5'	
82	R334	X	43 09 37	76 20 32	M	3'	SG	8'	CB	12.7'	M	11.9'	SG	8'	
83	G331	X	43 09 31	76 20 21	SG	4'	SG	8.5'	M	13.5'	M	11.2'	M	5'	
84	ABOVE LOCK	X	43 09 26	76 20 14	SG	4'	M	13.8'	M	14'	M	13.6'	M	5'	
85	G325	XI	43 09 17	76 19 38	M	11.1'	M	12.2'	M	12.9'	M	11.1'	CB	3.6'	
86	R324	XI	43 09 12	76 19 33	SG,CB	11.1'	M	12.8'	M	12.9'	CB,M	13'	BR,SG	4'	POST R324-43 09 13 / 76 19 32
87	R324-OHCAB	XI	43 09 08	76 19 30	SG	3'	SG,CB	6.5'	CB	13.6'	BR	13.8'	M	7'	
88	R322	XI	43 09 04	76 19 27	M	7'	M	13.4'	CB	16.1'	CB	16.4'	M	6'	
89	R322-R320	XI	43 09 00	76 19 22	M	5'	M	7.5'	HC	19.5'	CB	17.4'	M	4'	
90	R320	XI	43 08 55	76 19 10	CB	9'	SG	15.4'	CB	16.7'	M	17.6'	CB,BR	7'	
91	R320-W319	XI	43 08 54	76 19 02	M	5'	M	9.2'	M	17.2'	M	17.8'	CB,BR	18.9'	
92	G319	XI	43 08 55	76 18 57	M	3.6'	M	8'	M	19.1'	M	22'	M	19.8'	POST G319- 43 08 53 / 76 18 58
93	G317	XI	43 08 49	76 18 50	M	14.9'	CB	17.8'	CB	23.2'	CB	21.8'	M	6'	
94	G317-R316	XI	43 08 46	76 18 49	M	15.9'	M	20.4'	CB	19.8'	M	5.8'	M	3'	
95	R316	XI	43 08 41	76 18 47	M	16.9'	M	20'	M	19.3'	M	16.7'	M	3'	
96	R316-R314	XI	43 08 38	76 18 44	M	15.7'	M	21.2'	M	21.4'	M	21.6'	M	19.5'	
97	R314	XI	43 08 31	76 18 37	M	13.9'	M	17'	M	19.6'	M	19.5'	M	12.1'	
98	R310	XI	43 08 28	76 18 28	CB	8.2'	CB	14.4'	CB	14.8'	CB	14.1'	CB	8.8'	
99	BRIDGE	XI	43 08 31	76 18 18	M	3'	M	9.9'	CB	14.1'	CB	10.2'	CB	8.5'	
100	W307A	XI	43 08 30	76 18 08	CB	13.6'	CB	15'	CB	13.6'	CB	14.6'	CB,M	14.3'	
101	W307	XI	43 08 26	76 18 01	CB	14.1'	CB	13.8'	CB	14'	M	13.9'	M	13.3'	
102	W307-W305	XI	43 08 23	76 17 54	CB	12.5'	CB	17.6'	CB	18.4'	CB	17.2'	M	14.8'	
103	W305	XI	43 08 20	76 17 48	M	19.5'	M	21'	CB,M	20.7	M	17.9'	M	13.9'	
104	W303-R302	XII	43 08 12	76 17 41	M	12.9'	M	14.7'	M	16.5'	M	14.9'	M	7'	
105	R302	XII	43 08 05	76 17 37	SG	6.4'	SG	13.6'	M	14.2'	M	11.5'	SG,M	4.9'	
106	G301	XII	43 08 01	76 17 32	HC	5.2'	BR	8.6'	BR	14.3'	BR	13.5'	BR	4'	
107	R300	XII	43 07 54	76 17 25	SG	3'	BR	4'	M	14.1'	BR	13.5'	BR	13.7'	
108	G299	XII	43 07 41	76 17 09	M	7'	HC	13.8'	BR	13.5'	M	9.4'	M	7'	
109	R298	XII	43 07 39	76 17 06	M	4'	M	14'	CB	13.6'	CB	8.2'	CB	7'	
110	R298-R296	XII	43 07 33	76 16 55	BR	17.1'	BR	17.5'	CB	16.4'	BR	15.8'	BR	7'	
111	R296	XIII	43 07 28	76 16 44	SG,CB	7'	CB	19.7'	BR	23'	M	19.6'	SG OVER BR	7'	POST R296- 43 07 29 / 76 16 43
112	R294	XIII	43 07 26	76 16 35	M	7'	M	12.2'	CB	18.1'	M	17.7'	M	10'	
113	R292	XIII	43 07 28	76 16 27	M	4'	BR	12.1'	BR	19.9'	BR	23.8'	BR	16'	
114	R290	XIII	43 07 30	76 16 14	M	18.6'	M	22.2'	M	21.9'	BR	20.9'	M	5'	
115	W289-R286	XIII	43 07 26	76 16 05	CB	18.9'	M	20.2'	M	20.2'	M	6'	M	3'	
116	W287	XIII	43 07 23	76 15 58	M	23.1'	M	24.1'	M	21.9'	M	20.9'	M	19.2'	
117	JS MARINA	XIII	43 07 23	76 15 51	M	9'	M	14.8'	M	23.9'	M	23.4'	M	23.7'	

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Transect	Bouy/Ref.	Zone	Latitude (deg min sec)	Longitude (deg min sec)	Probe- Red to Green										Comments
					1		2		3		4		5		
					Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	
118	W285	XIII	43 07 26	76 15 44	M	7'	M	19.6'	M	24.8'	M	19.9'	CB	3'	POST W285- 43 07 25 / 76 15 44
119	OH CABLE	XIII	43 07 28	76 15 39	M	9.8'	M	14.6'	M	16'	M	16.3'	M	16.1'	
120	COLD SP HARB	XIII	43 07 34	76 15 30	M	7'	M	13.5'	M	17.8'	M	14.3'	HC	4'	
121	W275	XIII	43 07 43	76 15 20	M	3'	M	6'	M	14.9'	M	15.9'	SG,M	3'	
122	R282A	XIII	43 07 23	76 15 37	M	17.2'	M	19.9'	M	15'	M	6'	M	3'	
123	R282	XIII	43 07 17	76 15 31	M	15.5'	M	17.8'	M	16.9'	M	14.8'	M	12.8'	
124	R280	XIII	43 07 14	76 15 20	M	7.7'	M	15.9'	M	19.1'	M	23.1'	M	14.2'	POST R280- 43 07 15 / 76 15 20
125	R280-OUTLET	XIII	43 07 17	76 15 09	M	11.9'	M	16.3'	M	17.6'	M	19.6'	M	18.4'	
126	R2 OUTLET	XIII	43 07 19	76 15 04	HC	4'	M	9.9'	M	18.4'	M	18.3'	M	7'	
127	J.GLENN	XIV	43 07 17	76 15 01	CB,SG	5'	CB,SG	9.7'	CB	15.6'	CB,SG	17.6'	CB,SG	8'	
128	MIDWAYOUTLEY	XIV	43 07 11	76 14 53	SG,CB	6'	SG	11.8'	SG,CB	17.1'	SG,CB	13.2'	CB	4'	
129	WATER QUALIT	XIV	43 07 09	76 14 49	SG	8'	SG,CB	15'	SG,CB	16.1'	M	11.8'	M,SG	7'	
130	I-90 BRIDGE	XIV	43 07 01	76 14 40	CB	4'	CB	13.4'	CB	15.8'	SG	9.8'	M,SG	3'	
131	R278	XIII	43 07 29	76 15 05	M	11.7'	M	15.9'	M	18.9'	M	21.9'	SG	7'	
132	W277	XIII	43 07 35	76 15 13	SG	5'	M	20.3'	M	19.9'	M	15.6'	M	10.9'	
133	W271	XIII	43 07 50	76 15 03	M	18.3'	M	23.9'	M	26.1'	M	22.6'	M	13.4'	
134	R270	XIII	43 07 49	76 14 56	M	22.1'	M	29.1'	M	35.2'	M	23.3'	M	17.7'	
135	W269	XIII	43 07 49	76 14 51	M	18'	M	27.2'	M	31.2'	M	26.6'	CB	8'	POST W269- 43 07 48 / 76 14 51
136	OH CABLE	XIII	43 08 03	76 14 30	M	7'	M	19.3'	CB	25.5'	M	24.7'	M	9'	
137	W267A	XIII	43 08 12	76 14 20	M	6'	M	19'	M	27.2'	CB	23.7'	CB	12.4'	
138	W267A-267	XIII	43 08 16	76 14 17	M	5'	M	24.1'	M	27.1'	M	28.5'	M	20.7'	
139	R266	XIII	43 08 20	76 14 16	M	5'	M	23.6'	M	28.8'	M	27.3'	M	15.7'	
140	R266-W265	XIII	43 08 25	76 14 19	M	3'	M	4'	M	6'	M	38'	M	32'	
141	W265	XIII	43 08 31	76 14 21	CB	13'	CB	27.1'	M	30'	M	9'	M	4'	
142	W263	XIII	43 08 37	76 14 20	HC	3'	M	23.3'	M	31.9'	CB	27.4'	CB	15.6'	
143	R260	XIII	43 08 41	76 14 16	HC	4'	M	22.8'	M	29.4'	M	27.6'	CB	6'	
144	R260-W259A	XIII	43 08 46	76 14 14	HC	6'	M	28.3'	M	33.6'	M	25.9'	CB	11'	
145	W259A	XIII	43 08 49	76 14 13	M	12'	M	22'	M	30.2'	M	21.8'	M	8'	W261=259A- 43 08 49 / 76 14 11
146	W259A-W259	XV	43 08 53	76 14 12	M	5'	M	21.9'	M	29.2'	M	25.4'	CB	12.7'	
147	W259	XV	43 09 01	76 14 14	M	4'	M	8'	M	30.9'	M	33.2'	CB,HC	13'	
148	W258-W257	XV	43 09 07	76 14 20	M	4'	M	8'	M	28'	M	29.5'	CB	4'	
149	W257	XV	43 09 16	76 14 28	CB	4'	CB	22'	M	27.2'	M	26.8'	CB	17.3'	
150	W257-R254(1/2)	XV	43 09 22	76 14 33	SG	4'	M	19'	CB	25.9'	M	21.5'	SG	3'	
151	W257-R254(2/3)	XVI	43 09 28	76 14 38	M	7'	M	24.7'	M	23.1'	M	20.7'	SG	3'	
152	W255	XVI	43 09 32	76 14 41	HC	4'	M	17.3'	M	16'	M	23.9'	HC	4'	POST 254- 43 09 31 / 76 14 42
153	R252	XVI	43 09 39	76 14 50	M	4'	M	22.1'	M	27.1'	M	26.5'	M	4'	
154	R252-R250	XVI	43 09 43	76 14 59	SG	5'	CB	18.9'	M	26'	CB	27.9'	M	13.3'	
155	R250	XVI	43 09 46	76 15 08	HC	3'	M	18'	M	20.9'	M	23.7'	M	21'	
156	W249	XVI	43 09 48	76 15 22	HC	3'	CB	21.4'	CB	22.5'	M	21.9'	CB,SG	3'	

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Transect	Bouy/Ref.	Zone	Latitude (deg min sec)	Longitude (deg min sec)	Probe- Red to Green										Comments
					1		2		3		4		5		
					Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	
157	W249-R248	XVI	43 09 52	76 15 29	HC	3'	HC	9.4'	M	19.5'	HC	26.7'	SG,HC	7'	
158	R248	XVI	43 09 55	76 15 35	SG	3'	M	15.7'	M	18.3'	M	24.2'	SG	5'	
159	R248-R246	XVI	43 10 00	76 15 49	HC	3'	HC	13.1'	CB	22.2'	CB	22.4'	CB	20.8'	
160	R246	XVI	43 10 04	76 15 57	M	3'	CB	16.2'	CB	20'	CB	20.8'	CB	19.5'	
161	R246-R244	XVII	43 10 06	76 16 01	CB	8'	CB	21'	BR	15.4'	BR	21.6'	CB	17.9'	
162	R244	XVII	43 10 10	76 16 05	CB	13.6'	CB	19'	CB	20'	CB	23.2'	CB	19.5'	
163	R244-R242	XVII	43 10 15	76 16 07	CB	11.2'	CB	15.2'	CB	18.5'	M	19.4'	M	6'	
164	R242	XVII	43 10 21	76 16 09	M,CB	4'	CB	26.2'	CB	23.3'	CB	21.2'	SG,CB	13.5'	POST R242- 43 10 20 / 76 16 10
165	R242-R240	XVII	43 10 25	76 16 13	CB	15.6'	CB	23.5'	CB	18.8'	CB	16'	CB	14.4'	
166	R240	XVII	43 10 26	76 16 17	CB	17.2'	CB	18'	HC	20.5'	CB	17.7'	M	15.4'	
167	W239	XVII	43 10 29	76 16 26	SG,M	15.3'	SG	15.8'	M	15.3'	M	15.7'	M	13.6'	
168	RT31BRIDGE	XVII	X	X	X	X	X	X	X	X	X	X	X	X	CONSTRUCTION - NO SAMPLE
169	W235- BRIDGE	XVII	43 10 39	76 16 42	SG	6'	SG	15.8'	CB	14.2'	M	13.8'	M	12.8'	
170	R236-R234	XVII	43 10 48	76 16 39	SG	3'	SG	6'	M	15.2'	SG	17'	M	15.6'	
171	R234	XVII	43 10 50	76 16 39	M	7'	M	18.3'	M	17.1'	M	15.8'	M	16.1'	
172	W233	XVII	43 10 53	76 16 38	CB	17.5'	CB	15.8'	M	15.8'	M	15.4'	M	16.3'	
173	R232A	XVII	43 10 58	76 16 39	M	5'	M	16'	M	15.5'	M	15.4'	M	15.9'	
174	R232A-R232	XVII	43 11 03	76 16 42	M	3'	M	8'	M	15.1'	M	15.2'	M	15.5'	
175	R232	XVII	43 11 07	76 16 43	M	3'	M	8.5'	M	14.3'	M	14.6'	M	15.3'	
176	R230	XVII	43 11 18	76 16 36	CB	13.3'	CB	14.6'	M	14.8'	CB	15.3'	CB	15.1'	
177	W229	XVIII	43 11 20	76 16 35	CB	14.4'	CB	14.6'	CB	15.5'	CB	15.1'	CB	3'	POST W229- 43 11 20 / 76 16 33
178	W229-W227(1/3)	XVIII	43 11 26	76 16 37	M	6'	M	9.2'	M	13.4'	M	15'	M	14.9'	
179	W229-W227(2/3)	XVIII	43 11 33	76 16 42	SG	3'	SG	8.6'	M	14.4'	M	15'	M	15.3'	
180	W227	XVIII	43 11 35	76 16 44	M	3'	M	4'	M	10.5'	M	14.7'	M	14.8'	
181	R224	XVIII	43 11 41	76 16 52	M	4'	M	7.6'	M	16.1'	CB	15.6'	M	15.7'	
182	R222B	XVIII	43 11 45	76 16 58	M	6'	M	17.1'	M	18.1'	CB	18.4'	M	18.3'	
183	R222A	XVIII	43 11 48	76 16 59	M	15.8'	M	16.4'	M	15.9'	M	15'	M	14.3'	
184	R222	XVIII	43 11 54	76 16 56	M	12.7'	M	15.2'	M	15.5'	M	16'	M	12.9'	
185	W219	XIX	43 12 03	76 16 49	CB	15.7'	CB	18.7'	CB	18.1'	M	20.9'	M	15'	
186	R214	XIX	43 12 07	76 16 31	M	16.2'	CB	17.9'	CB	18.6'	M	17.8'	CB	17.5'	
187	OSWEGO G1	OSWEGO	43 12 07	76 16 52	CB	18.6'	CB	20.9'	CB	20.8'	M	18.1'	SG	3'	POST G1- 43 12 06 / 76 16 54
188	R212	XIX	43 12 15	76 16 15	CB	16.1'	M	17.9'	CB	17.8'	M	15.5'	M	15.6	
189	OSWEGO R2	OSWEGO	43 12 14	76 16 54	CB	22.4'	BR	25.6'	BR	23'	CB	21.9'	BR	21.4'	
190	R210	XIX	43 12 25	76 16 09	CB	16.3'	CB	17.2'	CB	16.8'	M	16.9'	M	14.3'	
191	OSWEGO R2-R2A	OSWEGO	43 12 23	76 16 57	CB	18.6'	CB	21.8'	CB	21.8'	CB	19.5'	M	17.5'	
192	R208	XIX	43 12 35	76 16 04	CB	16.1'	CB	17.4'	CB	17.8'	CB	17.8'	M	16.4'	
193	OSWEGO G3	OSWEGO	43 12 31	76 17 03	M	13.5'	M	15.8'	CB	16.5'	CB	18.8'	M	3'	
194	OSWEGO G3A	OSWEGO	43 12 38	76 17 12	CB	16.1'	CB	16.6'	CB	16.5'	M	15'	CB	12.9'	
195	R204	XIX	43 12 53	76 15 40	M	14.2'	M	18.3'	M	18.2'	M	15.5'	HC	13.9'	

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Transect	Bouy/Ref.	Zone	Latitude (deg min sec)	Longitude (deg min sec)	Probe- Red to Green										Comments
					1		2		3		4		5		
					Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	
196	OSWEGO R4	OSWEGO	43 12 43	76 17 14	CB	15.2'	M	15.9'	M	16.7'	CB	15.8'	M	17.2'	
197	W203	XIX	43 13 01	76 15 08	M	15'	CB	15.7'	CB	16.6'	CB	16.4'	M	13.5'	
198	R202	XIX	43 13 02	76 15 03	M	15.2'	M	15.4'	CB	17.5'	M	16.5'	M	11.9'	
199	OSWEGO G7	OSWEGO	43 12 50	76 17 15	CB	3'	CB	15.9'	M	15.8'	M	15'	M	12.6'	
200	R200	XIX	43 13 00	76 14 47	M	16.9'	M	17.4'	M	16.8'	M	17'	M	14.8'	
201	W199	XIX	43 12 54	76 14 36	M	15'	M	16.5'	M	16.1'	M	14.1'	M	12.1'	POST W199- 43 12 53 / 76 14 36
202	OSWEGO R8-G9	OSWEGO	43 13 08	76 17 22	BR	3'	BR	16.3'	BR	16.8'	BR	15.3'	CB	3'	
203	G197	XIX	43 12 51	76 14 23	M	16.6'	M	17.2'	M	17'	M	16.8'	M	14.2'	
204	OSWEGO R10	OSWEGO	43 13 14	76 17 28	CB	3'	CB	3'	BR	16.1'	BR	15.7'	CB	6.9'	
205	G195	XIX	43 12 47	76 14 11	M	3'	M	6'	M	15'	M	18.1'	M	14.2'	
206	OSWEGO R12	OSWEGO	43 13 19	76 17 43	CB	3'	CB	15.6'	CB	16.3'	CB	15.9'	CB	8'	
207	G191	XIX	43 12 42	76 13 59	M	10.1	M	10.2'	M	16.7'	M	14.5'	M	8'	
208	OSWEGO B4/ R14	OSWEGO	43 13 24	76 17 50	CB,BR	4'	M	15.5'	SG	15.8'	CB	15.5'	SG	12'	
209	R190	XIX	43 12 29	76 13 49	M	15.7'	M	15.4'	CB	16.7'	CB	16.2'	M	15.5'	
210	G189	XIX	43 12 25	76 13 44	CB	13.1'	M	16.2'	CB	16.7'	CB	9.6'	M	7.5'	
211	G189-R188	XIX	43 12 23	76 13 40	M	3'	CB	15.1'	CB	17'	M	14.3'	M	7'	
212	R188	XIX	43 12 22	76 13 37	M	3'	M	6'	M	15'	CB	17.2'	CB	15.6'	
213	G187	XIX	43 12 18	76 13 26	CB	8'	CB	15.7'	CB	16.5'	M	17.1'	CB	6'	
214	R186	XIX	43 12 18	76 13 23	M	16.8'	M	17.2'	CB	16.2'	CB	16.2'	CB	16.5'	
215	W185A	XIX	43 12 17	76 13 12	M	15.9'	CB	17.3	CB	17.7'	CB	17.7'	CB	8'	
216	OH CABLE	XIX	43 12 17	76 13 08	CB	8'	CB	17.4'	CB	16.8'	CB	15.7'	CB	15.9'	
217	BRIDGE-R182	XIX	43 12 18	76 12 57	CB	16.7'	CB	16.4'	SG	3'	SG	3'	SG	3'	
218	R182	XIX	43 12 23	76 12 49	CB	15.2'	CB	16.4'	CB	16.6'	CB	16.6'	CB	15.4'	
219	R182-R180	XIX	43 12 28	76 12 43	CB	14.9'	CB	16.9'	CB	16.1'	M	14.5'	CB	8'	POST G181 - 43 12 27 / 76 12 41
220	R180	XIX	43 12 31	76 12 41	CB	14.2'	M	14.2'	M	18'	M	17'	M	13.4'	
221	W179	XIX	43 12 35	76 12 38	CB,M	15.1'	CB	17.5'	CB	17.3'	CB	15.6'	M	13'	
222	R178	XIX	43 12 38	76 12 38	M	16.7'	M	16.1'	M	16.8'	M	15.9'	SG	3'	
223	JACK REEF	I	43 06 09	76 26 36	M	4.6'	SG,M	4.2'	M	3.8'	M	11'	M	6.7'	BY MOUTH
224	JACK REEF	I	43 06 05	76 26 30	M	7.5'	M	8.4'	M	8.6'	M	8.1'	M	7.8'	
225	JACK REEF	I	43 06 00	76 26 23	M	8'	M	9.8'	M	9.2'	SG	7.1'	M	5.9'	
226	JACK REEF	I	43 05 56	76 26 20	SG	8.5'	M	11.2'	M	12.2'	M	10'	M	8.8'	BY TEE PEE
227	JACK REEF	I	43 06 55	76 26 14	M	5'	M	5.8'	M	3'	M	2.5'	M	2.5'	
228	JACK REEF	I	43 06 54	76 26 13	M	4.2'	M	5.5'	M	3'	M	3'	M	3'	
229	JACK REEF	I	43 06 52	76 26 11	M	3.2'	M	4'	M	5'	M	3.5'	M	3'	
230	JACK REEF	I	43 06 51	76 26 10	M	3'	M	3.5'	M	3.6'	M	3.5'	M	3.2'	
231	JACK REEF	I	43 06 50	76 26 10	M	3'	M	3'	M	3.1'	M	3'	M	3'	WATER CHESNUT
232	IA	I	43 06 05	76 26 30	M	7.9'	M	8'	M	8.7'	M	7.8'	M	6.7'	
233	IIA R410-G411A	II	43 06 25	76 27 05	M	3'	M,SG	15'	M	20'	SG,M	3'	SG,M	3'	
234	IIIA R402-G401	III	43 06 30	76 26 27	BR,SG	8.3'	CB	14'	BR	13.2'	CB,SG	11.1'	CB	8'	

Substrate Key:
M=Muck/Silt, HC=Hard Pan Clay,
SG=Sand/Gravel, CB=Cobble/Boulder, BR=Bedrock

Table A6 C-2. Substrate Probing Data, OCDWEP Summer 2004 Study

Transect	Bouy/Ref.	Zone	Latitude (deg min sec)	Longitude (deg min sec)	Probe- Red to Green										Comments
					1		2		3		4		5		
					Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	Substrate	Depth	
235	IVA G395-R394	IV	43 07 28	76 26 14	SG,BR	3'	SG,BR	14.1'	SG	13.4'	SG,M	5'	SG	6.6'	
236	V A	V	43 09 16	76 25 28	M	7.3'	BR,HC	13.9'	M	13.5'	M	13'	BR,CB	7'	
237	VI A R372-G371	VI	43 09 41	76 24 49	SG,CB	6'	BR,SG	9.7'	BR,SG	12.3'	CB,SG	11.3'	SG,CB	3.5'	
238	VIIA G353A-G353	VII	43 09 43	76 23 24	SG,BR	3'	BR	12.7'	BR	12.8'	SG,M	13.2'	M	5'	
239	VIII A	VIII	43 09 34	76 22 41	SG,CB	3'	BR	12.3'	BR,CB	13.1'	SG,CB	3'	SG,CB	3'	
240	IXA G339A-G339	IX	43 09 45	76 21 25	M	3'	M	15.8'	M	13.5'	BR	10.2'	M	3'	
241	X A G333-G331	X	43 09 33	76 20 26	M	8'	BR	9'	BR	12.9'	SG,M	12.7'	M	4'	
242	XI A	XI	43 08 43	76 18 48	M	18'	M	18.3'	M	19'	M	15.7'	M	3'	
243	XII A R302-G301	XII	43 08 02	76 17 35	SG,CB	3.6'	SG,M	14.2'	BR	14.2'	CB,SG	8.9'	SG,CB	3.4'	
244	XIII A R292-R290	XIII	43 07 30	76 16 19	HC	7.5'	HC	19.2'	BR	18.4'	M	21.3'	M	13.4'	
245	XIV A	XIV	43 07 15	76 14 58	SG,M	7.5'	SG,M	12.7'	M	16.1'	CB,M	14.3'	CB,SG	6'	
246	XV A	XV	43 09 13	76 14 26	M	11.7'	M	18.8'	M	22.3'	SG	22.8'	CB,SG	6'	
247	XVIA R252-W255	XVI	43 09 36	76 14 45	BR,CB	4'	BR	22.8'	BR	25'	BR	20'	M	4'	
248	XVIIA R236-W235	XVII	43 10 42	76 16 41	M	7'	BR	18.2'	BR	15.8'	BR	16.9'	BR	15.9'	
249	XVIIIA R224-W227	XVIII	43 11 39	76 16 49	M	4'	M	13.5'	BR	15.7'	BR	15.8'	CB,BR	15.5'	
250	XIXA W203-204	XIX	43 12 59	76 15 19	CB	14'	BR	16.7'	M	18.5'	M	12.4'	M	13.6'	

Substrate Key:
M=Muck/Silt, HC=Hard Pan Clay,
SG=Sand/Gravel, CB=Cobble/Boulder, BR=Bedrock

Appendix A6 C **Onondaga County Zebra Mussel Survey-Shell Length (mm), Summer 2004**
Length Data

Sample																														
Transect - Sample	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R
ID Number >	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	ZONE I			ZONE II			ZONE III			ZONE IV			ZONE V			ZONE VI			ZONE VII			ZONE VIII			ZONE IX			ZONE X		
1							4	15	17					11		19	17	6		9	5	24		26	22			19	4	17
2							4	6	10					15		12	18	20		12	7	7		9	12			7	5	17
3							16	20	20					10		12	15	5		23	10	20		7	19			17	8	16
4							17	15	6							22		6		18	20	26		6	22			3	13	22
5							18	5	10							19		8		9	15	8		9	11			2	5	7
6							16	9	10							17		3		11	19	12		9	6			3	6	6
7							12	3	7							18		14		9	12	5		2	20			17	17	6
8							10	11	25							4		16		8	11	10			6			3	7	7
9							15	12	12							18		14		8	7	10			7			3	18	6
10							17	10	9							9		9		10	22	10							7	6
11							13	15	9							16		12		11	25	10							32	7
12							8	10	11							4		8		24	13	14							9	23
13							11	11	8							3		9		22	6	10							7	6
14							13	15	8							3		5		22	18	11							11	7
15							14	19	16							21		6		23	12	7							8	16
16								12	15							20		6		3	8	7							4	20
17								14	11							8		8		9	10	10							7	6
18								21	11							7		5		12	5	13							6	8
19								22	13							6		11		12	9	6							7	7
20								18	10							8		3		6	10	5							3	6
21								12	5							10		12		28	12	11							6	4
22								15	10							8		8		15	9	8							26	5
23								18	16							17		11		15	16	9							12	6
24								13	8							7		7		6	15	10							4	6
25								20	6							4		5		6	12	22								7
26								20	5							23		19		6	13	26								10
27								21	8							19		6		11	10	14								6
28								11	8							10		6		9	13	11								5
29								15	10							17		17		9	14	12								8
30								13	15							12		12		12	12	6								6
31								14	10							18		5		11	12	20								7
32								20	11							3		8		7	12	10								6
33								11	9							19		19		7	7	25								6
34								11	10							17		4		7	11	28								6
35								10	10							16		10		8	11	5								8
36								6	14							12		10		10	25	11								7
37								19	10							11		19		12	21	11								8
38								16	9							8		10		8	10	9								6
39								12	10							10		7		5	9	9								4
40								15	18							6		11		10	5	11								6
41								11	14							13		10		9	12	20								3
42								13	12							15		14		7	20	8								3
43								10	10							17		8		15	21	9								5
44								13	15							16		6		9	5	6								6
45								15	14							23		10		8	16	10								4
46								12	16							17		5		5	10	7								7
47								9	13							8		19		2	12	11								7
48								6	10							10		8		6	9	9								7
49								6	11							15		6		9	9	8								7
50								12	11							12		6		8	11	20								5
51								14	10							6		5		12	11	12								5
52								10	10							7		3		7	5	10								5
53								16	9							12		4		7	22	8								6
54								12	6							7		4		8	9	12								5
55								16	12							11		4		7	8	9								6
56								19	10							16		3		6	25	15								4
57								10	9							15		3		12	15	4								33

Appendix A6 C **Onondaga County Zebra Mussel Survey-Shell Length (mm), Summer 2004**
Length Data

Sample																														
Transect - Sample	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R
ID Number >	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	ZONE I			ZONE II			ZONE III			ZONE IV			ZONE V			ZONE VI			ZONE VII			ZONE VIII			ZONE IX			ZONE X		
58								11	6							20		3		12	19	3								
59								10	14							22		3		9	20	8								
60								12	13							18		17		9	10	10								
61								13	11							14		17		8	12	21								
62								12	13							15		8		11	9	5								
63								10	4							16		6		14	11	9								
64								12	10							11		7		10	10	6								
65								13	8							5		11		22	12	22								
66								9	8							11		7		19	20	5								
67								10	13							17		7		6	10	25								
68								11	9							13		5		9	11	10								
69								16	10							9		9		10	12	10								
70								9	8							8		11		9	12	11								
71								15	17							8		21		20	19	22								
72								15	11							6		13		7	8	9								
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74								20	11							9		18		20	11	3								
75								14	14							8		8		9	17	18								
76								15	14							9		5		9	9	11								
77								15	11							11		4		11	11	8								
78								7	9							8		18		10	21	10								
79								19	10							6		8		20	15	11								
80								13	12							8		7		20	14	10								
81								12	12							9		13		20	13	6								
82								17	12							3		4		10	19	22								
83								13	10							9		4		15	2	6								
84								13	6							12		10		15	20	8								
85								11	11							10		6		10	9	26								
86								10	6							12		20		16	18	11								
87								11	10							9		7		8	2	7								
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89								10	12							11		19		5	11	11								
90								12	11							8		4		17	12	11								
91								13	10							8		17		11	10	9								
92								11	10							10		3		21	10	16								
93								15	14							8		8		24	20	6								
94								16	6							8		14		8	10	10								
95								15	13							12		13		9	9	7								
96								12	8							8		5		3	17	14								
97								10	7							8		7		18	10	10								
98								14	11							7		16		22	10	15								
99								11	8							8		6		10	20	11								
100								10	12							8		9		5	11	9								

Appendix A6 C **Onondaga County Zebra Mussel Survey-Shell Length (mm), Summer 2004**
Length Data

Sample																											
Transect - Sample	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R	A - G	A - M	A - R
ID Number >	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
	ZONE XI			ZONE XII			ZONE XIII			ZONE XIV			ZONE XV			ZONE XVI			ZONE XVII			ZONE XVIII			ZONE XIX		
1				21		20		13		20	18	12	6			17		20	17	23	12	12	9				4
2				4		10		13		30	12	12	8			16		11	14	22	10	34	16				5
3				4		18		8		30	7	10	9			19		2	18	26	6	24					3
4				3		10		13		35	12	12	6			15		2	8	12	3	18					13
5				20		6		4		16	12	12	14			3		2	18	13	1	17					13
6				6		26		4		14	13	5	7			16		3	6	4	2	15					7
7				14		5		3		17	8	14	6			15		10	5	12		18					
8				7		6		3		13	5	12	17			12		5	14	13		9					
9				21		9		24		19	7		11			12		3	18	3		21					
10				16		9		18		20	11		21			13		2	4	3		20					
11				17		7		17		25	10		9			12		4	8	4		15					
12				15		25		4		22	12		13			11		3	13	15		18					
13				7		2		17		17	10		4			10		3	18	6		12					
14				5		11		4		20	6		18			8		4	15	4		17					
15				14		22		2		8			20			7		7	15	13		18					
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19				17		10		4		15			5			7		2	20	12		22					
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21				17		20		5		10			3			6		4	19	9		11					
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23				12		4		18		6			12			3			3	8		30					
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25				15		3		5		8			18			6			8	26		19					
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27				17		22		4		12			8			5			12	3		12					
28				15		19		3		9			9			5			13	13		8					
29				20		8		3		17			12			2			14	13		14					
30				6		10		3		7			5			2			14	3		14					
31				18		14		3		7			10			3			17	10		13					
32				15		19		4		6			3			3			9	20		21					
33				16		11		4		10			5			3			15	8		10					
34				17		21		4		12			6			2			5	11		8					
35				17		20		3		5			7			2			21	3		20					
36				15		15		19		8			5			4			13	13		13					
37				11		15		3		23			10			4			6	12		20					
38				12		11		17		14			9			3			18	27		5					
39				14		16		5		24			7			2			16	12		7					
40				14		18		5		26			8						18	12		18					
41				16		16		16		24			6						4	10		18					
42				18		10		18		12			5						22	9		7					
43				13		4		5		14			16						21	10		9					
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45				16		15		4		12			13						14	21		8					
46				17		5		3		22			19						13			10					
47				17		6		5		12			19						8			18					
48				12		5		4		10			19						12			22					
49				11		10		17		8			20						12			24					
50				12		10		5		23			20						7			22					
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53				9		18		5		14			11									7					
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55				8		7		3		12			18									21					
56				10		7		3		22			14									27					
57				10		6		3		12			10									18					

Appendix A6 C **Onondaga County Zebra Mussel Survey-Shell Length (mm), Summer 2004**
Length Data

Sample																											
Transect - Sample	**A - G**	**A - M**	**A - R**	**A - G**	**A - M**	**A - R**	**A - G**	**A - M**	**A - R**	**A - G**	**A - M**	**A - R**	**A - G**	**A - M**	**A - R**	**A - G**	**A - M**	**A - R**	**A - G**	**A - M**	**A - R**	**A - G**	**A - M**	**A - R**	**A - G**	**A - M**	**A - R**
ID Number >	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**
	ZONE XI			**ZONE XII**			**ZONE XIII**			**ZONE XIV**			**ZONE XV**			**ZONE XVI**			**ZONE XVII**			**ZONE XVIII**			**ZONE XIX**		
58				9		14		3		10			11									18					
59				7		17		3		8			7									21					
60				5		3				23			3									17					
61				6		7				16			7									18					
62				3		8				9			18									7					
63				6		12				10			9									12					
64				6		9				11			9									18					
65				4		10				18			12									7					
66				5		20				19			20									8					
67						9				9			20									11					
68						9				13			13									23					
69						19				8			14									7					
70						20				25			17									23					
71						9				25			12									5					
72						15				27			8									6					
73						2				10			15									16					
74						21				10			3									12					
75						10				15			13									9					
76						9				10			6									15					
77						3				10			13									8					
78						8				11			15									8					
79						19				6			10									11					
80						17				9			16									11					
81						10				9			24									19					
82						7				20			3									21					
83						8				23			7									5					
84						18				24			6									12					
85						12				12			18									18					
86						8				13			8									22					
87						9				18			12									19					
88						15				12			7									22					
89						15				14			3									10					
90						10				13			6									20					
91						7				10			11									15					
92						9				6			11									10					
93						18				11			13									17					
94						9				12			8									12					
95						3				9			5									23					
96						6				26			8									12					
97						20				13			9									23					
98						22				23			17									22					
99						11				12			15									18					
100						10				9			5									12					

APPENDIX D

Fall 2004 Assessment

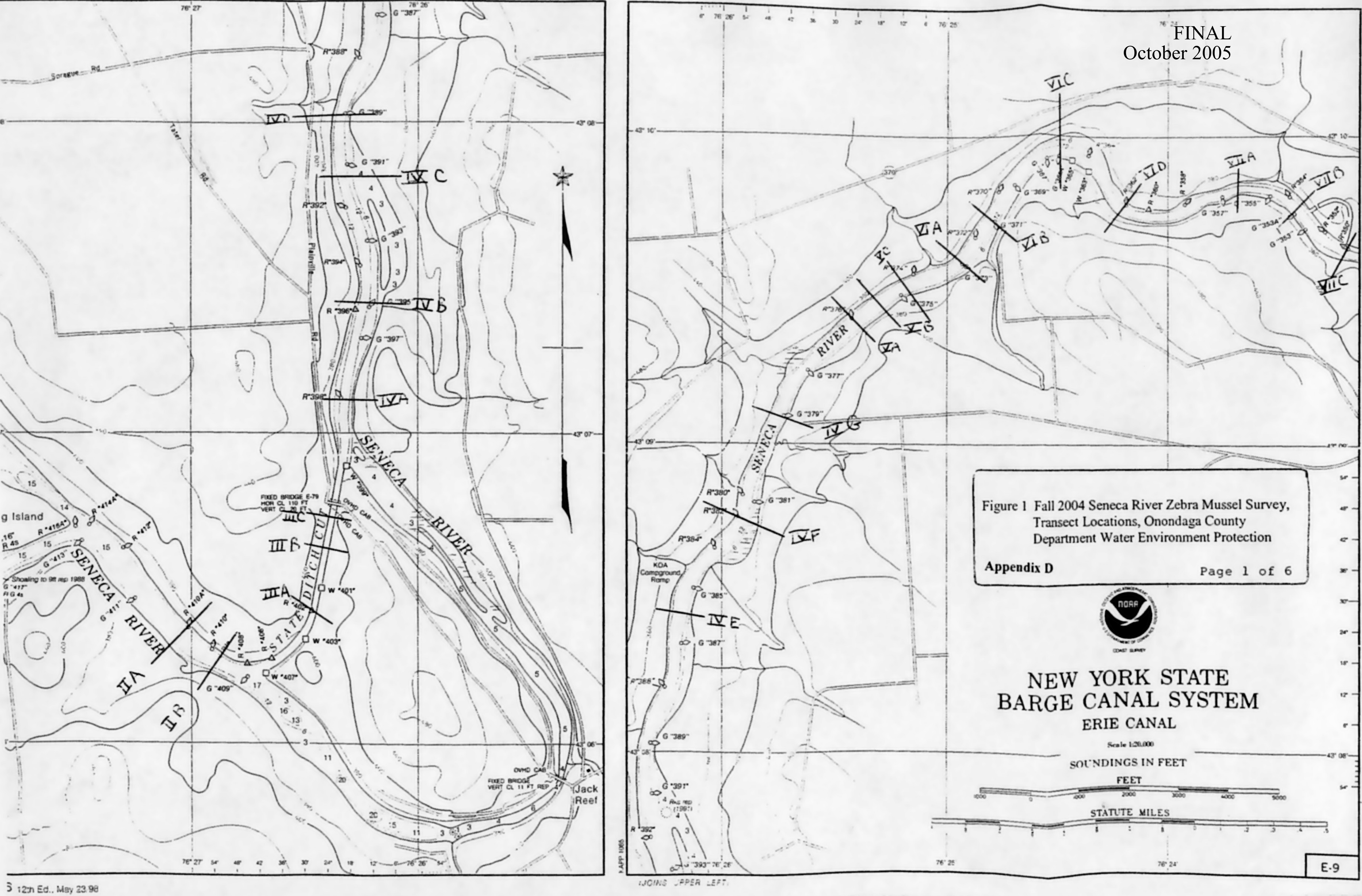

Figure 1 Fall 2004 Seneca River Zebra Mussel Survey, Transect Locations, Onondaga County Department Water Environment Protection

Appendix D

Page 1 of 6

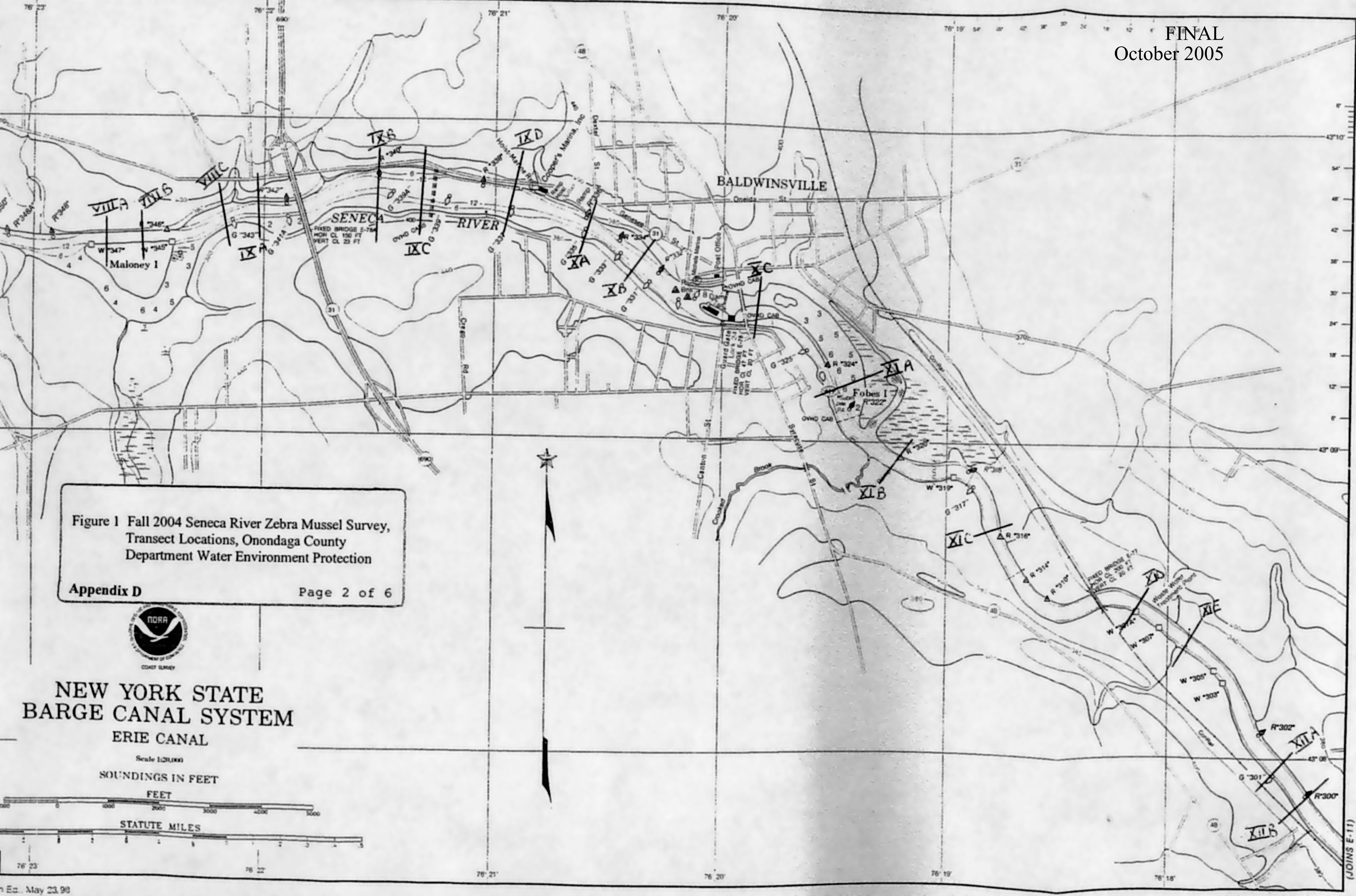

Figure 1 Fall 2004 Seneca River Zebra Mussel Survey, Transect Locations, Onondaga County Department Water Environment Protection

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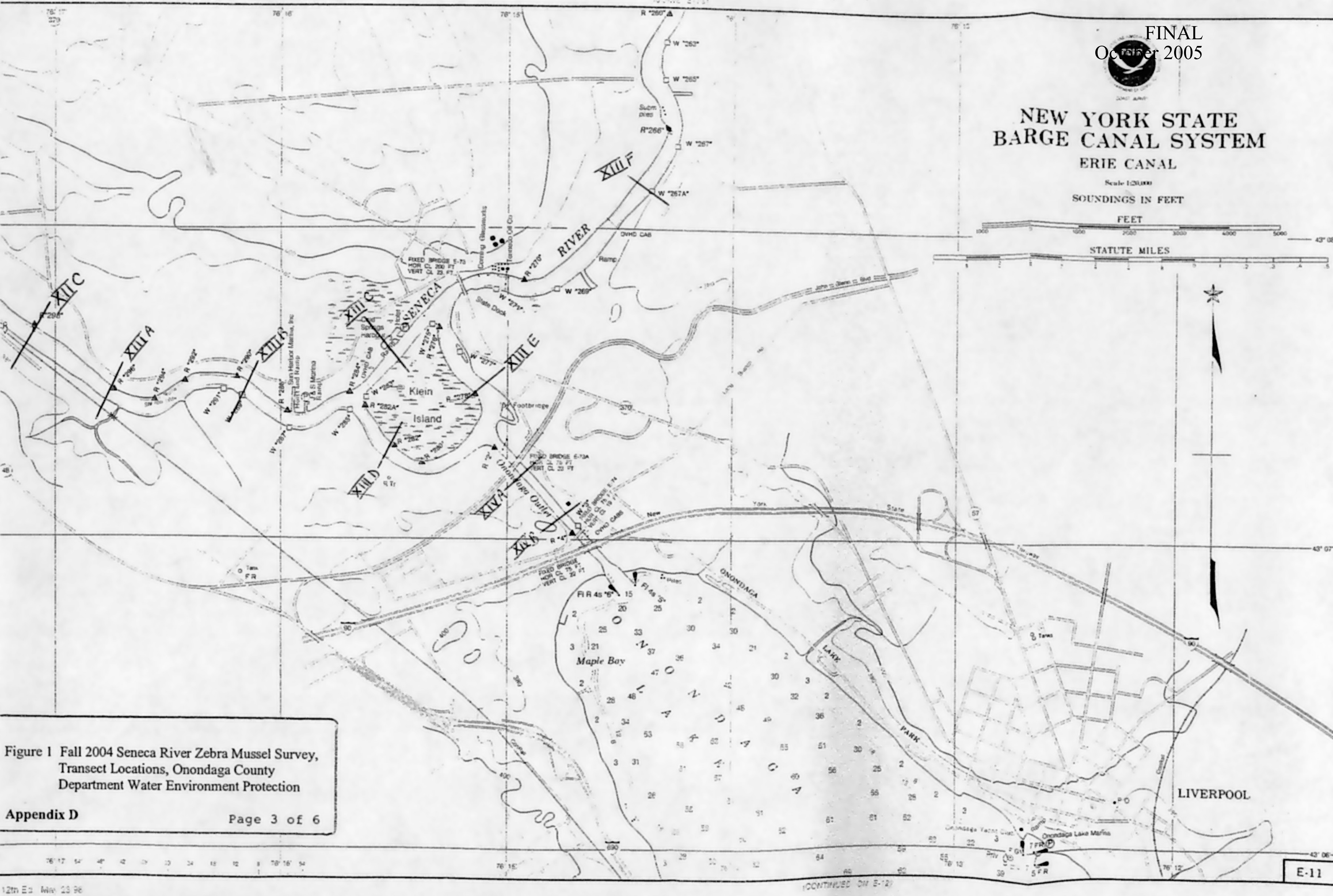

Figure 1 Fall 2004 Seneca River Zebra Mussel Survey, Transect Locations, Onondaga County Department Water Environment Protection

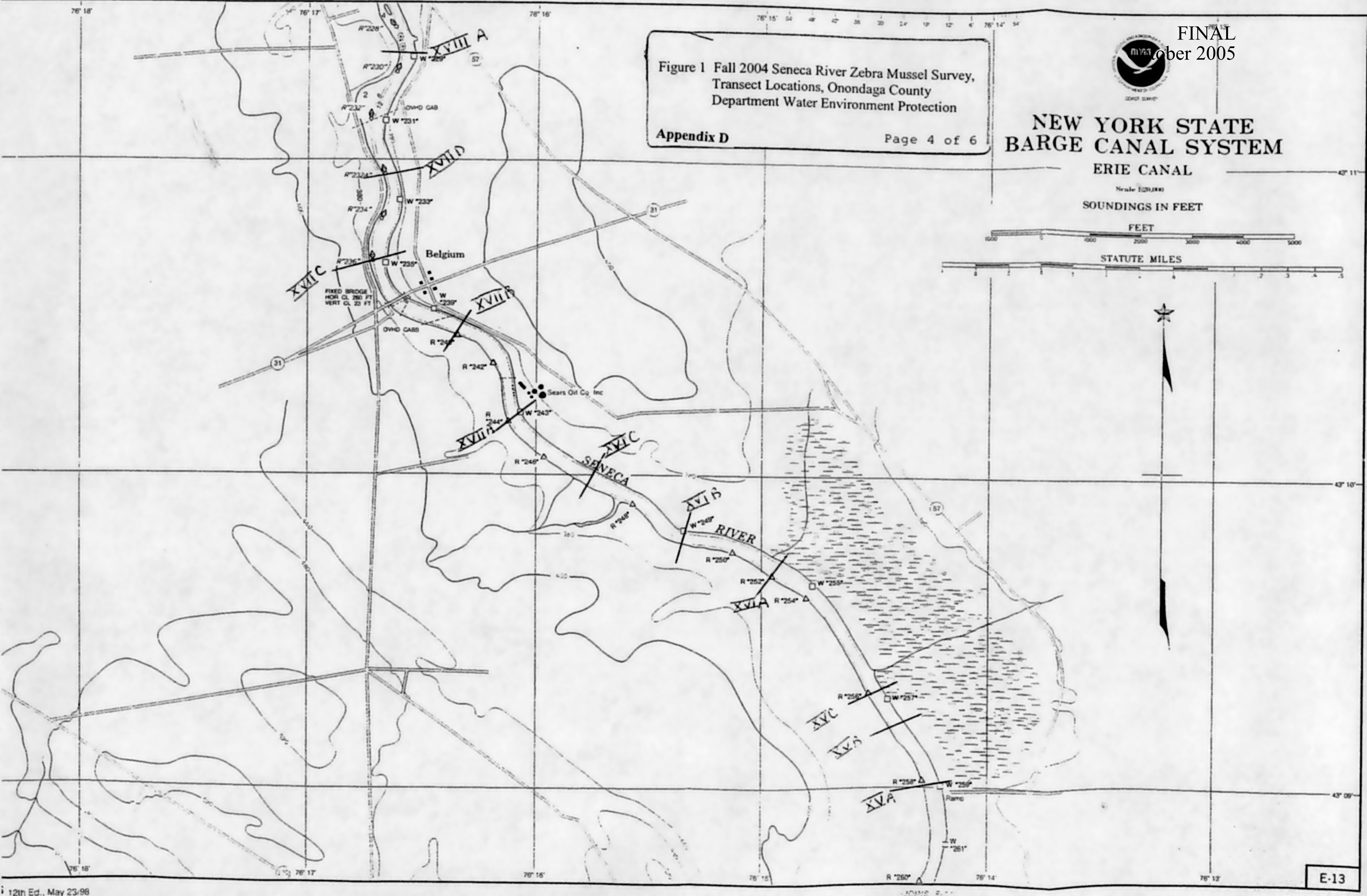

Figure 1 Fall 2004 Seneca River Zebra Mussel Survey, Transect Locations, Onondaga County Department Water Environment Protection

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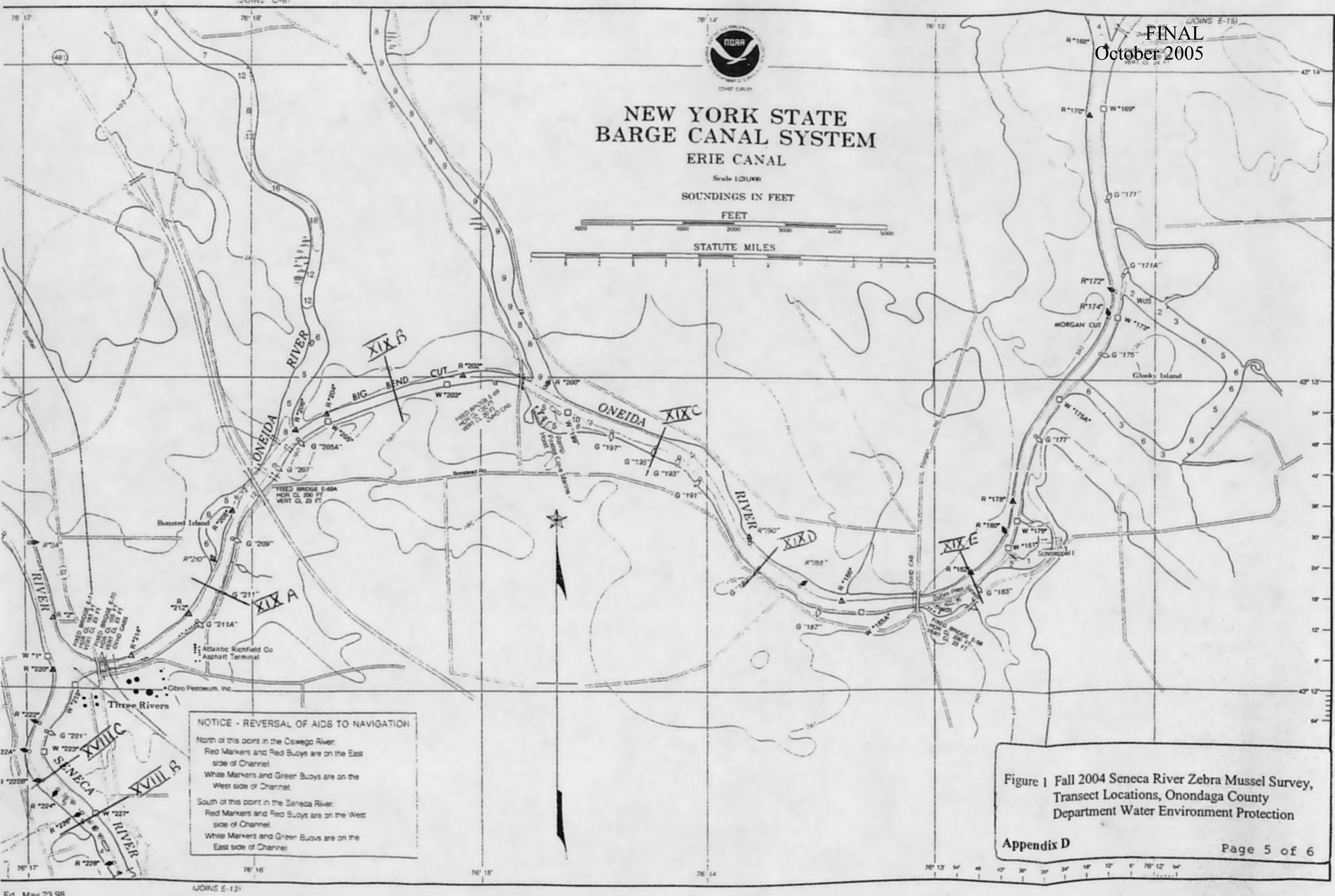


NOTICE - REVERSAL OF AIDS TO NAVIGATION

North of this point in the Oswego River:
Red Markers and Red Buoys are on the East side of Channel.
White Markers and Green Buoys are on the West side of Channel.

South of this point in the Seneca River:
Red Markers and Red Buoys are on the West side of Channel.
White Markers and Green Buoys are on the East side of Channel.

Figure 1 Fall 2004 Seneca River Zebra Mussel Survey, Transect Locations, Onondaga County Department Water Environment Protection

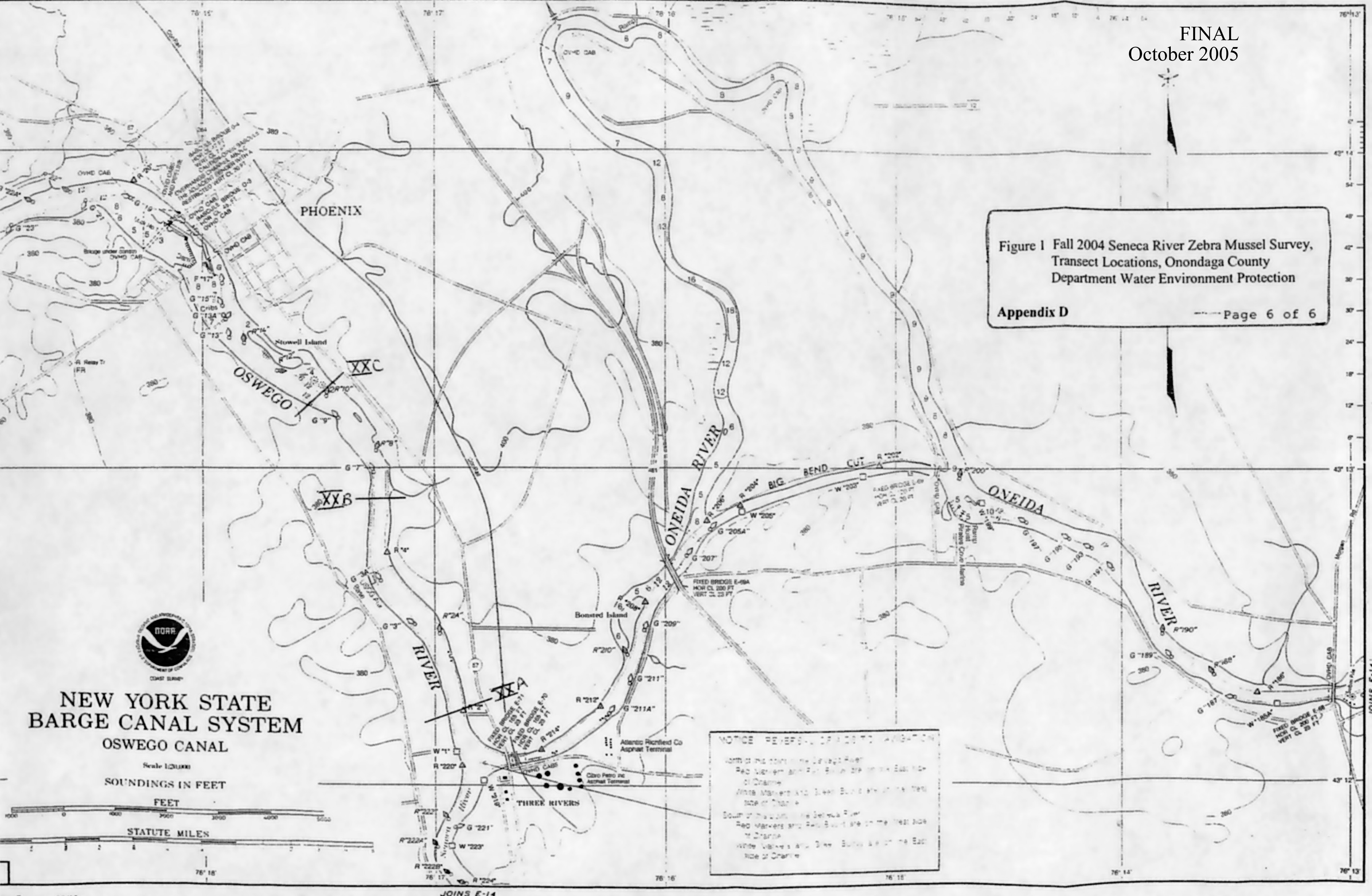


Figure 1 Fall 2004 Seneca River Zebra Mussel Survey, Transect Locations, Onondaga County Department Water Environment Protection

Appendix D

Figure 6D-2. Length vs. dry tissue weight regression results of Seneca River zebra mussel tissue study.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.766904226
R Square	0.588142092
Adjusted R Square	0.583896134
Standard Error	0.018328994
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.04653544	0.046535	138.5181	2.16233E-20
Residual	97	0.032587344	0.000336		
Total	98	0.079122784			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.022526134	0.00437242	-5.15187	1.36E-06	-0.03120417	-0.01384809	-0.03120417	-0.013848094
3	0.002836333	0.000240993	11.76937	2.16E-20	0.00235803	0.003314637	0.00235803	0.003314637

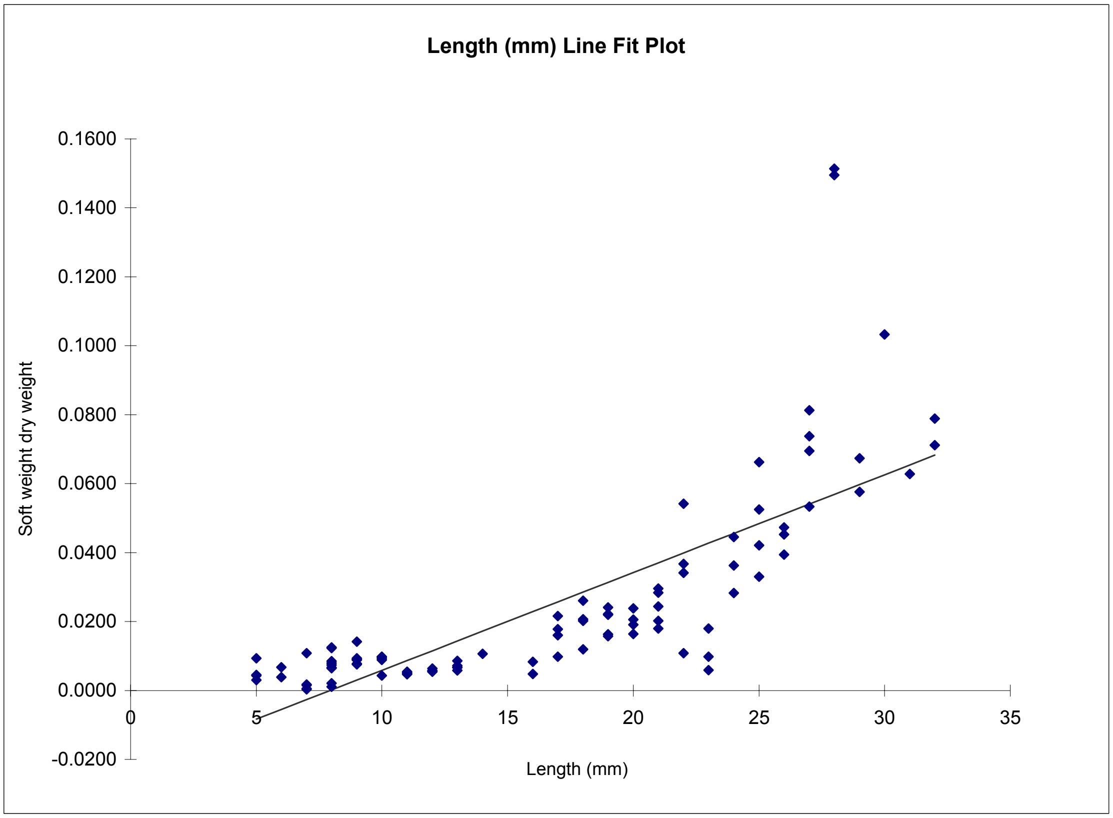


Figure 6D-3. Log length vs. Log dry tissue weight regression results of Seneca River zebra mussel tissue study.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.812567725
R Square	0.660266308
Adjusted R Square	0.656763899
Standard Error	0.291825784
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	16.05460309	16.0546	188.5178	1.80123E-24
Residual	97	8.260741943	0.085162		
Total	98	24.31534503			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-3.950817605	0.154489623	-25.5734	6.71E-45	-4.257436571	-3.644198639	-4.25743657	-3.644198639
0.477121255	1.791299365	0.130464407	13.73018	1.8E-24	1.532363776	2.050234955	1.532363776	2.050234955

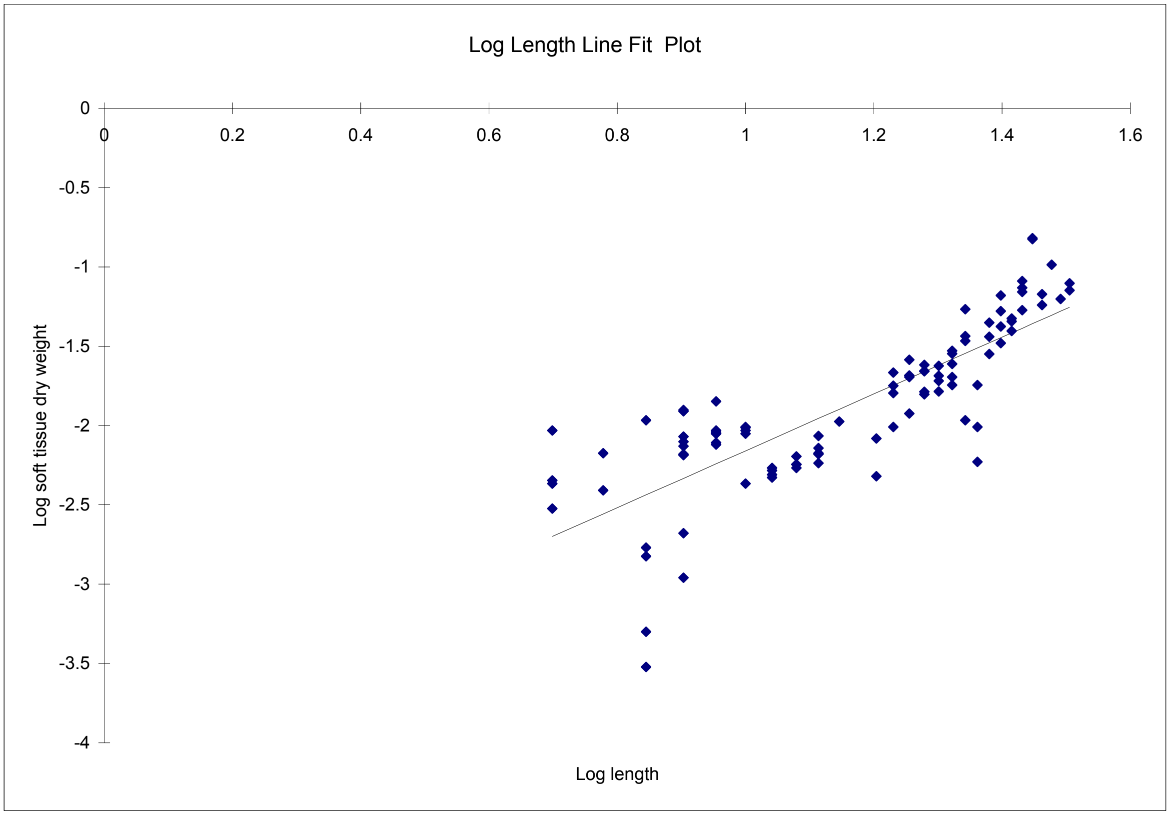


Figure 6D-4. Whole wet weight vs. dry tissue weight regression results of Seneca River zebra mussel tissue study.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.856911616
R Square	0.734297518
Adjusted R Square	0.731558317
Standard Error	0.014721861
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.058099664	0.0581	268.07	1.13792E-29
Residual	97	0.02102312	0.000217		
Total	98	0.079122784			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.00264769	0.001978147	1.338469	0.183872	-0.001278383	0.006573762	-0.001278383	0.006573762
0.0047	0.024762994	0.001512443	16.37284	1.14E-29	0.021761214	0.027764773	0.021761214	0.027764773

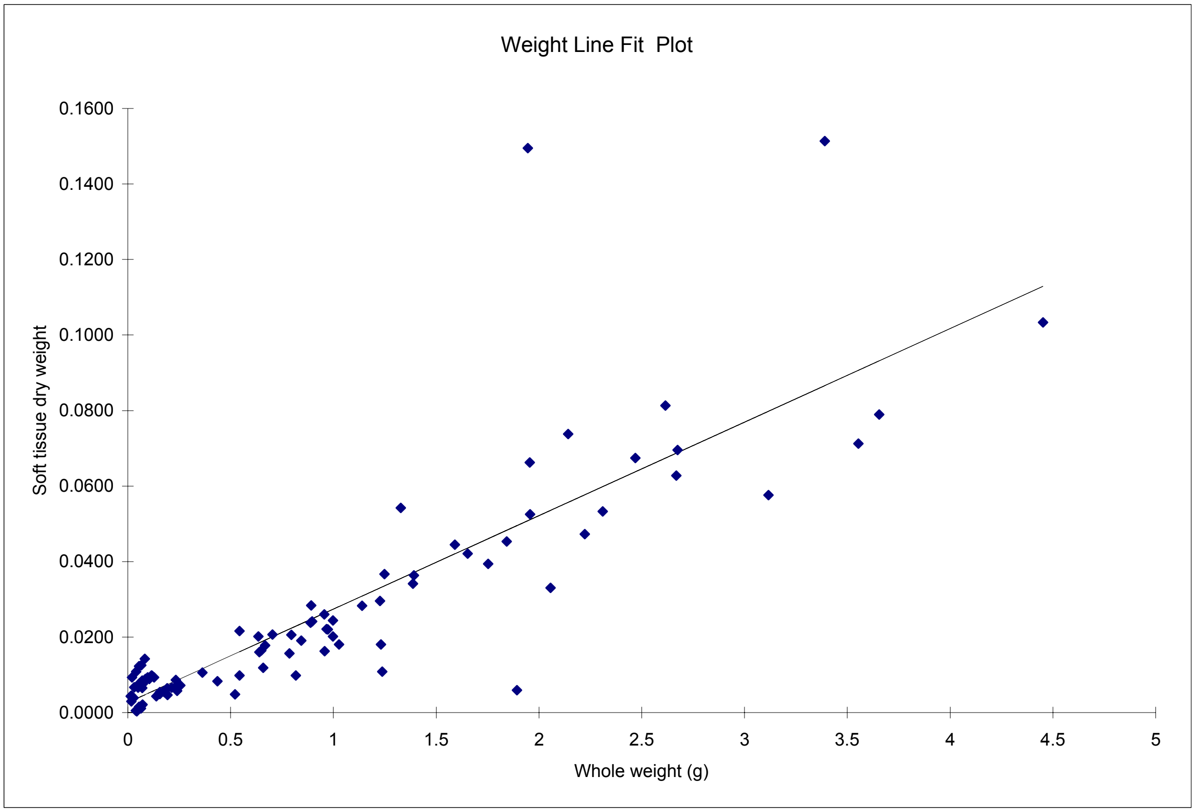


Figure 6D-5. Log whole wet weight vs. log dry tissue weight regression results of Seneca River zebra mussel tissue study.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.81510785
R Square	0.664400807
Adjusted R Square	0.660941021
Standard Error	0.290044614
Observations	99

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	16.15513486	16.15513	192.03526	9.91619E-25
Residual	97	8.16021017	0.084126		
Total	98	24.31534503			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.598935878	0.035033935	-45.63963	2.29422E-67	-1.6684685	-1.529403254	-1.6684685	-1.529403254
-2.327902142	0.611811062	0.044149606	13.85768	9.91619E-25	0.524186363	0.69943576	0.52418636	0.69943576

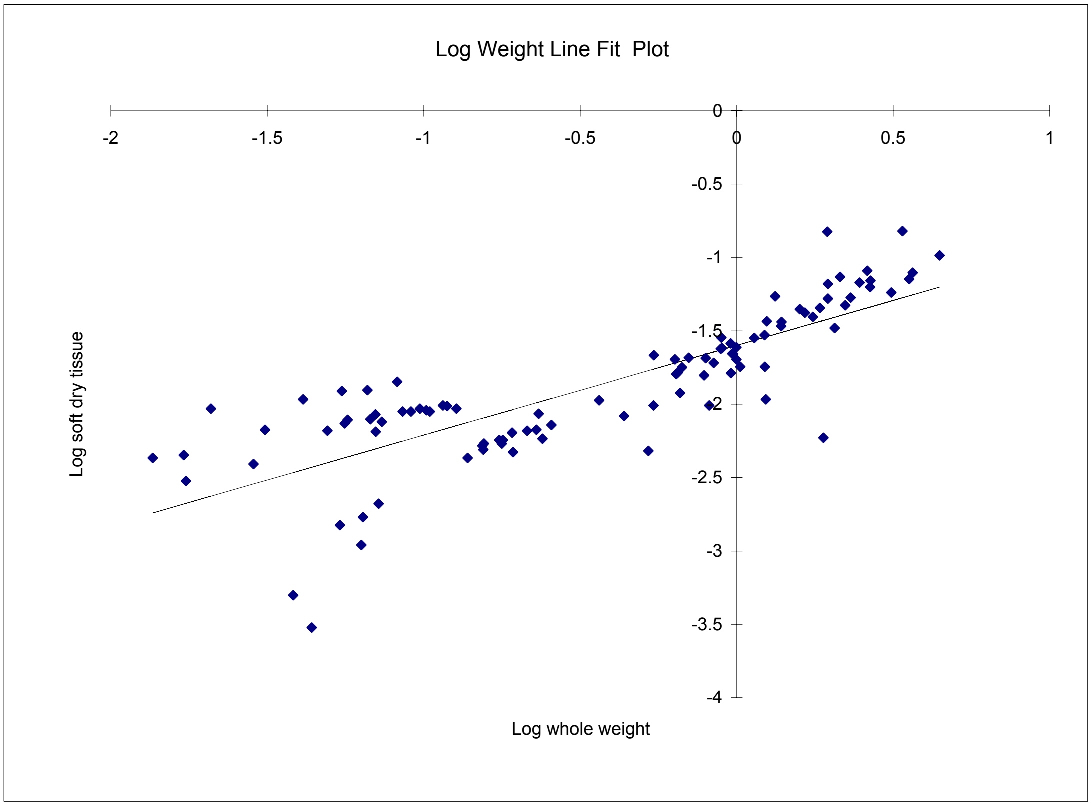


Table 6D-1.Summary of Results of the Fall 2004 Seneca River Zebra Mussel Survey, Onondaga County Department Water Environment Protection.

Habitat Zone	Transect	Sample	Depth (feet)	Median Particle Size Per Sample	Mean Particle Size Per Zone	Numbers Per Subsample	Weight Per Subsample g	Weight Per Sample g	TOTAL WEIGHT g/M2	MEAN WEIGHT g/M2 PER ZONE	TOTAL NUMBER Per Sample	TOTAL NUMBER PER M2	MEAN NUMBER PER M^2 ZONE
II	A	G	18	1.25	**2.90**	100	16	113	1,216.4	**202.73**	706	7,602.2	**1,267**
II	A	M	22	6.50		0	0	0	0.0		0	0.0	
II	A	R	13.5	-0.50		0	0	0	0.0		0	0.0	
II	B	G	11	0.75		0	0	0	0.0		0	0.0	
II	B	M	25	6.50		0	0	0	0.0		0	0.0	
II	B	R	8.8	2.90		0	0	0	0.0		0	0.0	
III	A	G	10	-7.25	**-8.35**	100	37	909	9,784.7	**2,662.35**	2457	26,445.0	**13,179**
III	A	M	14	-8.24		100	18	149	1,603.9		828	8,910.4	
III	A	R	8	-7.25		100	114	64	688.9		56	604.3	
III	B	G	9	-8.99		100	28	197	2,120.5		704	7,573.4	
III	B	M	13.8	-8.99		100	16	160	1,722.3		1000	10,764.2	
III	B	R	11	-8.99		100	36	359	3,864.3		997	10,734.3	
III	C	G	11	-8.24		100	5	177	1,905.3		3540	38,105.3	
III	C	M	14.5	-8.24		100	12	134	1,442.4		1117	12,020.0	
III	C	R	9.5	-8.99		100	24	77	828.8		321	3,453.5	
IV	A	G	11	-8.24	**-1.00**	100	28	378	4,068.9	**2,176.42**	1350	14,531.7	**8,467**
IV	A	M	13	-8.24		100	10	694	7,470.4		6940	74,703.5	
IV	A	R	12	-8.24		100	29	402	4,327.2		1386	14,921.4	
IV	B	G	6.3	-1.20		100	52	277	2,981.7		533	5,734.0	
IV	B	M	13.4	-1.20		100	8	15	161.5		188	2,018.3	
IV	B	R	13	-2.25		100	60	233	2,508.1		388	4,180.1	
IV	C	G	13.5	-0.50		100	70	84	904.2		120	1,291.7	
IV	C	M	14.4	0.75		0	0	0	0.0		0	0.0	
IV	C	R	13	6.50		0	0	0	0.0		0	0.0	
IV	D	G	13	-0.75		100	48	210	2,260.5		438	4,709.3	
IV	D	M	16.4	0.75		100	40	340	3,659.8		850	9,149.6	
IV	D	R	15	-0.75		100	36	179	1,926.8		497	5,352.2	
IV	E	G	8.9	-3.88		100	21	253	2,723.3		1205	12,968.3	
IV	E	M	14.1	-2.48		100	37	82	882.7		222	2,385.6	
IV	E	R	12	6.50		0	0	0	0.0		0	0.0	
IV	F	G	6.9	0.50		0	0	0	0.0		0	0.0	
IV	F	M	15.1	-4.75		100	42	348	3,745.9		829	8,918.9	
IV	F	R	12	-4.75		100	40	493	5,306.8		1233	13,266.9	
IV	G	G	14.2	6.50		100	102	124	1,334.8		122	1,308.6	
IV	G	M	14.5	-1.75		100	61	134	1,442.4		220	2,364.6	
IV	G	R	11.9	6.50		0	0	0	0.0		0	0.0	
V	A	G	8	-2.48	**-0.58**	100	52	301	3,240.0	**990.31**	579	6,230.8	**1,807**
V	A	M	14	-0.50		100	43	45	484.4		105	1,126.5	
V	A	R	11	-2.48		100	65	214	2,303.5		329	3,543.9	
V	B	G	12	-0.50		65	35	35	376.7		65	699.7	
V	B	M	13	0.75		0	0	0	0.0		0	0.0	
V	B	R	12	-8.00		86	42	42	452.1		86	925.7	
V	C	G	7	4.25		0	0	0	0.0		0	0.0	
V	C	M	13.5	4.25		74	8	8	86.1		74	796.6	
V	C	R	11	-0.50		100	67	183	1,969.8		273	2,940.1	
VI	A	G	12	-4.75	**-0.97**	9	6	6	64.6	**1,312.34**	9	96.9	**2,342**
VI	A	M	12	-3.00		100	58	107	1,151.8		184	1,985.8	
VI	A	R	10	-6.92		100	55	181	1,948.3		329	3,542.4	
VI	B	G	13	0.50		0	0	0	0.0		0	0.0	
VI	B	M	13	-0.50		66	37	37	398.3		66	710.4	
VI	B	R	7	-8.00		37	14	14	150.7		37	398.3	
VI	C	G	9	6.50		0	0	0	0.0		0	0.0	
VI	C	M	13	-0.50		100	96	226	2,432.7		235	2,534.1	
VI	C	R	12.6	6.50		25	24	24	0.0		25	269.1	
VI	D	G	12	-0.50		100	72	234	2,518.8		325	3,498.4	
VI	D	M	13	-0.50		100	47	658	7,082.8		1400	15,069.9	
VI	D	R	12	-0.50		0	0	0	0.0		0	0.0	
VII	A	G	10	-3.00	**-0.35**	0	0	0	0.0	**1,117.08**	0	0.0	**2,342**
VII	A	M	14	-9.97		100	45	290	3,121.6		644	6,936.9	
VII	A	R	12	1.75		0	0	0	0.0		0	0.0	
VII	B	G	12.9	2.00		100	55	106	1,141.0		193	2,074.6	
VII	B	M	13	6.50		100	38	230	2,475.8		605	6,515.2	
VII	B	R	6	-2.48		100	58	89	958.0		153	1,651.7	
VII	C	G	8	3.25		100	65	170	1,829.9		262	2,815.3	
VII	C	M	13	0.75		31	15	15	161.5		31	333.7	
VII	C	R	8	-3.00		70	34	34	366.0		70	753.5	
VIII	A	G	9	6.50	**2.34**	0	0	0	0.0	**1,130.24**	0	0.0	**3,391**
VIII	A	M	12	2.00		0	0	0	0.0		0	0.0	
VIII	A	R	8	-4.75		100	36	144	1,550.0		400	4,305.7	
VIII	B	G	5	9.00		0	0	0	0.0		0	0.0	
VIII	B	M	13	1.85		100	35	237	2,551.1		677	7,288.9	
VIII	B	R	9	-6.50		85	21	21	226.0		85	915.0	
VIII	C	G	10.2	0.00		100	33	475	5,113.0		1439	15,493.9	
VIII	C	M	13.1	6.50		100	44	44	473.6		100	1,076.4	
VIII	C	R	12.7	6.50		100	18	24	258.3		133	1,435.2	

Table 6D-1.Summary of Results of the Fall 2004 Seneca River Zebra Mussel Survey, Onondaga County Department Water Environment Protection.

Habitat Zone	Transect	Sample	Depth (feet)	Median Particle Size Per Sample	Mean Particle Size Per Zone	Numbers Per Subsample	Weight Per Subsample g	Weight Per Sample g	TOTAL WEIGHT g/M2	MEAN WEIGHT g/M2 PER ZONE	TOTAL NUMBER Per Sample	TOTAL NUMBER PER M2	MEAN NUMBER PER M^2 ZONE
IX	A	G	12	6.50	**5.21**	100	41	238	2,561.9	**380.34**	580	6,248.5	**992**
IX	A	M	13.6	6.50		100	37	141	1,517.8		381	4,102.0	
IX	A	R	12	-3.00		0	0	0	0.0		0	0.0	
IX	B	G	11	6.50		0	0	0	0.0		0	0.0	
IX	B	M	14	6.50		32	9	9	96.9		32	344.5	
IX	B	R	9	6.50		0	0	0	0.0		0	0.0	
IX	C	G	9	6.50		0	0	0	0.0		0	0.0	
IX	C	M	13	4.25		0	0	0	0.0		0	0.0	
IX	C	R	11	3.25		100	32	36	387.5		113	1,211.0	
IX	D	G	12	6.50		0	0	0	0.0		0	0.0	
IX	D	M	13	6.05		0	0	0	0.0		0	0.0	
IX	D	R	12	6.50		0	0	0	0.0		0	0.0	
X	A	G	9	3.18	**2.56**	100	28	29	312.2	**331.30**	104	1,114.9	**1,064**
X	A	M	13	-2.25		47	17	17	183.0		47	505.9	
X	A	R	7	-0.50		100	40	107	1,151.8		268	2,879.4	
X	B	G	12	-0.50		0	0	0	0.0		0	0.0	
X	B	M	12	-0.50		100	34	48	516.7		141	1,519.7	
X	B	R	9	4.13		100	23	76	818.1		330	3,556.9	
X	C	G	13	6.50		0	0	0	0.0		0	0.0	
X	C	M	13	6.50		0	0	0	0.0		0	0.0	
X	C	R	10	6.50		0	0	0	0.0		0	0.0	
XI	A	G	11	-0.50	**3.40**	100	13	15	161.5	**147.83**	115	1,242.0	**611**
XI	A	M	14	-0.50		20	2	2	21.5		20	215.3	
XI	A	R	13	-3.00		100	19	19	204.5		100	1,076.4	
XI	B	G	16	6.50		0	0	0	0.0		0	0.0	
XI	B	M	16	6.50		0	0	0	0.0		0	0.0	
XI	B	R	11	6.50		0	0	0	0.0		0	0.0	
XI	C	G	15	6.50		0	0	0	0.0		0	0.0	
XI	C	M	20	6.50		0	0	0	0.0		0	0.0	
XI	C	R	18	6.50		0	0	0	0.0		0	0.0	
XI	D	G	13	-0.50		100	23	26	279.9		113	1,216.8	
XI	D	M	15	-2.48		100	33	110	1,184.1		333	3,588.1	
XI	D	R	14	-0.50		100	20	34	366.0		170	1,829.9	
XI	E	G	12	6.50		0	0	0	0.0		0	0.0	
XI	E	M	18	6.50		0	0	0	0.0		0	0.0	
XI	E	R	15	6.50		0	0	0	0.0		0	0.0	
XII	A	G	13	-3.00	**-0.94**	100	16	65	699.7	**375.55**	406	4,373.0	**1,743**
XII	A	M	14	-3.00		49	5	5	53.8		49	527.4	
XII	A	R	13	-3.00		93	31	31	333.7		93	1,001.1	
XII	B	G	13	-4.75		100	31	35	376.7		113	1,215.3	
XII	B	M	14	-4.75		100	21	61	656.6		290	3,126.7	
XII	B	R	10	-4.75		63	9	9	96.9		63	678.1	
XII	C	G	7	1.75		60	7	7	75.3		60	645.9	
XII	C	M	15	6.50		100	33	74	796.6		224	2,413.8	
XII	C	R	13	6.50		100	17	27	290.6		159	1,709.6	
XIII	A	G	15	6.50	**6.28**	100	25	133	1,431.6	**384.52**	532	5,726.6	**1,796**
XIII	A	M	23	6.50		0	0	0	0.0		0	0.0	
XIII	A	R	15	6.50		0	0	0	0.0		0	0.0	
XIII	B	G	5	6.50		0	0	0	0.0		0	0.0	
XIII	B	M	23	6.50		0	0	0	0.0		0	0.0	
XIII	B	R	21	0.00		100	28	157	1,690.0		561	6,035.6	
XIII	C	G	16	9.00		0	0	0	0.0		0	0.0	
XIII	C	M	13	6.50		0	0	0	0.0		0	0.0	
XIII	C	R	4	6.50		0	0	0	0.0		0	0.0	
XIII	D	G	9	6.50		0	0	0	0.0		0	0.0	
XIII	D	M	9	6.50		0	0	0	0.0		0	0.0	
XIII	D	R	13.2	6.50		100	17	86	925.7		506	5,445.4	
XIII	E	G	22	6.50		100	19	267	2,874.0		1405	15,126.5	
XIII	E	M	15	6.50		0	0	0	0.0		0	0.0	
XIII	E	R	11	6.50		0	0	0	0.0		0	0.0	
XIII	F	G	22	6.50		0	0	0	0.0		0	0.0	
XIII	F	M	27	6.50		0	0	0	0.0		0	0.0	
XIII	F	R	19	6.50		0	0	0	0.0		0	0.0	
XIV	A	G	7	-0.50	**-0.50**	100	16	272	2,927.9	**2,287.39**	1700	18,299.1	**11,803**
XIV	A	M	16	-0.50		100	27	154	1,657.7		570	6,139.6	
XIV	A	R	8	-0.50		3	1	1	10.8		3	32.3	
XIV	B	G	13	-0.50		100	21	72	775.0		343	3,690.6	
XIV	B	M	13	2.00		100	26	369	3,972.0		1419	15,276.9	
XIV	B	R	9	-3.00		100	16	407	4,381.0		2544	27,381.4	

Table 6D-1.Summary of Results of the Fall 2004 Seneca River Zebra Mussel Survey, Onondaga County Department Water Environment Protection.

Habitat Zone	Transect	Sample	Depth (feet)	Median Particle Size Per Sample	Mean Particle Size Per Zone	Numbers Per Subsample	Weight Per Subsample g	Weight Per Sample g	TOTAL WEIGHT g/M2	MEAN WEIGHT g/M2 PER ZONE	TOTAL NUMBER Per Sample	TOTAL NUMBER PER M2	MEAN NUMBER PER M^2 ZONE
XV	A	G	25	0.50	**3.66**	100	23	205	2,206.7	**364.79**	891	9,594.2	**1,829**
XV	A	M	33.6	4.25		0	0	0	0.0		0	0.0	
XV	A	R	6.3	6.50		0	0	0	0.0		0	0.0	
XV	B	G	23	-0.50		100	17	46	495.2		271	2,912.7	
XV	B	M	31	2.00		0	0	0	0.0		0	0.0	
XV	B	R	17.5	6.50		0	0	0	0.0		0	0.0	
XV	C	G	4	3.60		100	20	41	441.3		205	2,206.7	
XV	C	M	22.2	3.60		100	8	13	139.9		163	1,749.2	
XV	C	R	18.9	6.50		0	0	0	0.0		0	0.0	
XVI	A	G	14	-0.75	**1.12**	100	12	13	139.9	**482.00**	108	1,166.1	**3,271**
XVI	A	M	26	-0.50		100	22	84	904.2		382	4,110.0	
XVI	A	R	23.4	6.50		0	0	0	0.0		0	0.0	
XVI	B	G	20.2	-0.75		100	11	102	1,097.9		927	9,981.3	
XVI	B	M	23.5	5.05		0	0	0	0.0		0	0.0	
XVI	B	R	18.4	5.05		100	18	86	925.7		478	5,142.9	
XVI	C	G	19	-6.75		100	18	66	710.4		367	3,946.9	
XVI	C	M	18.7	-6.75		100	11	52	559.7		473	5,088.5	
XVI	C	R	4.6	9.00		0	0	0	0.0		0	0.0	
XVII	A	G	18	2.88	**-0.57**	100	48	83	893.4	**1,152.67**	173	1,861.3	**4,516**
XVII	A	M	23	2.88		53	5	5	53.8		53	570.5	
XVII	A	R	18.5	6.50		100	31	217	2,335.8		700	7,534.9	
XVII	B	G	15.9	4.25		100	22	40	430.6		182	1,957.1	
XVII	B	M	18.8	-3.00		100	8	66	710.4		825	8,880.5	
XVII	B	R	13.9	6.50		100	28	145	1,560.8		518	5,574.3	
XVII	C	G	14	6.50		0	0	0	0.0		0	0.0	
XVII	C	M	17	-9.97		100	41	165	1,776.1		402	4,331.9	
XVII	C	R	17.6	-9.97		100	25	283	3,046.3		1132	12,185.1	
XVII	D	G	14	-9.97		100	32	44	473.6		138	1,480.1	
XVII	D	M	16	-9.97		100	26	237	2,551.1		912	9,812.0	
XVII	D	R	5.5	6.50		0	0	0	0.0		0	0.0	
XVIII	A	G	17	-3.00	**-4.30**	100	41	63	678.1	**766.65**	154	1,654.0	**1,950**
XVIII	A	M	15	-9.97		100	36	109	1,173.3		303	3,259.2	
XVIII	A	R	14.8	-0.50		32	10	10	107.6		32	344.5	
XVIII	B	G	14	-8.00		100	43	65	699.7		151	1,627.1	
XVIII	B	M	16	-8.00		100	50	118	1,270.2		236	2,540.4	
XVIII	B	R	14	-8.00		100	37	84	904.2		227	2,443.8	
XVIII	C	G	18	-4.75		100	43	152	1,636.2		353	3,805.0	
XVIII	C	M	18	-3.00		100	23	40	430.6		174	1,872.0	
XVIII	C	R	16	6.50		0	0	0	0.0		0	0.0	
XIX	A	G	16	3.20	**4.35**	100	35	53	570.5	**182.99**	151	1,630.0	**484**
XIX	A	M	16	1.75		0	0	0	0.0		0	0.0	
XIX	A	R	14	6.50		0	0	0	0.0		0	0.0	
XIX	B	G	15	5.20		79	12	12	129.2		79	850.4	
XIX	B	M	17	-3.88		100	41	94	1,011.8		229	2,467.9	
XIX	B	R	15	5.60		0	0	0	0.0		0	0.0	
XIX	C	G	19	6.05		0	0	0	0.0		0	0.0	
XIX	C	M	17	5.20		87	54	54	581.3		87	936.5	
XIX	C	R	11	-4.75		100	33	42	452.1		127	1,370.0	
XIX	D	G	13	6.50		0	0	0	0.0		0	0.0	
XIX	D	M	16	6.50		0	0	0	0.0		0	0.0	
XIX	D	R	13	6.50		0	0	0	0.0		0	0.0	
XIX	E	G	15	6.50		0	0	0	0.0		0	0.0	
XIX	E	M	17	9.00		0	0	0	0.0		0	0.0	
XIX	E	R	15	5.38		0	0	0	0.0		0	0.0	
XX	A	G	19	-8.00	**-5.84**	100	26	59	635.09	**639.27**	227	2,442.6	**2,253**
XX	A	M	21	-9.28		100	12	16	172.23		133	1,435.2	
XX	A	R	20	-9.58		100	25	108	1,162.53		432	4,650.1	
XX	B	G	9	4.13		5	0.5	0.5	5.38		5	53.8	
XX	B	M	15.6	-9.10		100	27	80	861.14		296	3,189.4	
XX	B	R	11.2	-9.10		100	40	96	1,033.36		240	2,583.4	
XX	C	G	15.8	-3.88		100	33	61	656.62		185	1,989.7	
XX	C	M	15.8	-3.00		80	14	14	150.70		80	861.1	
XX	C	R	15.7	-4.75		100	35	100	1,076.4		286	3,075.5	

Table A6 D-2. Measurements from zebra mussels used in the soft tissue analysis (Fall 2004).

Length (mm)	Width (mm)	Height (mm)	Whole weight (g)	Dry weight (g)
3	1	2	0.0047	0.0036
5	2	3	0.0174	0.0030
5	2	3	0.0209	0.0093
5	2	3	0.0136	0.0043
5	2	3	0.0171	0.0045
6	2	3	0.0286	0.0039
6	3	4	0.0311	0.0067
7	3	4	0.0412	0.0108
7	2	3	0.0439	0.0003
7	3	4	0.0639	0.0017
7	2	3	0.0383	0.0005
7	3	4	0.0540	0.0015
8	3	4	0.0547	0.0123
8	3	4	0.0492	0.0066
8	3	4	0.0559	0.0074
8	3	4	0.0702	0.0065
8	3	4	0.0675	0.0079
8	3	4	0.0660	0.0125
8	3	4	0.0700	0.0085
8	3	4	0.0718	0.0021
8	3	4	0.0632	0.0011
9	3	4	0.0734	0.0076
9	3	4	0.0823	0.0142
9	3	4	0.0857	0.0089
9	3	4	0.0571	0.0078
9	3	4	0.0910	0.0089
9	4	4	0.1020	0.0091
9	3	4	0.0971	0.0093
10	4	5	0.1271	0.0093
10	4	5	0.1187	0.0097
10	4	4	0.1151	0.0098
10	4	5	0.1382	0.0043
10	4	5	0.1046	0.0089
11	4	5	0.1551	0.0049
11	4	5	0.1537	0.0052
11	4	5	0.1778	0.0054
11	5	5	0.1930	0.0047
12	4	5	0.1558	0.0054
12	4	5	0.1790	0.0057
12	4	6	0.1914	0.0064
12	5	5	0.1745	0.0057
13	4	6	0.2139	0.0066
13	5	5	0.2560	0.0072
13	5	5	0.2394	0.0058
13	4	5	0.2328	0.0086
13	5	5	0.2288	0.0067
14	5	6	0.3631	0.0106
16	6	7	0.4366	0.0083
16	7	8	0.5219	0.0048
17	8	9	0.6678	0.0178
17	6	6	0.5431	0.0216
17	7	6	0.5426	0.0098
17	7	7	0.6405	0.0160
18	9	8	0.9561	0.0260
18	8	8	0.6590	0.0119
18	8	7	0.7030	0.0207
18	6	7	0.6349	0.0202
19	8	8	0.9580	0.0163
19	9	9	0.9734	0.0220
19	9	8	0.9669	0.0221
19	8	8	0.7857	0.0157
19	8	7	0.8964	0.0241
20	8	8	0.6486	0.0164
20	7	7	0.7956	0.0206
20	7	8	0.8881	0.0238
20	8	8	0.8438	0.0191
21	8	8	1.0274	0.0180
21	7	8	0.9971	0.0202
21	8	8	0.9978	0.0244
21	9	9	0.8922	0.0284
21	9	8	1.227	0.0296
22	11	9	1.3873	0.0341
22	10	10	1.3274	0.0542
22	10	9	1.2481	0.0367
22	11	10	1.2376	0.0108
23	9	9	1.2313	0.0180
23	8	8	0.8170	0.0098
23	11	11	1.8924	0.0059
24	9	9	1.1391	0.0283
24	12	10	1.5915	0.0445
24	11	9	1.3912	0.0363
25	13	8	1.9573	0.0525
25	13	12	1.9549	0.0662
25	10	11	1.6524	0.0421
25	12	12	2.0559	0.0330
26	13	10	1.8437	0.0453
26	13	12	2.2230	0.0473
26	13	12	1.7529	0.0394
27	14	17	2.6736	0.0695
27	12	16	2.1413	0.0738
27	17	12	2.3106	0.0533
27	14	12	2.6159	0.0813
28	15	14	3.3897	0.1514
28	12	12	1.9454	0.1495
29	14	11	3.1165	0.0576
29	13	13	2.4688	0.0674
30	16	11	4.4525	0.1033
31	16	11	2.6674	0.0628
32	16	14	3.6544	0.0789
32	15	13	3.5542	0.0712

APPENDIX 7: MASS BALANCES

APPENDIX 7: MASS BALANCES

1. INTRODUCTION

The development and structure of a mass-balance modeling framework for Onondaga Lake is described in previous lake monitoring reports (Ecologic, 2003). The framework facilitates computation and analysis of mass balances for nutrients and other water-quality components using hydrologic and water quality data collected in the Lake and its tributaries since 1986. Results provide a basis for:

(1) Estimating the magnitude and precision of loads from each source;
(2) Assessing long-term trends in load and inflow concentration from each source and source category (point, nonpoint, total);
(3) Evaluating the adequacy of the monitoring program, based upon the precision of loads computed from concentration and flow data;
(4) Developing and periodic updating of an empirical nutrient loading model that predicts eutrophication-related water quality conditions (as measured by nutrient concentrations, chlorophyll-a, algal bloom frequency, transparency, and hypolimnetic oxygen depletion) as a function of yearly nutrient loads, inflows, and lake morphometry (Ecologic, 2001).
(5) Developing simple input/output models for other constituents; and
(6) Developing data summaries to support integration and interpretation of monitoring results in each yearly AMP report.

This appendix updates the mass-balance framework to include 2003 and 2004 data. Recent mass balances for key water quality components are summarized. Long-term trends in total loads (point, nonpoint), inflow concentrations, and outflow concentrations are documented.

2. REFINEMENTS TO MASS-BALANCE FRAMEWORK

The mass-balance framework has been integrated with the AMP's Long-term Database (Figure 1). The database supplies yearly flows and loads for monitored tributaries. A separate workbook (MASSBAL.XLS) performs lake mass-balance calculations and supplies output in various formats, including those shown below. This workbook also computes total nitrogen loads & balances based upon nitrite, nitrate, and TKN results.

3. LONG-TERM TRENDS

Yearly variations in precipitation and lake inflow volume are summarized in Figure 2. Over the 1990-2004 period, yearly runoff from the Onondaga Lake watershed varied from 31 to 75 cm and was strongly correlated with precipitation ($r^2 = 0.85$). The strength of this correlation suggests that year-to-year variations in the lake water budget can be simulated using a simple rainfall/runoff model. Runoff was 63 cm in 2004, as compared with a 15-year mean of 51 cm.

The following figures show trends in each water quality component over the 1990-2004 period:

Figure 3	Total Inflow & Outflow Concentrations
Figure 4	Total Inflow & Outflow Loads
Figure 5	Total NonPoint & Total Metro Loads

Ten-year (1995-2004) trends in concentration and load for each mass-balance term and water quality component are summarized in Table 1. Trends are tested using a linear regression of flow-weighted-mean concentration or load against year. Trend slopes that are significantly different from zero ($p < .10$ for a two-tailed hypothesis or $p < 0.05$ for a one-tailed hypothesis) are listed. A ten-year rolling window has been consistently used for trend analysis in yearly AMP reports. With a longer period, results would be strongly influenced by historical data that are not representative of current conditions with respect to municipal and industrial wastewater inputs. With a shorter period, results would be increasingly influenced by short-term variations in hydrology and other random factors.

For total inflows, decreasing trends in concentration and/or load are indicated for BOD, calcium, ammonia nitrogen, Kjeldahl nitrogen, nitrite nitrogen, total nitrogen, total & filtered organic carbon, and total phosphorus. An increasing trend in nitrate nitrogen load reflects increased nitrification of the Metro effluent. Trends in nutrient species and BOD generally mimic those detected in the Metro discharge. For the lake outflow (12 foot samples considered most representative), significant decreasing trends in concentration and/or load are indicated for BOD, calcium, chloride, ammonia nitrogen, total Kjeldahl nitrogen, nitrite nitrogen, total nitrogen, soluble reactive phosphorus, and total phosphorus. Outflow trends are generally consistent with inflow trends and improving water quality conditions resulting primarily from Metro improvements over the 1995-2004 period. The phosphorus decreases occurred primarily between 1995 and 1998. After that, lake inflow and outflow loads were relatively stable.

4. MASS BALANCES

Five-year average (2000-2004) mass balances for the following constituents are summarized in the following tables:

Table 2	Chloride
Table 3	Total Phosphorus
Table 4	Soluble Reactive Phosphorus
Table 5	Total Nitrogen
Table 6	Ammonia Nitrogen

Since chloride is expected to be conservative, the chloride balance provides a basis for testing the accuracy and completeness of the data and methods used to develop the mass balances. Outflow loads computed from 12-foot outlet samples exceeded inflow loads by 7% ± 2% or 13,738 ± 4,062 metric tons/year in 200-2004 (Table 2). Excess loads (outflow-inflow) in chloride and sodium load were fairly consistent from year to year (Figure 4). These may be attributed to application of road deicing salts in ungauged portions of the watershed, salt springs contributing directly to the lake, and/or over-estimation of lake outflow volumes.

Direct monitoring of lake outflows by the USGS provides a basis for comparison with the lake water budget estimates (Walker, 2005). Figure 6 compares provisional measurements with computed net outflows for October 2003 – December 2004. On the average, the USGS net outflows differed from the computed values by -0.4 to +6.4%, depending upon subtle differences in how the measured net outflows are computed from raw data. Further analysis using final USGS data is recommended. Agreement with preliminary data tends to validate the computed water budgets and mass balances derived from them.

Theoretically, it would be possible to include reverse flow as a term in the lake mass balances by using the USGS measured flows and Outlet 2 foot samples. Such estimates would be highly uncertain, however, because the extent to which the reverse flow actually enters the open Lake (vs. just the outlet canal) is unknown.

5 . REFERENCES

Ecologic, LLC et al., “Onondaga Lake Monitoring Program, 2000 Annual Report”, prepared for Onondaga County, New York, November 2001.

Ecologic, LLC et al., “Onondaga Lake Monitoring Program, 2003 Annual Report”, prepared for Onondaga County, New York, 2004.

Walker, W.W., Lake Advisors Meeting Presentation, March 2005.

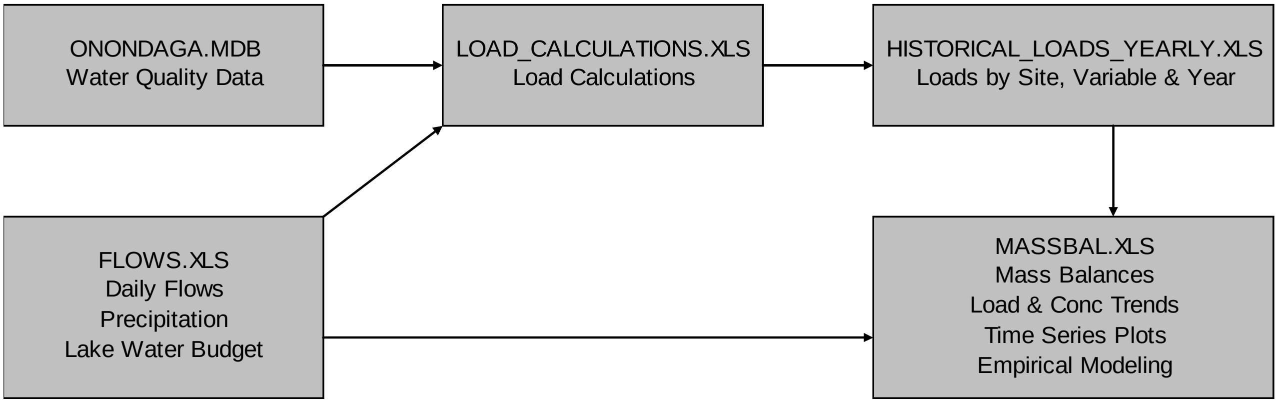
Mass Balance Appendix

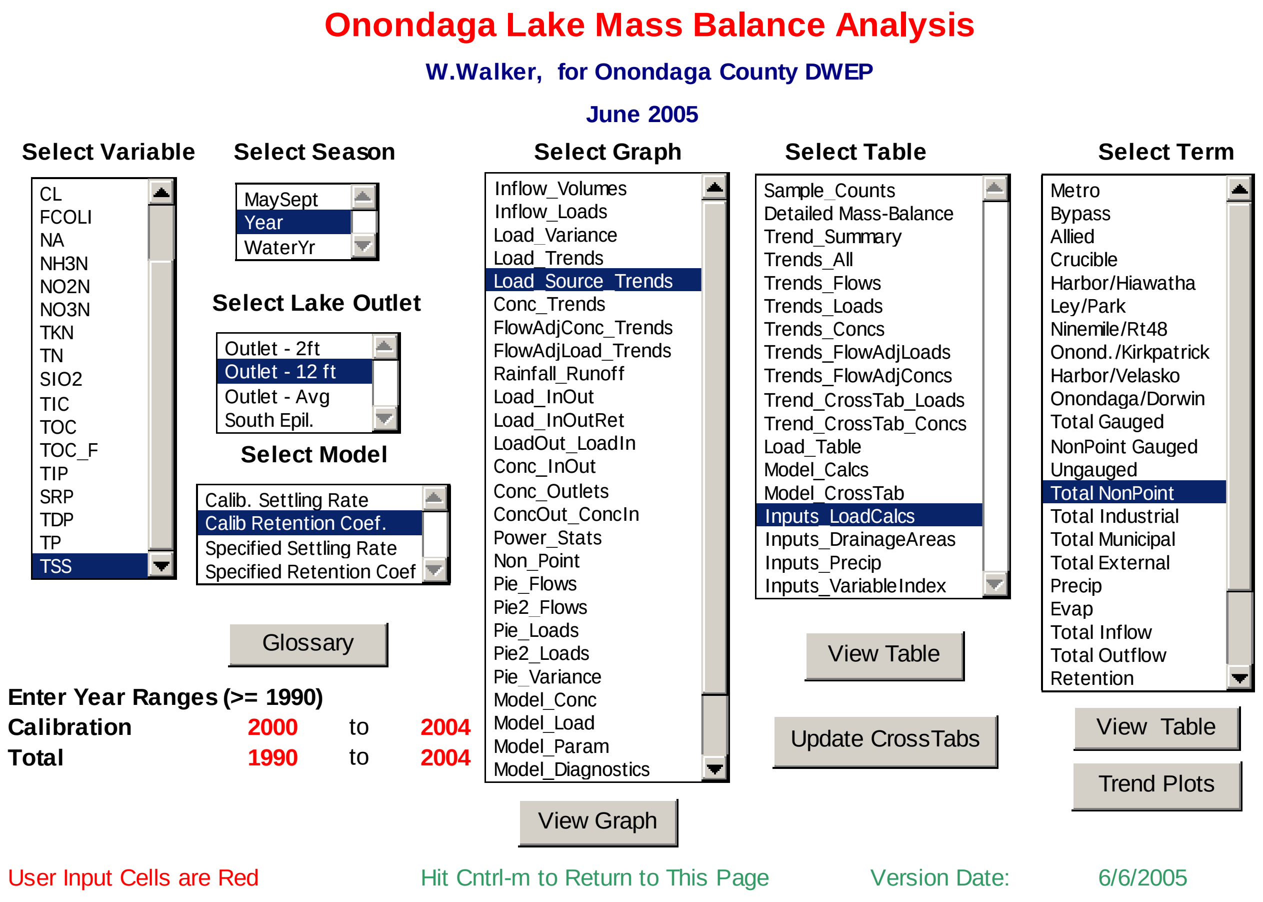
List of Figures

List of Tables

Figure 1

Mass Balance Compuations Integrated with Long-Term Database





Onondaga Lake Mass Balance Analysis

W.Walker, for Onondaga County DWEP

June 2005

Enter Year Ranges (>= 1990)

Calibration	2000	to	2004
Total	1990	to	2004

User Input Cells are Red

Hit Cntrl-m to Return to This Page

Version Date: 6/6/2005

Figure 2
Precipitation, Runoff, & Lake Inflow Volumes

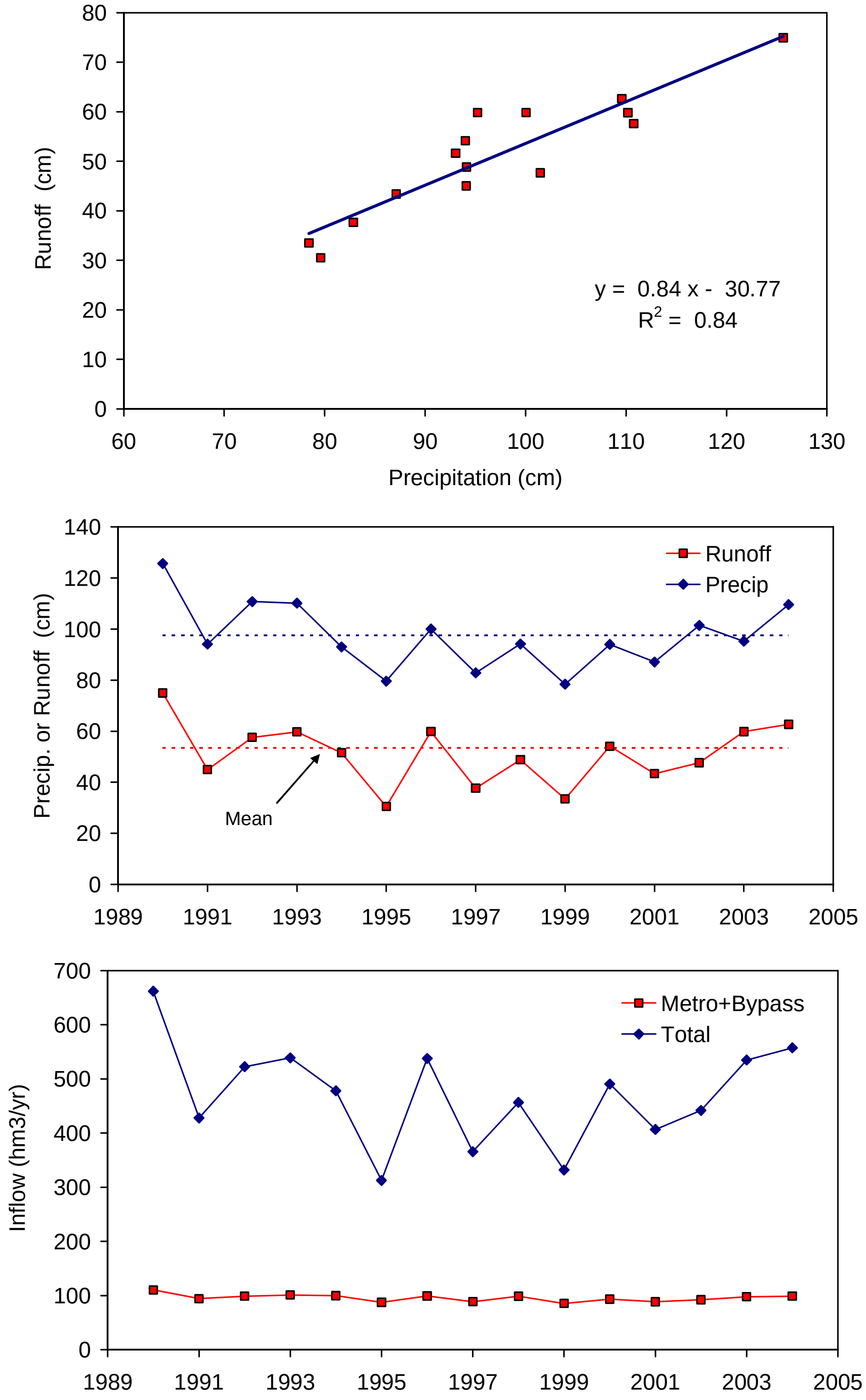


Figure 3
Long-Term Trends in Total Inflow & Outflow Concentrations

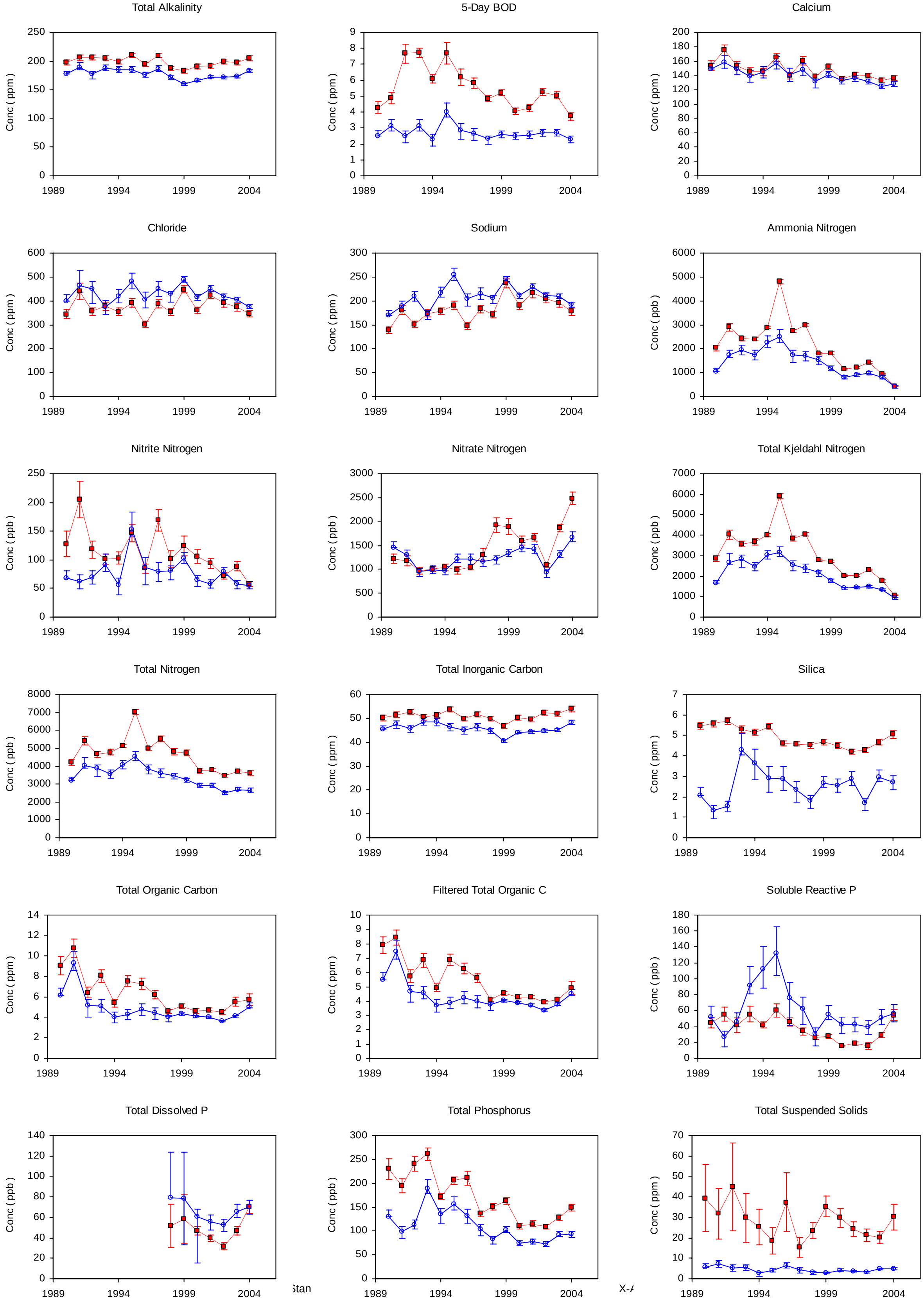


Figure 4
Long-Term Trends in Total Inflow & Outflow Loads

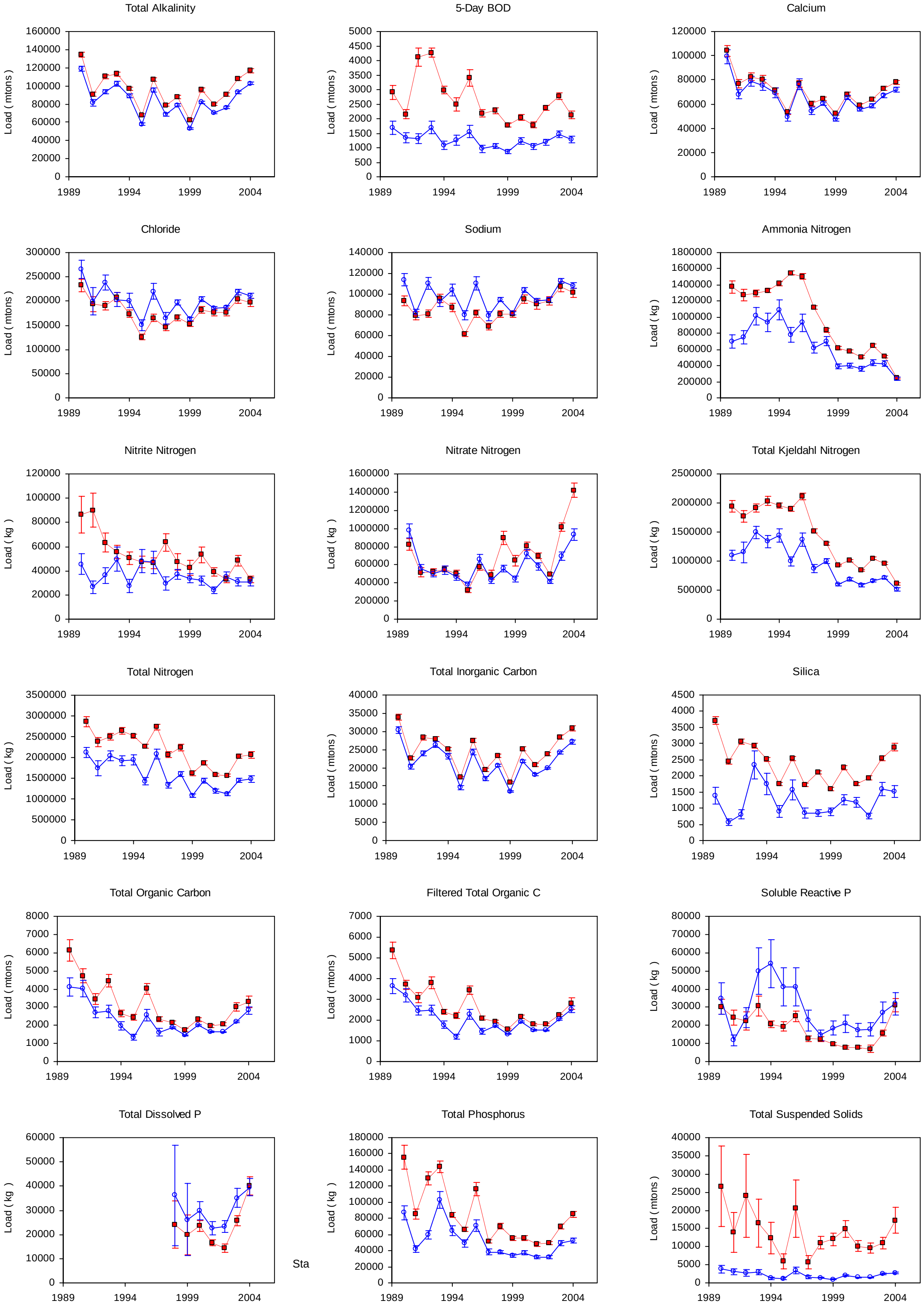


Figure 5
Long-Term Trends in NonPoint & Metro Loads

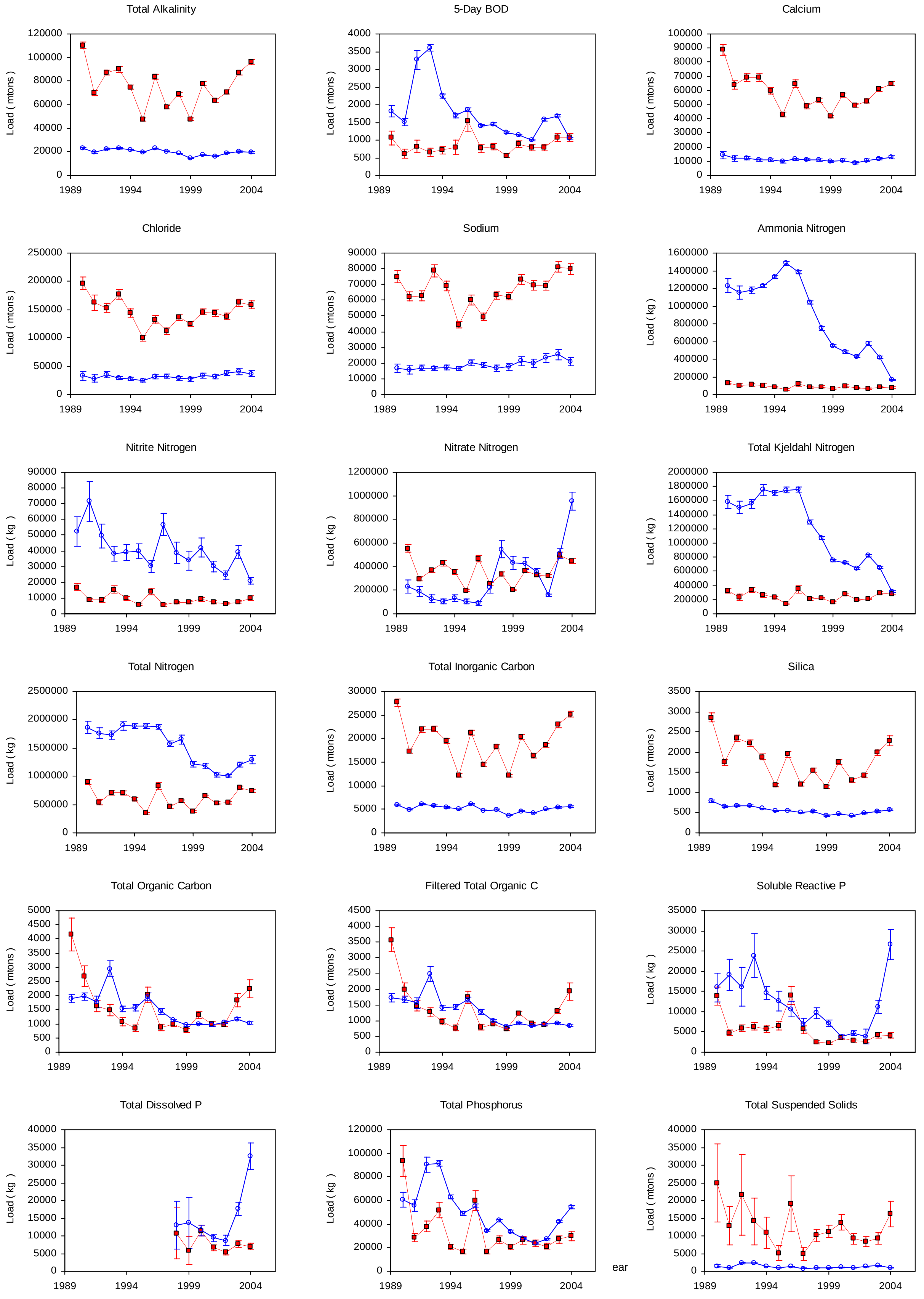
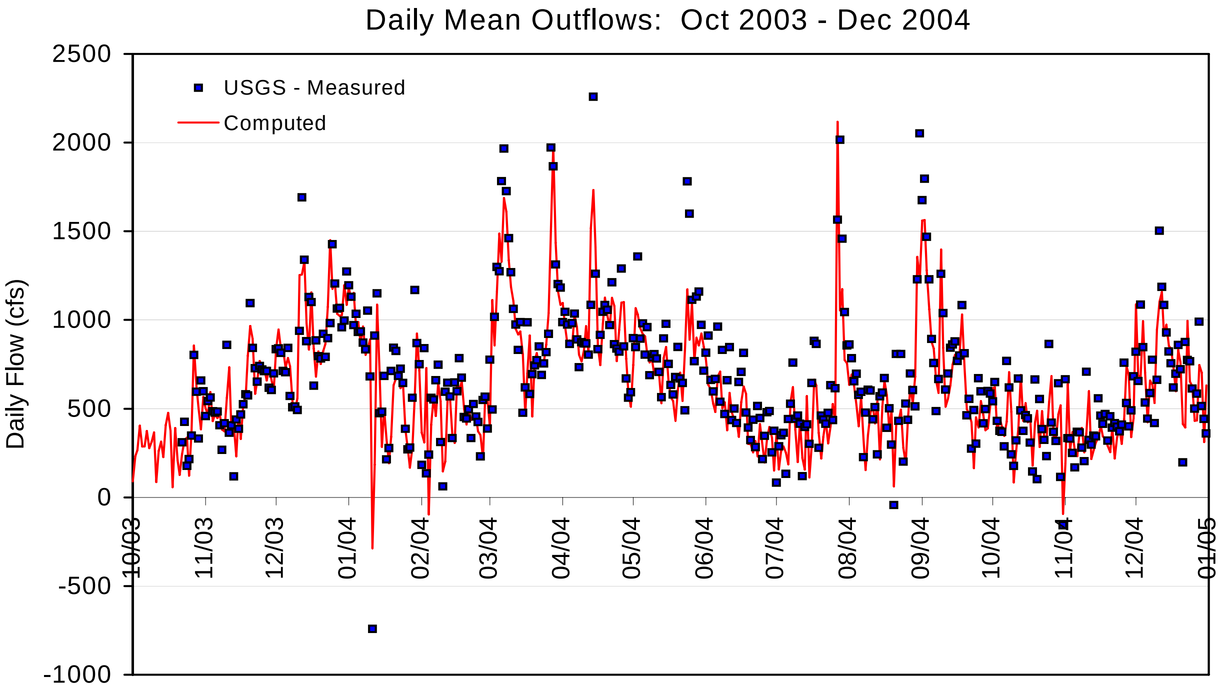


Figure 6
Comparison of USGS Measured Outflows with Water Budget Estimates



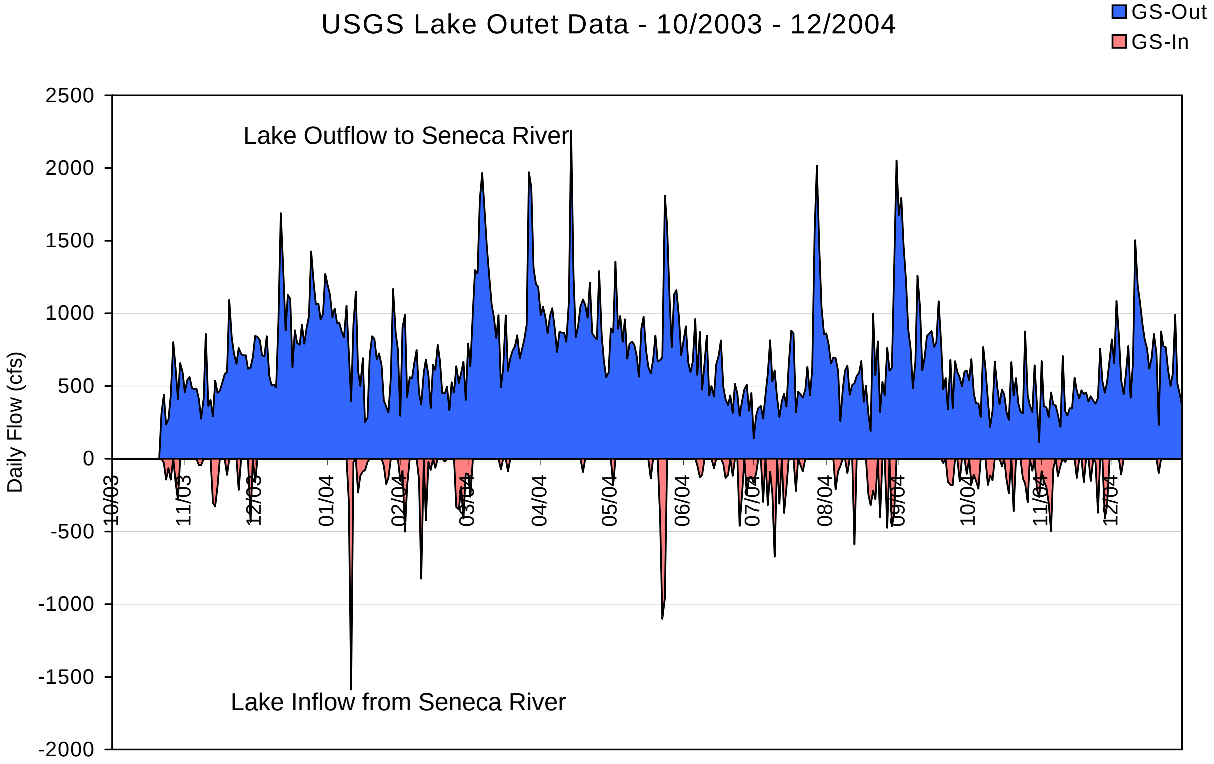


Table 1: 10-Year Trends in Load & Flow-Wtd-Mean Concentration

Load Trends (% / yr) **Period: 1995 to 2004**

Term	ALK	BOD5	CA	CL	NA	NH3N	NO2N	NO3N	TKN	TN	SIO2	TIC	TOC	TOC_F	SRP	TP	TSS
Metro				4%	3%	-18%		16%	-15%	-7%			-6%	-7%			
Bypass								14%					-16%	-17%			
Allied	14%		12%	16%	16%			15%				13%					21%
Crucible		-6%					-15%	-14%		-11%			-6%	-6%			
Harbor/Hiawatha	6%		4%	7%	8%			8%		7%		6%				7%	
Ley/Park	4%	-17%	4%	5%	5%							5%					
Ninemile/Rt48		8%										5%	11%	8%			
Onond./Kirkpatrick	5%		4%	8%	8%				6%			5%			-19%		
Harbor/Velasko	6%	11%	4%	7%	8%			8%	7%	8%	5%	6%	10%	10%			
Onondaga/Dorwin	5%	9%		4%	4%				8%			5%					
Total Gauged				4%	5%	-17%	-4%	11%	-12%	-4%		4%					
NonPoint Gauged	5%			4%	6%							5%					
Ungauged	5%			4%	6%							5%					
Total NonPoint	5%			4%	6%							5%					
Total Industrial								-5%								7%	
Total Municipal				4%	3%	-18%		16%	-15%	-6%			-6%	-7%			
Total Inflow				4%	5%	-16%	-4%	10%	-12%	-3%		4%					
Total Outflow						-12%	-5%	6%	-8%								
Retention	5%			-14%	-21%	-25%		28%	-18%	-5%		5%		-20%	-11%		
Outlet2		4%		3%	4%	-9%		6%	-6%								8%
Outlet12						-12%	-5%	6%	-8%								

Concentration Trends (% / yr) **Period: 1995 to 2004**

Term	ALK	BOD5	CA	CL	NA	NH3N	NO2N	NO3N	TKN	TN	SIO2	TIC	TOC	TOC_F	SRP	TP	TSS
Metro		-4%		3%	3%	-19%	-6%	15%	-16%	-7%			-6%	-7%			
Bypass		-7%	-6%			-10%	10%	10%	-9%	-7%		-3%	-16%	-17%	-17%	-9%	-4%
Allied		-3%	-3%			-19%	-10%		-12%	-5%	-6%		-4%	-4%	-8%	-5%	10%
Crucible	2%		3%	5%		6%	-10%	-11%		-7%	5%	3%			13%	10%	
Harbor/Hiawatha					2%	-8%	-6%	2%		2%							
Ley/Park		-20%				-10%	-7%			-6%		1%	-5%	-6%	-14%		
Ninemile/Rt48		3%	-4%	-6%	-5%	-4%	-5%						6%	3%	-13%		
Onond./Kirkpatrick															-22%		
Harbor/Velasko		5%	-2%			-9%	-8%	2%		2%	-2%						
Onondaga/Dorwin		5%				-10%			4%						-22%		
Total Gauged		-6%	-2%			-20%	-8%	7%	-15%	-7%			-4%	-5%		-6%	
NonPoint Gauged		-5%	-3%			-5%	-4%								-17%		
Ungauged		-5%	-3%			-5%	-4%								-17%		
Total NonPoint		-5%	-3%			-5%	-4%								-17%		
Total Industrial	2%		2%	5%	4%						4%	3%			10%	8%	
Total Municipal		-4%		3%	3%	-19%		15%	-15%	-7%			-7%	-8%			
Total Inflow		-6%	-2%			-20%	-8%	7%	-15%	-7%			-4%	-5%		-6%	
Total Outflow		-4%	-2%	-2%		-15%	-9%		-12%	-6%					-10%	-6%	
Outlet2			-1%			-12%	-7%		-9%	-4%						-5%	5%
Outlet12		-4%	-2%	-2%		-15%	-9%		-12%	-6%					-10%	-6%	

Trends Significant at p < .10 (2-tailed hypothesis), based upon linear regression of yearly values

Table 2: Chloride Balance for 2000-2004

Variable: **Chloride** **Average for Years:** **2000** **thru** **2004** **Season:** **Year**

							Percent of Total Inflow			Drain.		Export
Term	**Flow 10^6 m3**	**Load mtons**	**Std Error mtons**	**Conc ppm**	**RSE %**	**Sampl per yr**	**Flow %**	**Load %**	**Error %**	**Area km2**	**Runoff cm**	**mtons/ km2**
Metro Effluent	91.85	35106	2038	382	6%	33	18%	19%	37%			
Metro Bypass	2.21	956	176	432	18%	4	0%	1%	0%			
East Flume	0.65	314	15	484	5%	27	0%	0%	0%			
Crucible	2.43	1000	19	411	2%	27	0%	1%	0%			
Harbor Brook	10.06	2712	196	270	7%	30	2%	1%	0%	31.4	32.1	86.5
Ley Creek	40.21	13559	1418	337	10%	31	8%	7%	18%	66.1	60.8	205.1
Ninemile Creek	146.98	53012	846	361	2%	29	30%	28%	6%	298.1	49.3	177.8
Onondaga Creek	167.12	71031	1600	425	2%	33	34%	38%	23%	285.1	58.6	249.1
Nonpoint Gauged	364.37	140314	2308	385	2%	123	73%	75%	48%	680.7	53.5	206.1
Nonpoint Ungauged	24.82	9557	1294	385	14%	0	5%	5%	15%	46.4	53.5	206.1
NonPoint Total	389.19	149871	2646	385	2%	123	78%	80%	63%	727.0	53.5	206.1
Industrial	3.08	1314	24	426	2%	54	1%	1%	0%			
Municipal	94.07	36062	2046	383	6%	37	19%	19%	37%			
Total External	486.34	187247	3345	385	2%	214	98%	100%	100%	727.0	66.9	257.5
Precipitation	11.41	11	1	1	9%	0	2%	0%	0%	11.7	97.5	1.0
Total Inflow	497.74	187258	3345	376	2%	214	100%	100%	100%	738.7	67.4	253.5
Evaporation	8.86						2%			11.7	75.7	
Outflow	488.89	200996	2304	411	1%		98%	107%	47%	738.7	66.2	272.1
Retention	0.00	-13738	4062		30%		0%	-7%				
Alternative Estimates of Lake Output												
Outlet 12 Feet	488.89	200996	2304	411	1%	26	98%	107%	47%	738.7	66.2	272.1
Outlet 2 Feet	488.89	175253	4532	358	3%	26	98%	94%	184%	738.7	66.2	237.2
Upstream/Downstream Contrast- Harbor Brook												
Upstream - Velasko	9.43	2151	73	228	3%	30	2%	1%	0%	27.0	35.0	79.8
Downstream - Hiawatha	10.06	2712	196	270	7%	30	2%	1%	0%	31.4	32.1	86.5
Local Inflow	0.63	561	209	896	37%		0%	0%	0%	4.4	14.2	127.4
Upstream/Downstream Contrast - Onondaga Creek												
Upstream - Dorwin	130.12	15339	291	118	2%	33	26%	8%	1%	229.4	56.7	66.9
Downstream - Kirkpatrick	167.12	71031	1600	425	2%	33	34%	38%	23%	285.1	58.6	249.1
Local Inflow	37.00	55692	1627	1505	3%		7%	30%	24%	55.7	66.4	999.3

Lake Overflow Rate 41.79 m/yr Calib. Settling Rate -2.9 m/yr RSE % = Relative Std. Error of Load & Inflow Conc. Estimates
Lake Residence Time 0.26 years Calib. Retention Coef. -7% Error % = Percent of Variance in Total Inflow Load Estimate

Table 3: Total Phosphorus Balance for 2000-2004

Variable: **Total Phosphorus** **Average for Years:** 2000 thru 2004 **Season:** Year

							Percent of Total Inflow			Drain.		Export
Term	Flow 10^6 m3	Load kg	Std Error kg	Conc ppb	RSE %	Sampl per yr	Flow %	Load %	Error %	Area km2	Runoff cm	kg / km2
Metro Effluent	91.85	32709	354	356	1%	363	18%	53%	7%			
Metro Bypass	2.21	2396	78	1082	3%	46	0%	4%	0%			
East Flume	0.65	105	7	162	6%	27	0%	0%	0%			
Crucible	2.43	313	10	129	3%	27	0%	1%	0%			
Harbor Brook	10.06	811	112	81	14%	30	2%	1%	1%	31.4	32.1	25.9
Ley Creek	40.21	3834	430	95	11%	31	8%	6%	10%	66.1	60.8	58.0
Ninemile Creek	146.98	8377	494	57	6%	29	30%	14%	13%	298.1	49.3	28.1
Onondaga Creek	167.12	10945	1131	65	10%	33	34%	18%	67%	285.1	58.6	38.4
Nonpoint Gauged	364.37	23966	1312	66	5%	123	73%	39%	90%	680.7	53.5	35.2
Nonpoint Ungauged	24.82	1632	238	66	15%	0	5%	3%	3%	46.4	53.5	35.2
NonPoint Total	389.19	25599	1333	66	5%	123	78%	42%	93%	727.0	53.5	35.2
Industrial	3.08	418	12	136	3%	54	1%	1%	0%			
Municipal	94.07	35105	362	373	1%	409	19%	57%	7%			
Total External	486.34	61122	1382	126	2%	587	98%	99%	100%	727.0	66.9	84.1
Precipitation	11.41	342	31	30	9%	0	2%	1%	0%	11.7	97.5	29.2
Total Inflow	497.74	61464	1382	123	2%	587	100%	100%	100%	738.7	67.4	83.2
Evaporation	8.86						2%			11.7	75.7	
Outflow	488.89	40586	1199	83	3%		98%	66%	75%	738.7	66.2	54.9
Retention	0.00	20878	1830		9%		0%	34%				
Alternative Estimates of Lake Output												
Outlet 12 Feet	488.89	40586	1199	83	3%	26	98%	66%	75%	738.7	66.2	54.9
Outlet 2 Feet	488.89	38318	1221	78	3%	26	98%	62%	78%	738.7	66.2	51.9
Upstream/Downstream Contrast- Harbor Brook												
Upstream - Velasko	9.43	398	144	42	36%	30	2%	1%	1%	27.0	35.0	14.8
Downstream - Hiawatha	10.06	811	112	81	14%	30	2%	1%	1%	31.4	32.1	25.9
Local Inflow	0.63	413	182	659	44%		0%	1%	2%	4.4	14.2	93.7
Upstream/Downstream Contrast - Onondaga Creek												
Upstream - Dorwin	130.12	7942	980	61	12%	33	26%	13%	50%	229.4	56.7	34.6
Downstream - Kirkpatrick	167.12	10945	1131	65	10%	33	34%	18%	67%	285.1	58.6	38.4
Local Inflow	37.00	3002	1497	81	50%		7%	5%	117%	55.7	66.4	53.9

Lake Overflow Rate 41.79 m/yr Calib. Settling Rate 21.5 m/yr RSE % = Relative Std. Error of Load & Inflow Conc. Estimates
Lake Residence Time 0.26 years Calib. Retention Coef. 34% Error % = Percent of Variance in Total Inflow Load Estimate

Table 4: Soluble Reactive P Balance for 2000-2004

Variable: **Soluble Reactive P** **Average for Years:** **2000** **thru** **2004** **Season: Year**

							Percent of Total Inflow			Drain.		Export
Term	**Flow 10^6 m3**	**Load kg**	**Std Error kg**	**Conc ppb**	**RSE %**	**Sampl per yr**	**Flow %**	**Load %**	**Error %**	**Area km2**	**Runoff cm**	**kg / km2**
Metro Effluent	91.85	9552	794	104	8%	29	18%	69%	75%			
Metro Bypass	2.21	509	391	230	77%	4	0%	4%	18%			
East Flume	0.65	47	5	73	11%	27	0%	0%	0%			
Crucible	2.43	123	6	51	5%	27	0%	1%	0%			
Harbor Brook	10.06	255	34	25	13%	30	2%	2%	0%	31.4	32.1	8.1
Ley Creek	40.21	657	38	16	6%	31	8%	5%	0%	66.1	60.8	9.9
Ninemile Creek	146.98	1108	149	8	13%	29	30%	8%	3%	298.1	49.3	3.7
Onondaga Creek	167.12	1253	174	7	14%	33	34%	9%	4%	285.1	58.6	4.4
Nonpoint Gauged	364.37	3272	235	9	7%	123	73%	24%	7%	680.7	53.5	4.8
Nonpoint Ungauged	24.82	223	34	9	15%	0	5%	2%	0%	46.4	53.5	4.8
NonPoint Total	389.19	3495	237	9	7%	123	78%	25%	7%	727.0	53.5	4.8
Industrial	3.08	171	8	55	5%	54	1%	1%	0%			
Municipal	94.07	10061	885	107	9%	33	19%	72%	93%			
Total External	486.34	13727	917	28	7%	210	98%	99%	100%	727.0	66.9	18.9
Precipitation	11.41	171	15	15	9%	0	2%	1%	0%	11.7	97.5	14.6
Total Inflow	497.74	13898	917	28	7%	210	100%	100%	100%	738.7	67.4	18.8
Evaporation	8.86						2%			11.7	75.7	
Outflow	488.89	22992	2216	47	10%		98%	165%	584%	738.7	66.2	31.1
Retention	0.00	-9094	2398		26%		0%	-65%				
Alternative Estimates of Lake Output												
Outlet 12 Feet	488.89	22992	2216	47	10%	26	98%	165%	584%	738.7	66.2	31.1
Outlet 2 Feet	488.89	19879	1294	41	7%	26	98%	143%	199%	738.7	66.2	26.9
Upstream/Downstream Contrast- Harbor Brook												
Upstream - Velasko	9.43	76	14	8	19%	30	2%	1%	0%	27.0	35.0	2.8
Downstream - Hiawatha	10.06	255	34	25	13%	30	2%	2%	0%	31.4	32.1	8.1
Local Inflow	0.63	179	37	286	21%		0%	1%	0%	4.4	14.2	40.6
Upstream/Downstream Contrast - Onondaga Creek												
Upstream - Dorwin	130.12	554	86	4	16%	33	26%	4%	1%	229.4	56.7	2.4
Downstream - Kirkpatrick	167.12	1253	174	7	14%	33	34%	9%	4%	285.1	58.6	4.4
Local Inflow	37.00	699	195	19	28%		7%	5%	5%	55.7	66.4	12.5

Lake Overflow Rate 41.79 m/yr Calib. Settling Rate -16.5 m/yr RSE % = Relative Std. Error of Load & Inflow Conc. Estimates
Lake Residence Time 0.26 years Calib. Retention Coef. -65% Error % = Percent of Variance in Total Inflow Load Estimate

Table 5: Total Nitrogen Balance for 2000-2004

Variable: **Total Nitrogen** **Average for Years:** **2000** **thru** **2004** **Season: Year**

						Percent of Total Inflow				Drain.		Export
	Flow	Load	Std Error	Conc	RSE	Sampl	Flow	Load	Error	Area	Runoff	kg/
Term	**10^6 m3**	**kg**	**kg**	**ppb**	**%**	**per yr**	**%**	**%**	**%**	**km2**	**cm**	**km2**
Metro Effluent	91.85	1113752	21271	12125	2%	72	18%	61%	76%			
Metro Bypass	2.21	28642	1140	12939	4%	4	0%	2%	0%			
East Flume	0.65	4048	114	6249	3%	27	0%	0%	0%			
Crucible	2.43	3663	162	1506	4%	27	0%	0%	0%			
Harbor Brook	10.06	21434	733	2131	3%	27	2%	1%	0%	31.4	32.1	683.4
Ley Creek	40.21	58350	2731	1451	5%	26	8%	3%	1%	66.1	60.8	882.8
Ninemile Creek	146.98	262289	7079	1784	3%	26	30%	14%	8%	298.1	49.3	879.9
Onondaga Creek	167.12	266582	6935	1595	3%	27	34%	15%	8%	285.1	58.6	934.9
Nonpoint Gauged	364.37	608654	10306	1670	2%	107	73%	33%	18%	680.7	53.5	894.2
Nonpoint Ungauged	24.82	41457	5682	1670	14%	0	5%	2%	5%	46.4	53.5	894.2
NonPoint Total	389.19	650111	11768	1670	2%	107	78%	36%	23%	727.0	53.5	894.2
Industrial	3.08	7711	198	2503	3%	53	1%	0%	0%			
Municipal	94.07	1142394	21301	12144	2%	76	19%	63%	76%			
Total External	486.34	1800216	24337	3702	1%	236	98%	99%	99%	727.0	66.9	2476.1
Precipitation	11.41	21670	1944	1900	9%	0	2%	1%	1%	11.7	97.5	1852.1
Total Inflow	497.74	1821886	24414	3660	1%	236	100%	100%	100%	738.7	67.4	2466.2
Evaporation	8.86						2%			11.7	75.7	
Outflow	488.89	1335770	24683	2732	2%		98%	73%	102%	738.7	66.2	1808.2
Retention	0.00	486115	34718		7%		0%	27%				
Alternative Estimates of Lake Output												
Outlet 12 Feet	488.89	1335770	24683	2732	2%	25	98%	73%	102%	738.7	66.2	1808.2
Outlet 2 Feet	488.89	1230299	26156	2517	2%	25	98%	68%	115%	738.7	66.2	1665.4
Upstream/Downstream Contrast- Harbor Brook												
Upstream - Velasko	9.43	20254	1031	2147	5%	27	2%	1%	0%	27.0	35.0	751.3
Downstream - Hiawatha	10.06	21434	733	2131	3%	27	2%	1%	0%	31.4	32.1	683.4
Local Inflow	0.63	1180	1265	1884	107%		0%	0%	0%	4.4	14.2	267.7
Upstream/Downstream Contrast - Onondaga Creek												
Upstream - Dorwin	130.12	200556	6531	1541	3%	27	26%	11%	7%	229.4	56.7	874.3
Downstream - Kirkpatrick	167.12	266582	6935	1595	3%	27	34%	15%	8%	285.1	58.6	934.9
Local Inflow	37.00	66026	9526	1785	14%		7%	4%	15%	55.7	66.4	1184.7

Lake Overflow Rate 41.79 m/yr Calib. Settling Rate 15.2 m/yr RSE % = Relative Std. Error of Load & Inflow Conc. Estimates
Lake Residence Time 0.26 years Calib. Retention Coef. 27% Error % = Percent of Variance in Total Inflow Load Estimate

Table 6: Ammonia Nitrogen Balance for 2000-2004

Variable: Ammonia Nitrogen Average for Years: 2000 thru 2004 Season: Year

							Percent of Total Inflow			Drain.		Export
Term	**Flow 10^6 m3**	**Load kg**	**Std Error kg**	**Conc ppb**	**RSE %**	**Sampl per yr**	**Flow %**	**Load %**	**Error %**	**Area km2**	**Runoff cm**	**kg/ km2**
Metro Effluent	91.85	402462	5939	4382	1%	363	18%	81%	60%			
Metro Bypass	2.21	13619	748	6153	5%	46	0%	3%	1%			
East Flume	0.65	400	21	618	5%	27	0%	0%	0%			
Crucible	2.43	433	83	178	19%	27	0%	0%	0%			
Harbor Brook	10.06	1134	107	113	9%	27	2%	0%	0%	31.4	32.1	36.1
Ley Creek	40.21	14132	952	351	7%	27	8%	3%	2%	66.1	60.8	213.8
Ninemile Creek	146.98	40725	4528	277	11%	26	30%	8%	35%	298.1	49.3	136.6
Onondaga Creek	167.12	18206	1129	109	6%	27	34%	4%	2%	285.1	58.6	63.8
Nonpoint Gauged	364.37	74197	4763	204	6%	107	73%	15%	38%	680.7	53.5	109.0
Nonpoint Ungauged	24.82	5054	756	204	15%	0	5%	1%	1%	46.4	53.5	109.0
NonPoint Total	389.19	79250	4823	204	6%	107	78%	16%	39%	727.0	53.5	109.0
Industrial	3.08	833	85	270	10%	54	1%	0%	0%			
Municipal	94.07	416081	5986	4423	1%	409	19%	84%	61%			
Total External	486.34	496164	7688	1020	2%	571	98%	100%	100%	727.0	66.9	682.4
Precipitation	11.41	1141	102	100	9%	0	2%	0%	0%	11.7	97.5	97.5
Total Inflow	497.74	497304	7688	999	2%	571	100%	100%	100%	738.7	67.4	673.2
Evaporation	8.86						2%			11.7	75.7	
Outflow	488.89	371713	13731	760	4%		98%	75%	319%	738.7	66.2	503.2
Retention	0.00	125591	15737		13%		0%	25%				
Alternative Estimates of Lake Output												
Outlet 12 Feet	488.89	371713	13731	760	4%	26	98%	75%	319%	738.7	66.2	503.2
Outlet 2 Feet	488.89	322068	13923	659	4%	26	98%	65%	328%	738.7	66.2	436.0
Upstream/Downstream Contrast- Harbor Brook												
Upstream - Velasko	9.43	611	51	65	8%	27	2%	0%	0%	27.0	35.0	22.7
Downstream - Hiawatha	10.06	1134	107	113	9%	27	2%	0%	0%	31.4	32.1	36.1
Local Inflow	0.63	523	118	835	23%		0%	0%	0%	4.4	14.2	118.6
Upstream/Downstream Contrast - Onondaga Creek												
Upstream - Dorwin	130.12	8440	424	65	5%	27	26%	2%	0%	229.4	56.7	36.8
Downstream - Kirkpatrick	167.12	18206	1129	109	6%	27	34%	4%	2%	285.1	58.6	63.8
Local Inflow	37.00	9766	1206	264	12%		7%	2%	2%	55.7	66.4	175.2

Lake Overflow Rate 41.79 m/yr Calib. Settling Rate 14.1 m/yr RSE % = Relative Std. Error of Load & Inflow Conc. Estimates
Lake Residence Time 0.26 years Calib. Retention Coef. 25% Error % = Percent of Variance in Total Inflow Load Estimate

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APPENDIX 8: FISH MONITORING:
METHODS AND DATA SUMMARIES

This Appendix summarizes the Methods used to collect and analyze fish data gathered as part of the Ambient Monitoring Program. For a discussion of the results of this study, refer to Chapter 2 of the 2004 Ambient Monitoring Program report.

A8-1 General Sampling Design

Different life stages of the Onondaga Lake fish community are sampled each year using equipment and methods targeted for the life stage and habitat of interest. The Ambient Monitoring Program (AMP) team has developed specific protocols for sampling pelagic (open water) larval fish, littoral (shallow water) larval fish, littoral juvenile fish, littoral adults, littoral-profundal (transitional area between shallow and deep water) adults, and littoral fish nests.

The lake's littoral zone was divided into five strata exhibiting different combinations of substrate type and wave energy. Because these factors influence habitat (especially the distribution and abundance of aquatic macrophytes), littoral fish data are tracked in the database along with the stratum in which they were collected or observed. The five strata are illustrated in Figure A8-1.

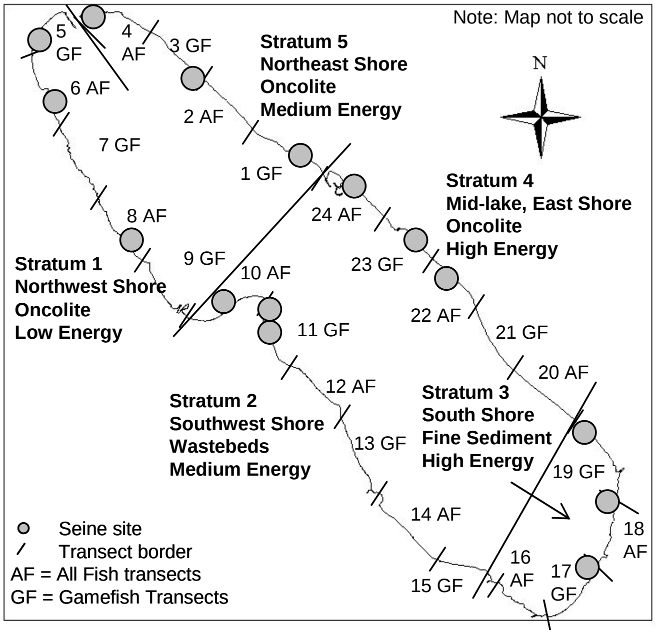

Figure A8-1. Location and description of strata, boat electrofishing transects, and seining sites in Onondaga Lake.

A8-2 Method Summaries

The 2004 sampling program is summarized in Table A8-1. The following sections describe the sampling methods. Additional details are included in the Annual AMP Program submittal, which is available from Onondaga County Department of Water Environment Protection (OCDWEP).

TABLE A8-1
Components of the 2004 Onondaga County AMP: Fishery Investigations

Component	Methods	SCHEDULE	Comments
ADULT	Littoral Electrofishing	Annual	Entire lake shoreline, transects alternate between collecting all fish encountered and gamefish only, 2 surveys; May, Sept.
	Littoral-profundal Gill Nets	Annual	One net each stratum, set on bottom at 5m depth, 2 events; May, Sept.
	Angler Diaries	Annual	Variable return from participating anglers
Young-of-the-Year	Littoral Seines	Annual	15 sites, three sites per stratum, every 3 weeks, May-Oct, 8 events total
Larvae	Pelagic Miller High Speed Trawls	Annual	Daytime samples, 4 transects N/S, oblique tows, ~surface to 5m depth, bi-weekly, May-Aug., 8 events total
Nests	Visual Observation	Annual	Entire Shoreline, June

A8-2.1 Adults: Littoral

Adult fish in the littoral zone were sampled by OCDWEP personnel using boat electrofishing. General procedures outlined in the NYSDEC Centrarchid Sampling Manual (1989) were followed. Electrofishing surveys were completed in May and September 2004. Water temperatures were between 15° and 21° C during the events.

The lake's littoral zone was divided into 24 equal-length transects (refer to Figure A8-1). A GPS unit was used in the field to locate the start and stop points during sampling events. Prior to sampling, water temperature, dissolved oxygen, specific conductance and pH were measured at a depth of 1 m. The electrofishing boat was navigated parallel to shore in approximately one meter of water along each transect and the time to cover each transect was recorded. Sampling occurred at night, from one-half hour after sunset to one-half hour before sunrise. The electrofishing unit (Smith-Root Type GPP 9.0) was set at a pulsed DC frequency of 120, 340 volts, and 21 to 25 amps.

Transects were sampled in one of two ways to reduce the time and costs associated with sampling: game fish only, or all fish encountered. In even-numbered transects only gamefish were netted for processing. In odd-numbered transects all fish were captured and processed. The following species were considered gamefish for this purpose:

Largemouth bass
Smallmouth bass
Walleye
Yellow perch
Bluegill
Pumpkinseed
Crappie (white and black)
Bowfin
Bullhead (brown and yellow)
Channel catfish
Rock bass
All esocids (pike family)
All salmonids (trout)

Fish collected for processing were identified to species, measured for total length (nearest mm) and, for the fall samples, weighed (nearest g). All fish were measured in samples where few to moderate numbers of fish were collected. In samples where high numbers of one or more species were collected, subsamples were taken by selecting 30 fish of each species. Fish in the subsample were measured for length and weight (September only); the remaining fish were identified to species level and counted.

When large numbers of fish were encountered the field team collected as many individual fish as possible and estimated the number of each species that were missed. These missed fish were noted in field log bulk section, but not included in the calculations with the exception of the clupeids. Due to the difficulty in netting clupeids (shad and alewives), a combination of fish that were boated and estimates of the number of fish missed were used in the calculations. Metrics where CPUE was used are depicted both with and without clupeids due to their potential to dominate the catch and because of the different method used for CPUE. A summary table of missed fish is included in this Appendix.

Due to their large size, carp were not boated; stunned carp were counted while in the water if they were within netting distance.

Adult fish of several species, including smallmouth bass, largemouth bass, bowfin, channel catfish, walleye and black crappie, were tagged with a numbered Floy tag. The Floy tags were labeled with information directing anyone recovering the tagged fish to contact the OCDWEP. This allows the County to collect information on the species, location/date of capture, movement, and growth of the fish.

Scale Samples

During the September sampling event, technicians collected scale samples from up to ten individuals captured in each transect of these species: walleye, rock bass, yellow perch, white perch, bluegill, pumpkinseed, gizzard shad, and black crappie. The goal was to collect a minimum of 30 scale samples per species.

Scale samples were removed from all smallmouth bass and largemouth bass greater than 100 mm collected during the fall electrofishing program. Scales were removed from the left side of the body below the lateral line, near the tip of the depressed pectoral fin. At least 15 scales were removed from each fish and placed in scale envelopes with length (mm), weight (g), date and site of capture recorded. Scales were pressed on clear cellulose acetate plastic slides and projected with a 40X Ken-A-Vision microprojector. Ages were interpreted by counting annuli, which were confirmed through blind comparisons by experienced personnel.

A8-2.2 Adults: Littoral-profundal

Gill nets were deployed in a manner to target smallmouth bass: set on the lake bottom, parallel to shore, at a water depth of 5m. Gill nets extended upward into the water column 1.8 m so the top of the net fished at a depth of 3.2m. Nets were set during the day at five locations (one in each stratum) and deployed for approximately two hours within one week of littoral electrofishing events (May and Sept.). GPS coordinates and water quality data are collected for each net set Standard NYSDEC sized experimental gillnets were used; these nets were 1.8 m deep with 7.6 m panels of 3.8, 5.1, 6.4, 7.6, 8.9, 10.2 cm (stretch) monofilament mesh.

A8-2.3 Juveniles

Juvenile fish were sampled using a 20-meter bag seine at 15 predetermined/historical monitoring sites in Onondaga Lake, three sites per stratum (Figure A8-1). Sampling was conducted at approximately three weeks intervals from May to October with a total of eight events. Methods were generally consistent with procedures outlined in the NYSDEC Centrarchid Sampling Manual (1989). Prior to sampling, water temperature, dissolved oxygen, specific conductance and pH were measured at a depth of 1 m. Samples were collected in water less than 1.5 m deep.

During sampling, one brail of the seine was held on shore and the other brail was extended perpendicular to shore. Holding the in-shore brail stationary, the lakeward brail was swept to shore, which resulted in a sample area equivalent to one quarter circle (90º). At each site a minimum of 30 individuals of each species were measured to the nearest millimeter. Largemouth and smallmouth bass were weighed to the nearest 0.1 gram. Species unable to be identified in the field were preserved in a 10% formalin solution and identified at a later date. Smaller (<30 mm long) bluegill and pumpkinseed sunfish were nearly indistinguishable; all young-of-year sunfish were recorded as "*Lepomis* spp."

A8-2.4 Larvae: Pelagic

A Miller high-speed sampler with a net mesh size of 500 μm was used to sample pelagic (open water) larvae. Eight sampling events were conducted during the day on a biweekly schedule from May to August. Oblique tows filtered water at depths from approximately 5 m to the surface in eight tows, four each in the north and south basin. Sampler contents were emptied into a labeled plastic sample jar and preserved in 10% formalin solution. Samples were subsequently transferred to 70% ethanol.

A8-2.5 Littoral Nesting Survey

Fish nests were counted along the entire shoreline in June. Date of the annual survey depends on water temperature (must be between 15 and 20º C), water clarity (target: see bottom in 2 m of water), and weather conditions (must be sunny and calm). Nests were counted by maneuvering a small boat driven at constant speed, parallel to the shoreline, in a single transect over 1 m of water. One observer wearing polarized sunglasses stood on an elevated platform at the front of the boat, reporting the number of nests observed and, if possible, the species guarding the nests. A second person recorded the observation data, while a third person piloted the boat.

A8-2.6 Angler Diaries

OCDWEP recruits anglers actively fishing Onondaga Lake, the Oneida River, and segments of the Seneca River to participate in an annual diary program. Participating anglers were asked to record number of anglers, target species, the number of fish of each species caught during each fishing trip, the location, the time spent angling and lake conditions. Data were summarized based on catch per hour per of each species caught.

A8-3 Age and Growth Calculations

The OCDWEP staff has calculated age and growth statistics and associated population attributes for largemouth and smallmouth bass collected in the first five years of the AMP. Methods and assumptions are summarized in this section.

The hard parts of fish (scales, otoliths, fin rays/spines, cleithra, vertebrae, opercular bones and dentary bones) are often used to estimate age. Of these, scale samples can be easily collected with little or no harm to the fish (obtaining most other types of hard parts requires killing the fish). Hard parts are used in age estimation because of the formation of marks on these structures referred to as annuli. Annuli formation is related to changes in growth during alternating periods of fast (spring/summer) and slow growth (fall/winter) (Devries and Frie 1996). False annulus formation can occur during period of repressed growth due to stress related to spawning or illness, and older fish may have the most recent annuli obscured by the outer margin of the scale. This can lead to overestimates of age in fish with false annuli and underaging of older fish. As a result, aging from scales is best viewed as an estimation of age and is best applied to populations and not individuals.

OCDWEP has been collecting scale samples on most largemouth and smallmouth bass captured in Onondaga Lake since the inception of the AMP in 2000. As part of the ongoing OCDWEP efforts to understand the Onondaga Lake fish community in the context of past population characteristics, future population changes and region wide comparisons OCDWEP has undertaken the task of aging largemouth and smallmouth bass collected from 2000-2004. A total of 333 largemouth bass and 259 smallmouth bass sampled between the 2000 and 2004 were aged for this analysis.

Length-at-age results from scale analysis were examined from the years 2000 – 2004 for both largemouth bass and smallmouth bass. Analysis of variance (ANOVA) was used to determine if there were any significant differences in length-at-age from year to year. Growth rates of smallmouth bass and largemouth bass from 2000 and 2004 were also compared to the previous decade using an analysis of variance. After determining no significant difference between years within each decade, data sets from the early 1990s were combined, and compared to combined data sets from 2000 through 2004.

A8-4 Data Interpretation: Metrics

As described in the Data Analysis and Interpretation Plan (Appendix 9) the fish data were evaluated to test specific hypotheses related to the lake improvement efforts. A series of metrics were used to evaluate the AMP fisheries data. Selected metrics examine species composition and community structure, system function and health, and trophic structure.

The following metrics were used to track changes in the Onondaga Lake fish community:

Species structure and composition

- Species Richness
- Diversity / Community Structure (relative abundance)
- Pollution Tolerance
- Thermal Guilds

Trophic structure

- Relative Proportion of Trophic Guild

System function

- Number of Reproducing Species
- Recruitment

Health

- Size

- Growth
- Relative Weight
- Deformities, erosion, lesions, tumors and fungal infections

Refer to the report Chapter 2 for discussion of the results of this study.

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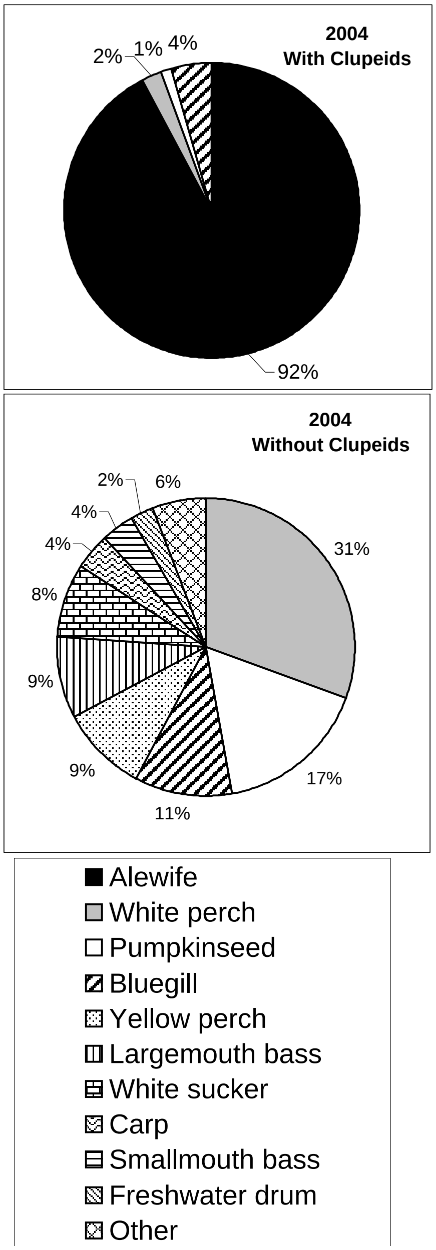
New York State Department of Environmental Conservation (NYSDEC). 1989. Centrarchid sampling manual. Chapter 1 *In*: Fish sampling manual: Guidelines for the collection, analyses and interpretation of fisheries data by units of the New York State Department of Environmental Conservation. Albany, NY.

Figure A8-2. Whole lake electrofishing relative abundance in 2004.

Note: CPUE (catch per hour) for gamefish (bolded) is calculated from all 24 transects. CPUE for non-gamefish are calculated from only the one-half of the transects where all fish are collected (every other transect). Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from a combination of fish that are boated and estimates of the number of fish missed. Because of their large size carp are not boated, instead carp within netting distance are counted while still in the water.



graph data without clupeids

Species	**Mean CPUE**	**SE**	**Number**	**Relative Abundance with Clupeids**	**Relative Abundance without Clupeids**
Alewife	2737.6	594.6	15236	92.1%	-
White perch	67.9	13.1	368	2.3%	30.6%
Pumpkinseed	37.0	5.6	402	1.2%	16.7%
Bluegill	23.3	4.8	252	0.78%	10.5%
Yellow perch	20.9	2.8	225	0.70%	9.4%
Largemouth bass	19.4	2.4	208	0.65%	8.7%
White sucker	18.0	4.7	96	0.60%	8.1%
Carp	8.8	1.6	48	0.30%	4.0%
Smallmouth bass	8.0	1.3	88	0.27%	3.6%
Freshwater drum	5.4	1.4	30	0.18%	2.4%
Other	25.2	10.8	179.0	1%	6%

graph data with clupeids

Species	**Mean CPUE**	**SE**	**Number**	**Relative Abundance with Clupeids**	**Relative Abundance without Clupeids**
Alewife	2737.6	594.6	15236	92.1%	-
White perch	67.9	13.1	368	2.3%	30.6%
Pumpkinseed	37.0	5.6	402	1.2%	16.7%
Other	128.9	29.8	1126.0	4%	53%

Figure A8-3. Trends in CPUE (catch per hour) of select species caught by electrofishing from 2000-2004.

Note: CPUE for gamefish (bolded) is calculated from all 24 transects. CPUE for non-gamefish are calculated from only the one-half of the transects where all fish are collected (every other transect). Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from a combination of fish that are boated and estimates of the number of fish missed. Because of their large size carp are not boated, instead carp within netting distance are counted while still in the water. Note: Y-axis differs for each species.

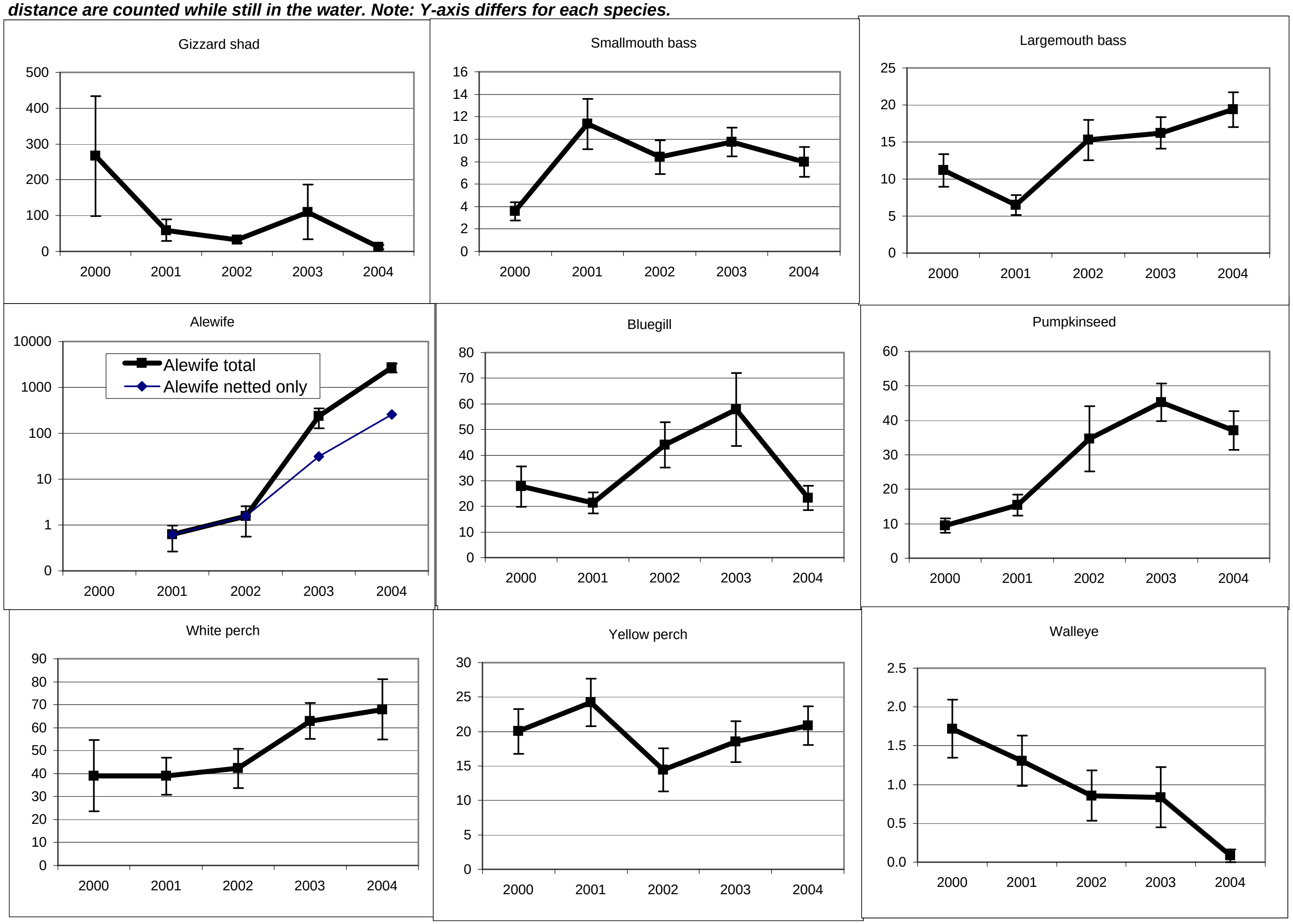


Figure A8-3 cont'd. Trends in CPUE (catch per hour) of select species caught by electrofishing from 2000-2004.

Note: CPUE for gamefish (bolded) is calculated from all 24 transects. CPUE for non-gamefish are calculated from only the one-half of the transects where all fish are collected (every other transect). Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from a combination of fish that are boated and estimates of the number of fish missed. Because of their large size carp are not boated, instead carp within netting distance are counted while still in the water. Note: Y-axis differs for each species.

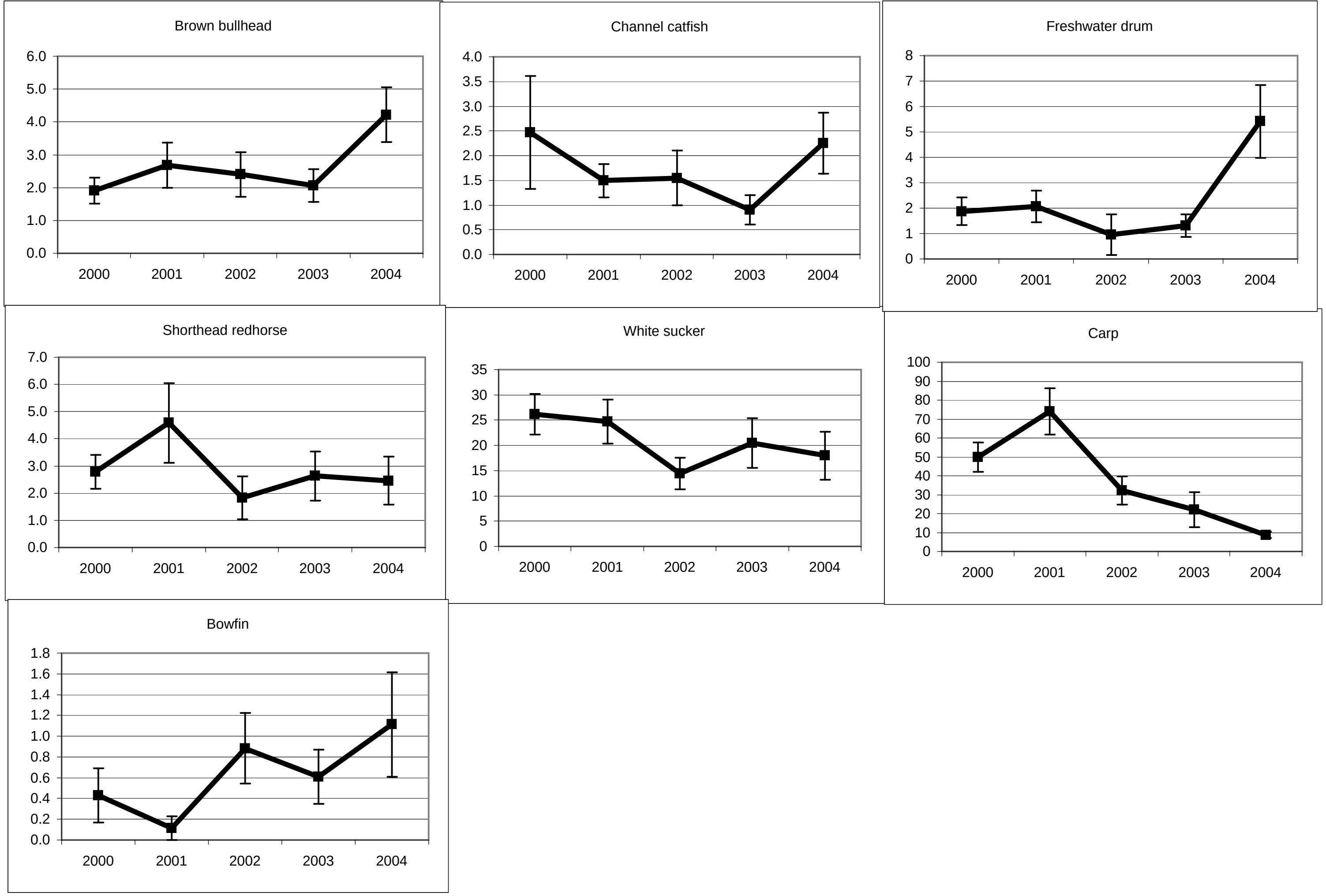


Figure A8-3 cont'd. Trends in CPUE (catch per hour) of select species caught by electrofishing from 2000-2004.

Graph Data

CPUE

Common name	2000	2001	2002	2003	2004
Gizzard shad	266.70	59.08	31.76	110.2	12.2
Bluegill	27.74	21.28	43.94	57.8	23.3
Pumpkinseed	9.47	15.34	34.66	45.3	37.0
White perch	39.07	38.88	42.27	62.9	67.9
Carp	49.91	74.06	32.32	22.0	8.8
Largemouth bass	11.16	6.49	15.26	16.2	19.4
Yellow perch	20.03	24.20	14.42	18.5	20.9
Smallmouth bass	3.57	11.36	8.41	9.7	8.0
White sucker	26.12	24.71	14.42	20.5	18.0
Brown bullhead	1.91	2.68	2.40	2.1	4.2
Channel catfish	2.46	1.49	1.55	0.90	2.2
Walleye	1.72	1.31	0.86	0.84	0.1
Shorthead redhorse	2.78	4.58	1.83	2.6	2.5
Bowfin	0.43	0.11	0.88	0.61	1.1
Alewife	0.00	0.62	1.58	238.4	2737.6
Rock bass	1.22	0.44		0.20	0.4
Freshwater drum	1.87	2.07	0.95	1.3	5.4
Longnose gar	0.47	0.97	0.72		0.6
Northern pike	0.19	0.15	0.18	0.22	0.1
Rainbow trout	0.06		0.10		
Northern hog sucker	0.25		0.18		
Logperch	0.22	0.31	0.20	0.20	0.2
Black crappie	0.33	0.20	0.08	0.17	0.1
Tiger muskellunge		0.08			0.1
Golden shiner	0.47			0.66	1.1
Banded killifish	0.11			0.19	0.20

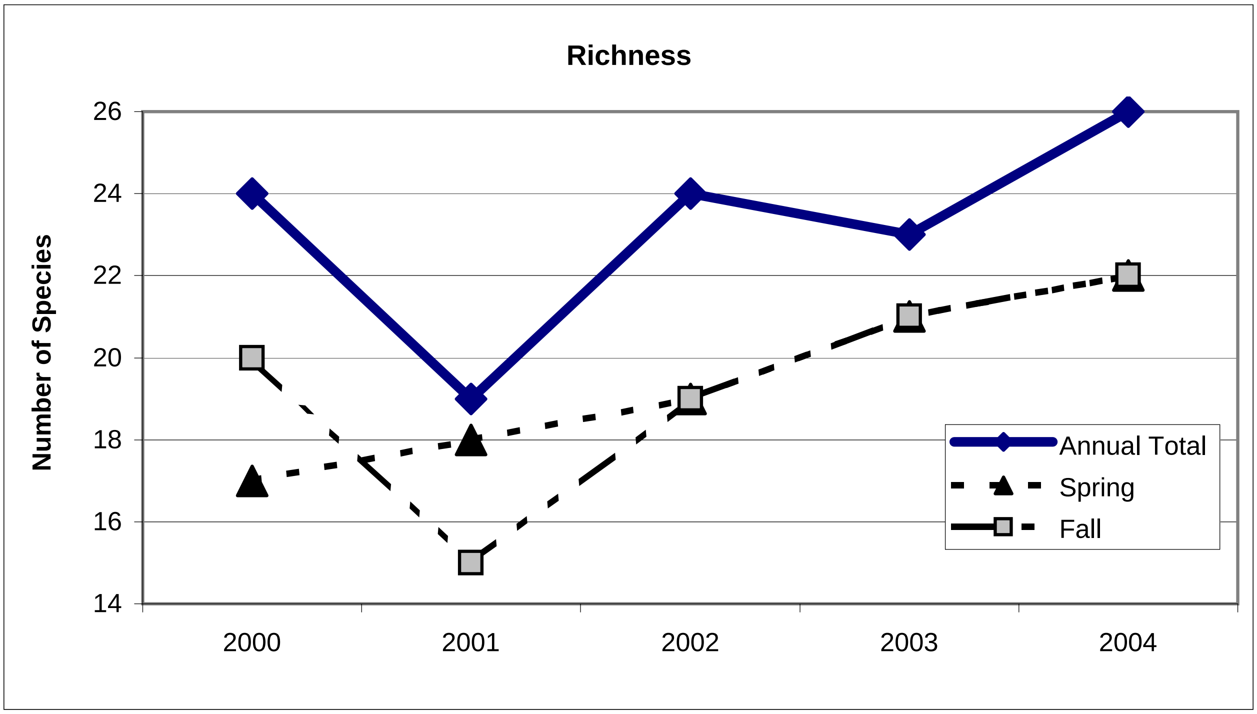
Standard Error of CPUE

Common name	2000	2001	2002	2003	2004
Gizzard shad	167.47	30.48	8.35	76.5	6.2
Bluegill	7.92	4.07	8.89	14.3	4.8
Pumpkinseed	2.07	3.05	9.43	5.5	5.6
White perch	15.57	7.96	8.49	7.8	13.1
Carp	7.68	12.24	7.45	9.3	1.6
Largemouth bass	2.18	1.36	2.71	2.1	2.4
Yellow perch	3.26	3.44	3.13	3.0	2.8
Smallmouth bass	0.81	2.24	1.49	1.3	1.3
White sucker	4.02	4.31	3.13	4.9	4.7
Brown bullhead	0.40	0.69	0.68	0.51	0.8
Channel catfish	1.14	0.33	0.55	0.30	0.6
Walleye	0.37	0.33	0.32	0.39	0.1
Shorthead redhorse	0.62	1.47	0.79	0.90	0.9
Bowfin	0.26	0.11	0.34	0.26	0.5
Alewife	0.00	0.36	1.01	110.0	594.6
Rock bass	0.33	0.28		0.14	0.2
Freshwater drum	0.55	0.63	0.79	0.44	1.4
Longnose gar	0.36	0.48	0.56		0.3
Northern pike	0.11	0.10	0.13	0.15	
Rainbow trout	0.06		0.10		
Northern hog sucker	0.17		0.18		
Logperch	0.16	0.31	0.20	0.20	0.2
Black crappie	0.17	0.11	0.08	0.17	0.10
Tiger muskellunge		0.08			
Golden shiner	0.28			0.48	0.50
Banded killifish	0.11			0.19	0.20

Netted Alewives CPUE

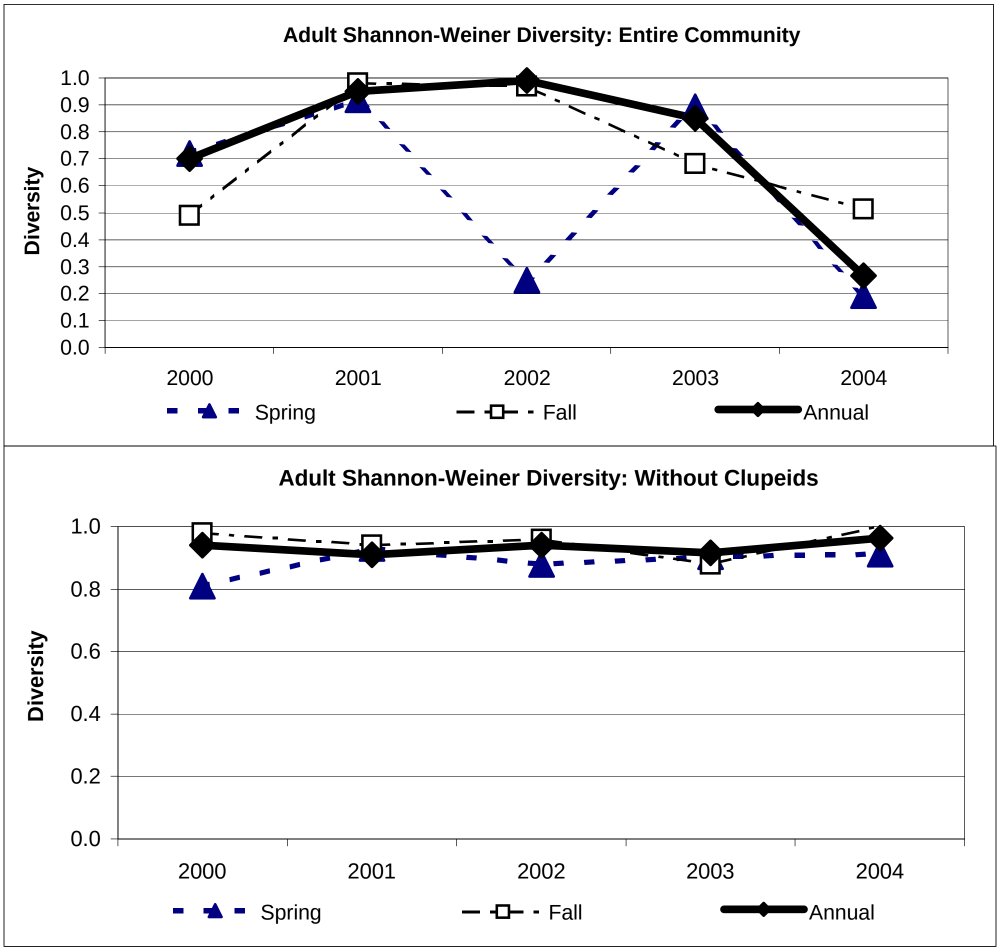
Common name	2000	2001	2002	2003	2004
Alewife		0.62	1.58	31.3	254

Figure A8-4. Electrofishing species richness in "all fish" transects from 2000-2004.



	2000	2001	2002	2003	2004
Annual Total	24	19	24	23	26
Spring	17	18	19	21	22
Fall	20	15	19	21	22

Figure A8-5. Electrofishing diversity in "all fish" transects from 2000-2004.



2000-2004 Trends

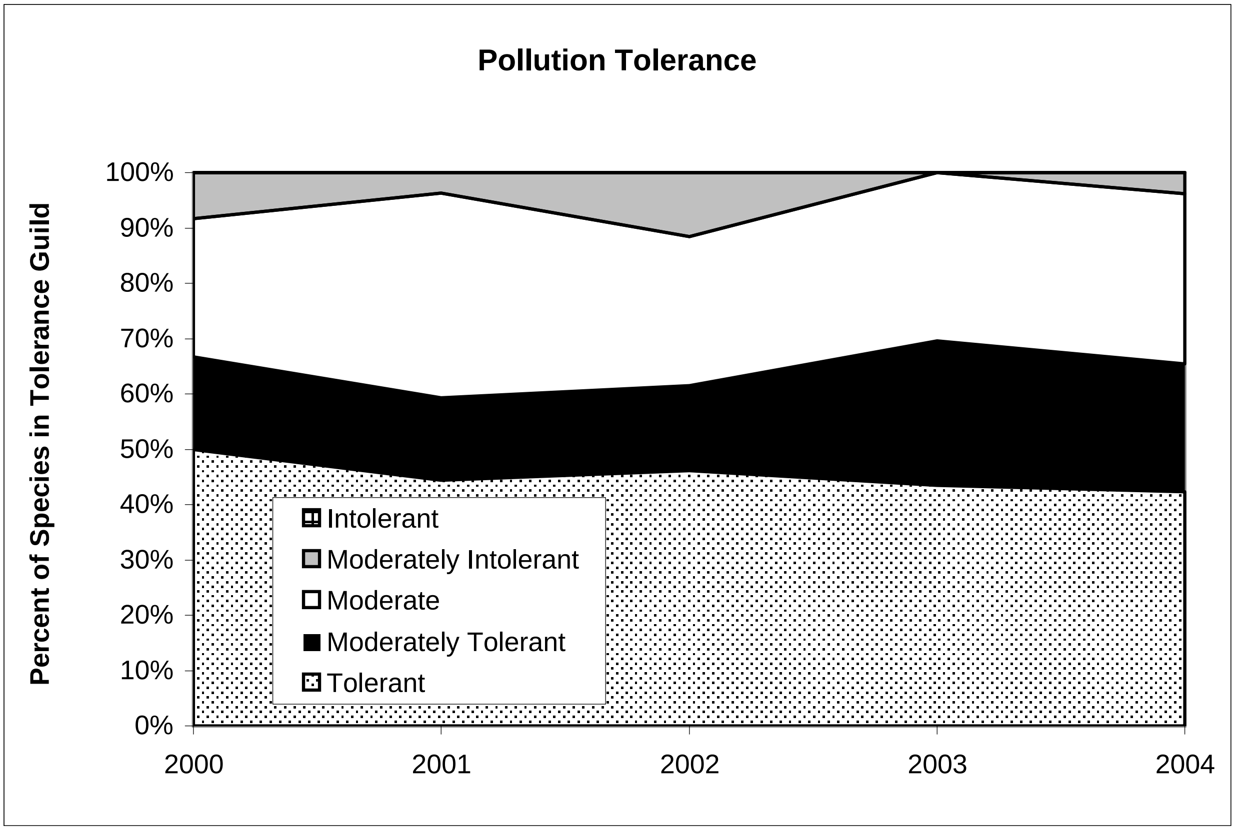
Diversity with Clupeids

Sample Period	2000	2001	2002	2003	2004
Spring	0.72	0.92	0.25	0.89	0.19
Fall	0.49	0.98	0.97	0.68	0.51
Annual	0.7	0.95	0.99	0.85	0.27

Diversity without Clupeids

Sample Period	2000	2001	2002	2003	2004
Spring	0.81	0.93	0.88	0.90	0.91
Fall	0.98	0.94	0.96	0.88	1.00
Annual	0.94	0.91	0.94	0.92	0.96

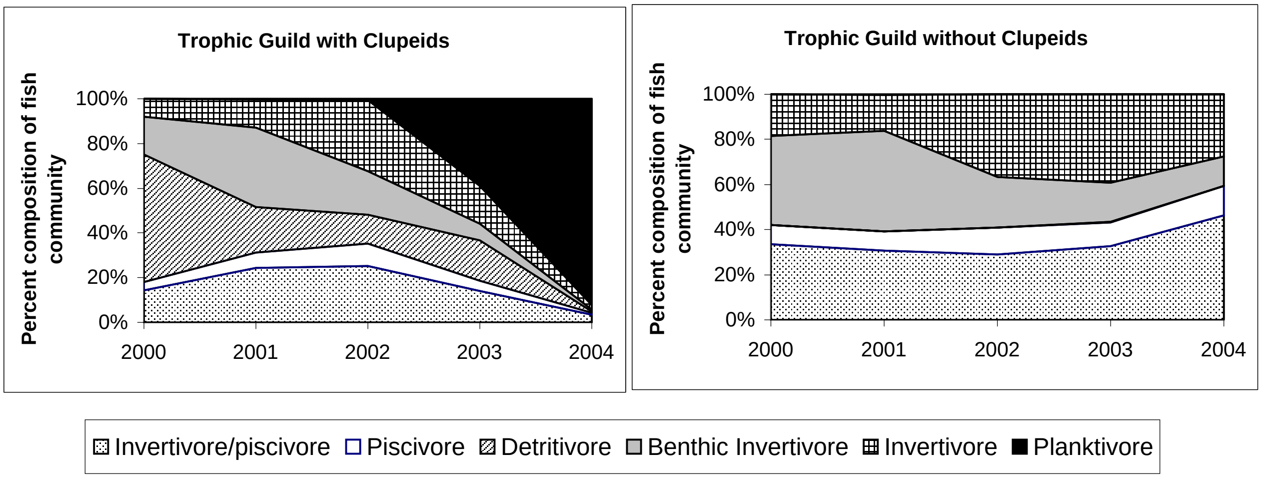
Figure A8-6. Pollution tolerance guild trends from electrofishing data in 2000 - 2004 based on species richness in each tolerance category.



Graph Data

Pollution Tolerance	2000	2001	2002	2003	2004
Tolerant	50.0%	44.4%	46.2%	43.5%	42%
Moderately Tolerant	16.7%	14.8%	15.4%	26.1%	23%
Moderate	25.0%	37.0%	26.9%	30.4%	31%
Moderately Intolerant	8.3%	3.7%	11.5%	0.0%	4%
Intolerant	0.0%	0.0%	0.0%	0.0%	0%

Figure A8-7. Trophic guild trends from electrofishing data in 2000-2004



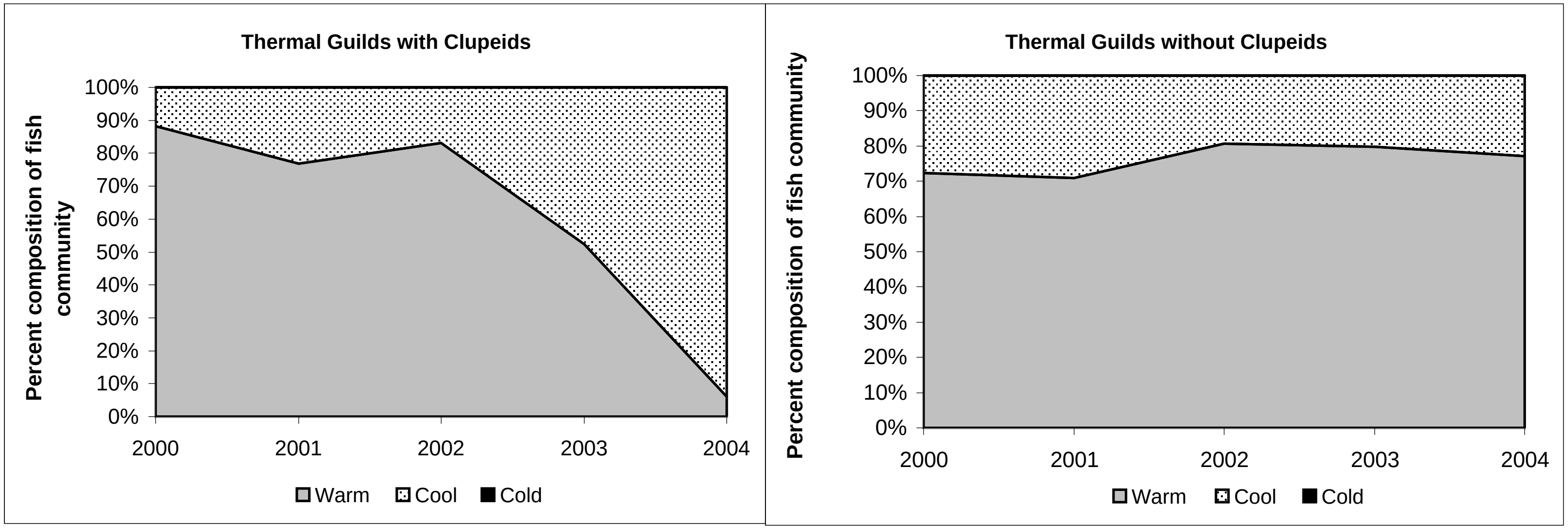
Graph Data
Trophic Guilds with Clupeids

Trophic Guild	2000	2001	2002	2003	2004
Benthic Invertivore	17%	36%	20%	7%	1%
Piscivore	4%	7%	10%	5%	1%
Detritivore	57%	20%	13%	18%	0%
Invertivore	8%	13%	32%	17%	2%
Invertivore/piscivore	14%	24%	25%	14%	3%
Planktivore	0%	0%	1%	39%	92%

Graph Data
Trophic Guilds without Clupeids

Trophic Guild	2000	2001	2002	2003	2004
Benthic Invertivore	39%	45%	22%	17%	13%
Piscivore	8%	8%	12%	10%	13%
Detritivore	0%	0%	0%	0%	0%
Invertivore	19%	16%	36%	39%	27%
Invertivore/piscivore	33%	31%	29%	33%	46%
Planktivore	0%	0%	0%	0%	0%

Figure A8-8. Thermal guild trends from electrofishing data in 2000 - 2004



Graph Data

Relative abundance of thermal guilds with Clupeids

Thermal Guild	2000	2001	2002	2003	2004
Cold	0.04%	0.00%	0.04%	0.00%	0.003%
Cool	11.81%	23.13%	16.83%	47.66%	94%
Warm	88.15%	76.87%	83.13%	52.30%	6%

Relative abundance of thermal guilds without Clupeids

Thermal Guild	2000	2001	2002	2003	2004
Cold	0.08%	0.00%	0.05%	0.00%	0.04%
Cool	27.55%	29.06%	19.29%	20.19%	23%
Warm	72.37%	70.94%	80.66%	79.70%	77%

Figure A8-9. Length frequency in Fall electrofishing and gill netting combined for select species from 2000 to 2004.

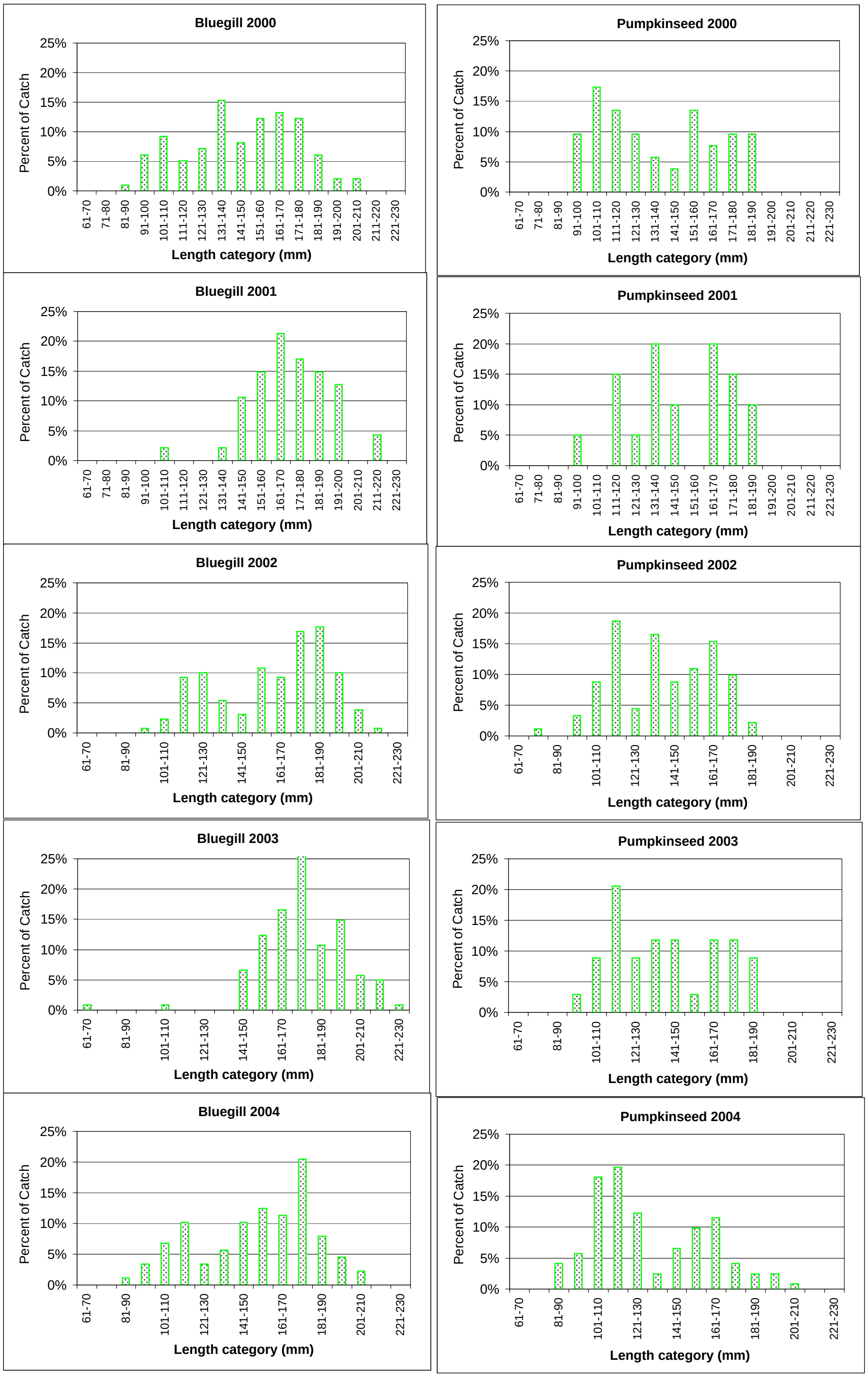
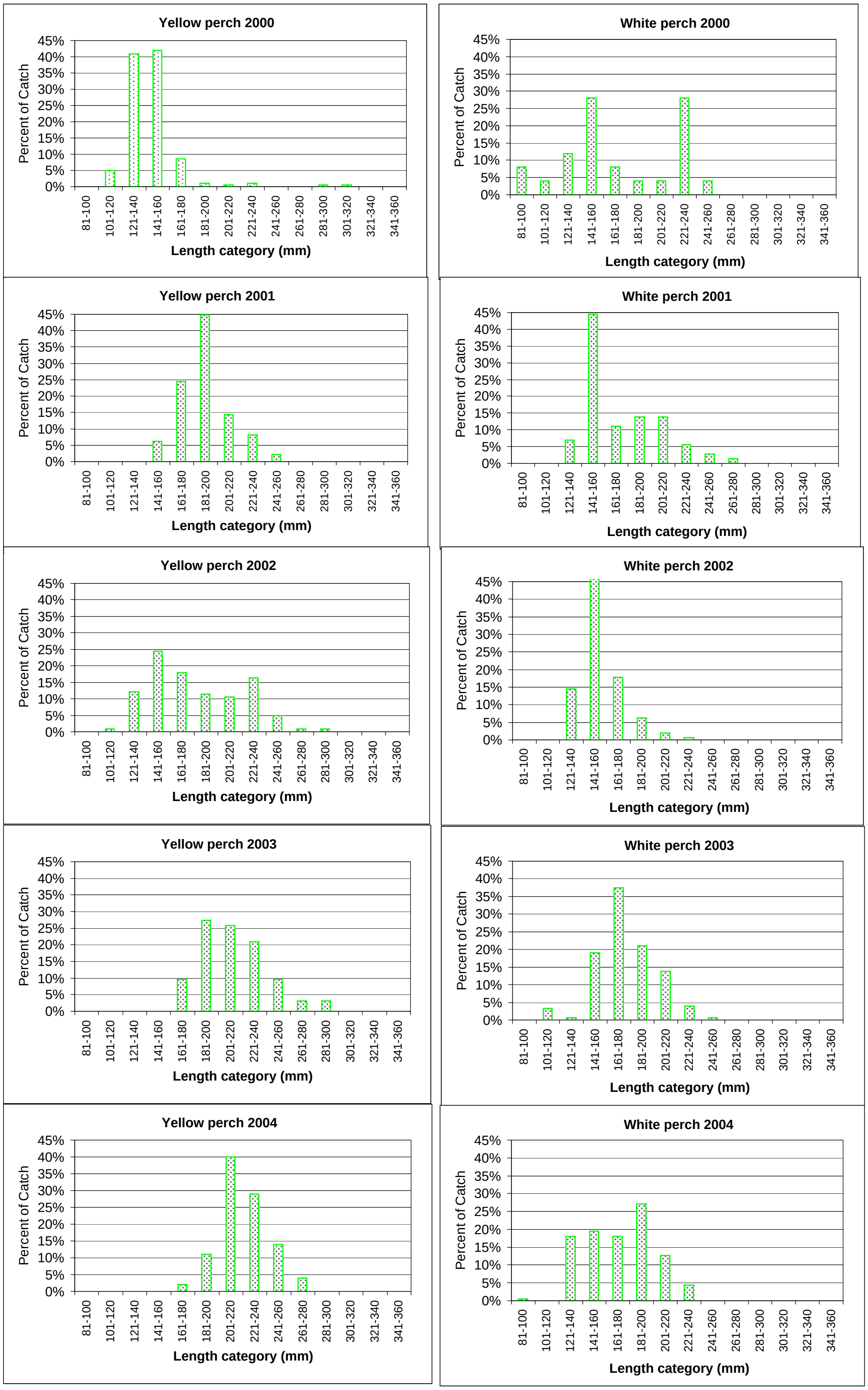


Figure A8-9. cont'd. Length frequency in Fall electrofishing and gill netting combined for select species from 2000 to 2004.



Yellow perch 2000

White perch 2000

Yellow perch 2001

White perch 2001

Yellow perch 2002

White perch 2002

Yellow perch 2003

White perch 2003

Yellow perch 2004

White perch 2004

Figure A8-9 cont'd. Length frequency in Fall electrofishing and gill netting combined for select species from 2000 to 2004.

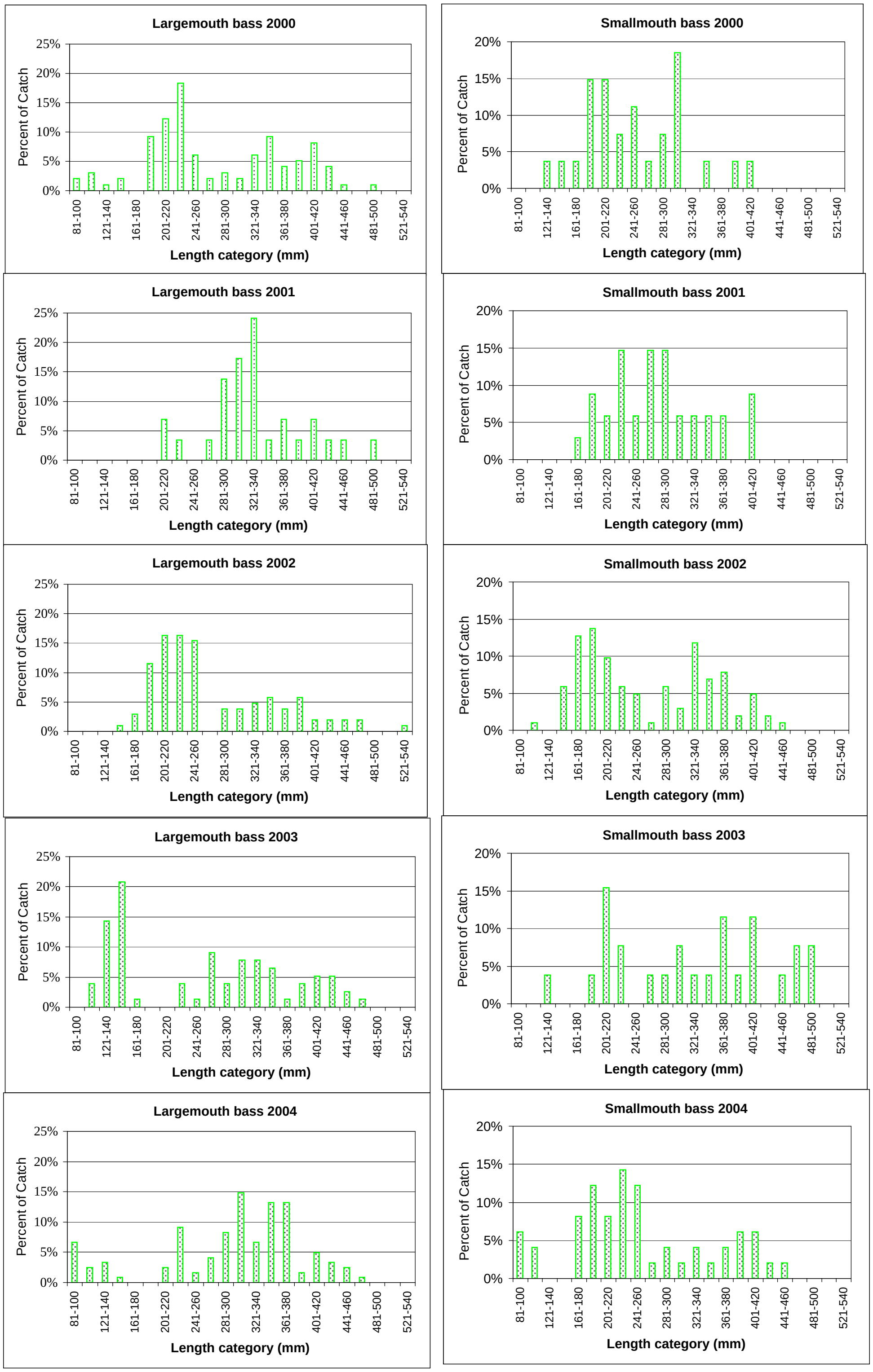


Figure A8-9 cont'd. Length frequency in Fall electrofishing and gill netting combined for select species from 2000 to 2004.

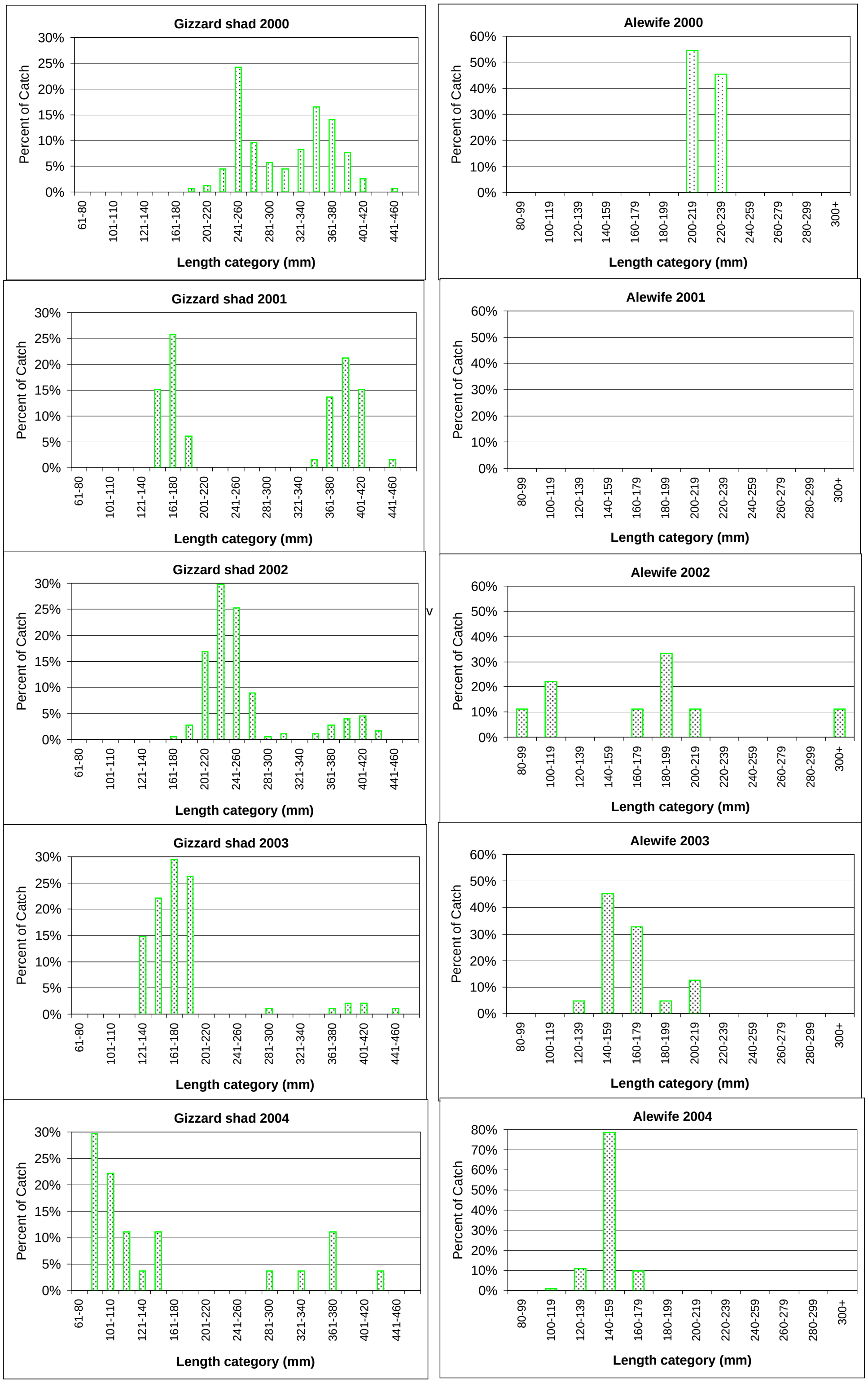
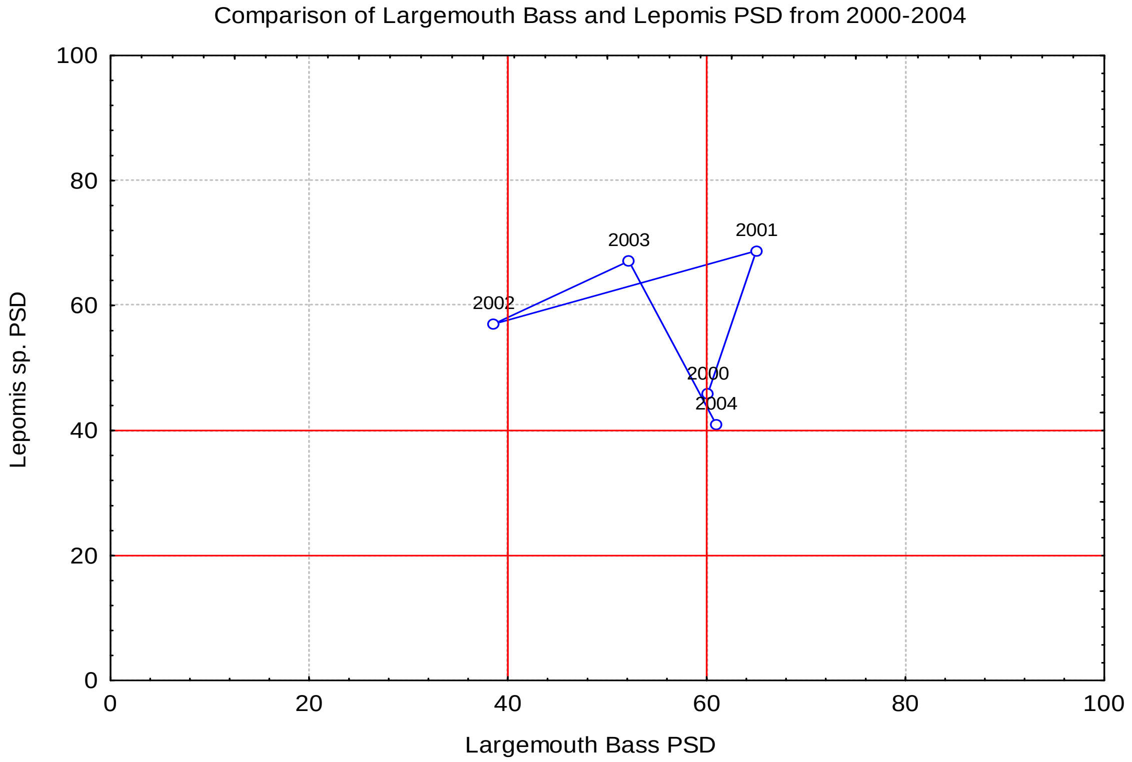


Figure A8-10. Comparison of largemouth and smallmouth bass Proportional Stock Denity (PSD) vs. *Lepomis* PSD from electrofihing data in 2000-2004.



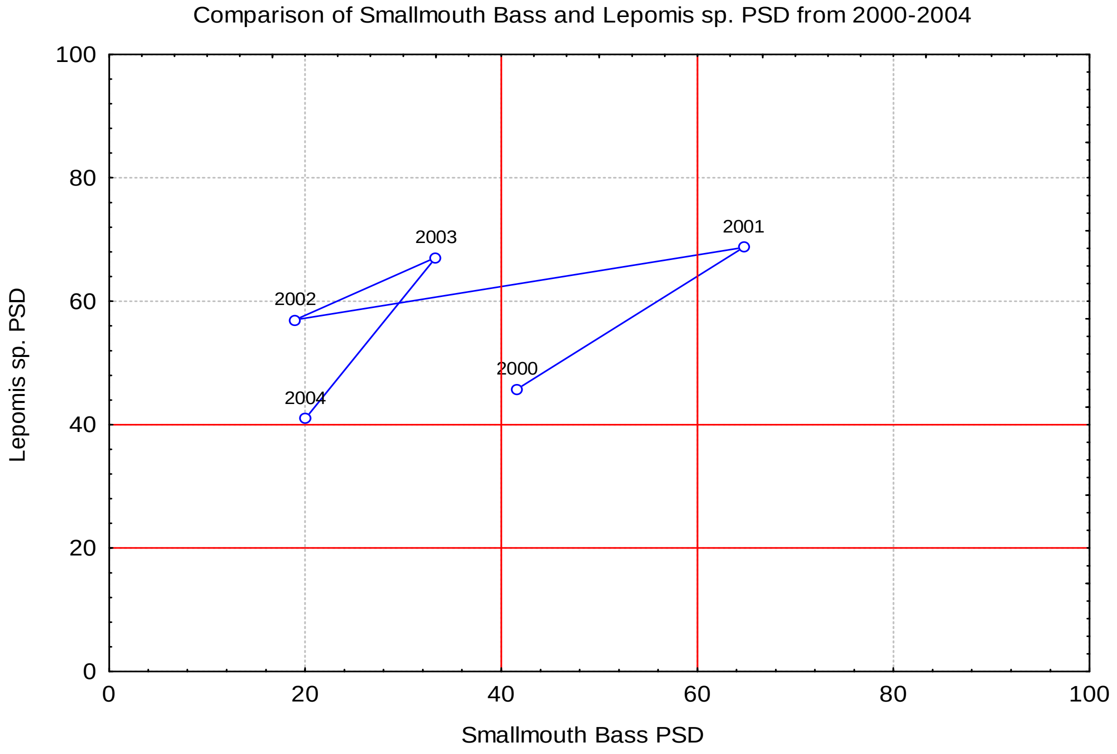
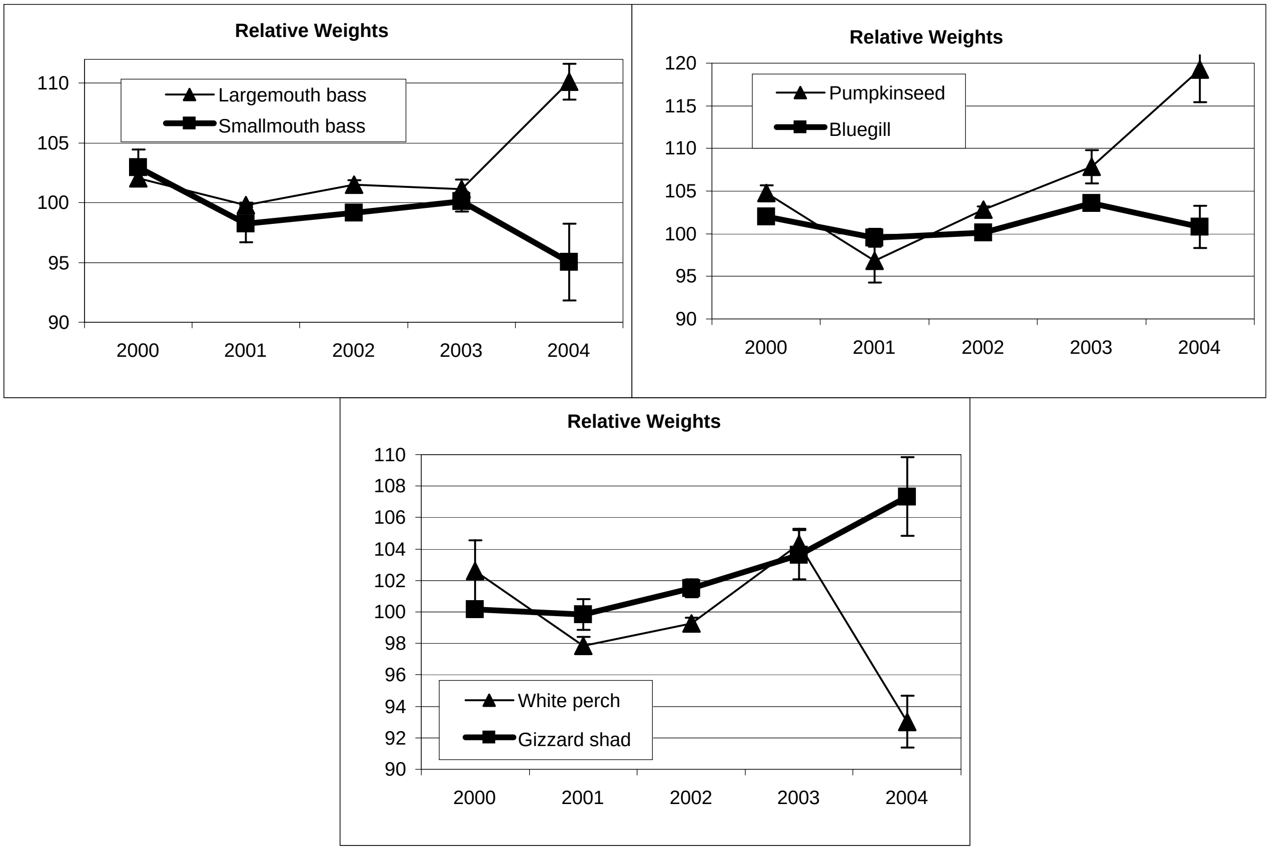


Figure A8-11. Relative weights trends of select species from 2000-2004.

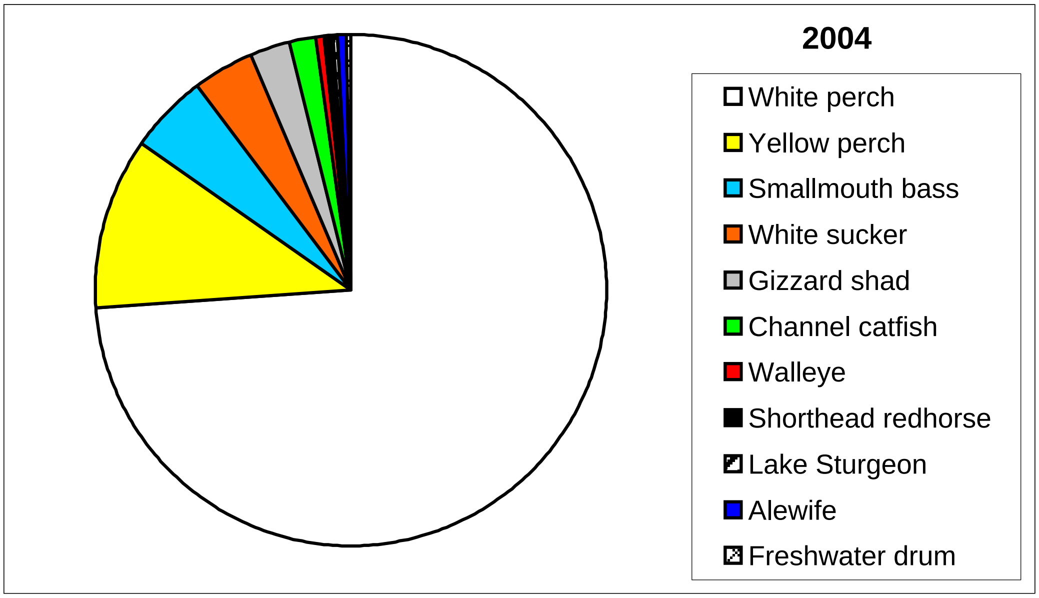


Graph Data

Relative weights of select species captured during electrofishing in the fall of 2000-2004.

	2000	**2001**	**2002**	**2003**	**2004**
Bluegill					
Rel. Wt	101.97	99.56	100.11	103.57	100.81
SE	0.42	1.04	0.37	0.61	2.46
Count	174	51	60	31	71
Gizzard shad	**2000**	**2001**	**2002**	**2003**	**2004**
Rel. Wt	100.17	99.83	101.50	103.62	107.32
SE	0.48	0.96	0.58	1.56	2.50
Count	191	15	60	30	20
Largemouth bass	**2000**	**2001**	**2002**	**2003**	**2004**
Rel. Wt	102.02	99.82	101.50	101.15	110.12
SE	0.34	0.17	0.39	0.77	1.51
Count	127	21	181	54	108
Pumpkinseed	**2000**	**2001**	**2002**	**2003**	**2004**
Rel. Wt	104.76	96.79	102.82	107.86	119.25
SE	0.92	2.55	0.41	1.93	3.80
Count	50	3	67	31	108
Smallmouth bass	**2000**	**2001**	**2002**	**2003**	**2004**
Rel. Wt	102.93	98.23	99.14	100.10	95.03
SE	1.53	1.56	0.41	0.83	3.23
Count	31	9	58	11	36
White perch	**2000**	**2001**	**2002**	**2003**	**2004**
Rel. Wt	102.59	97.86	99.27	104.31	93.02
SE	1.98	0.55	0.38	0.97	1.65
Count	51	42	92	31	158

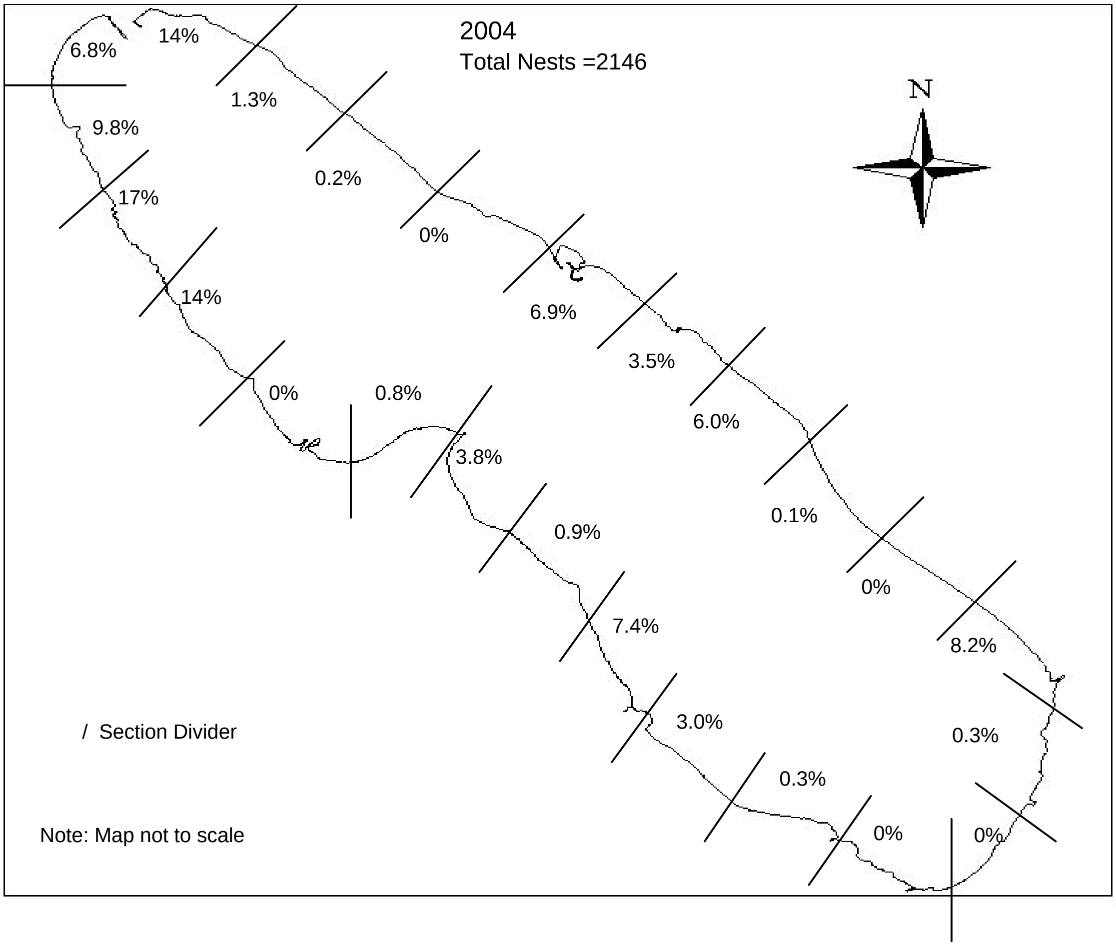
Figure A8-12. Gill net relative abundance in 2004

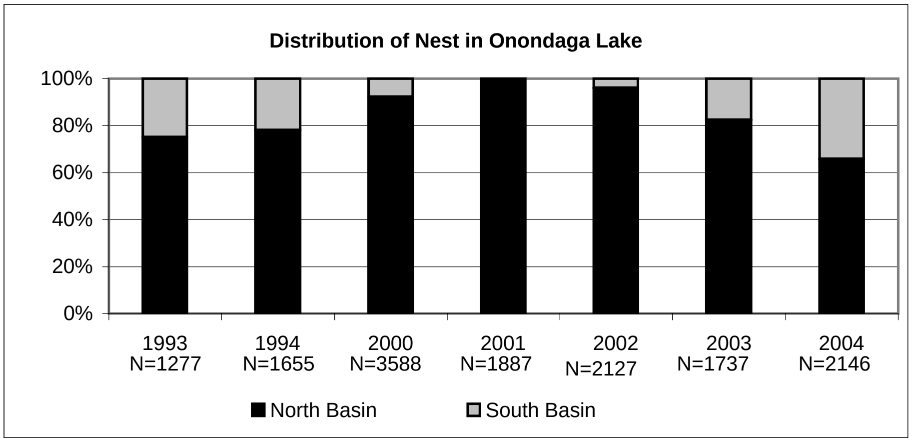


Graph Data

Species	Mean CPUE	Relative Abundance
White perch	9.289	74%
Yellow perch	1.347	11%
Smallmouth bass	0.642	5.1%
White sucker	0.466	3.7%
Gizzard shad	0.335	2.7%
Channel catfish	0.194	1.5%
Walleye	0.089	0.7%
Shorthead redhorse	0.050	0.4%
Lake Sturgeon	0.050	0.4%
Alewife	0.047	0.4%
Freshwater drum	0.047	0.4%

Figure A8-13. 2004 Nesting survey map and comparison of north vs. south nests from 2000-200

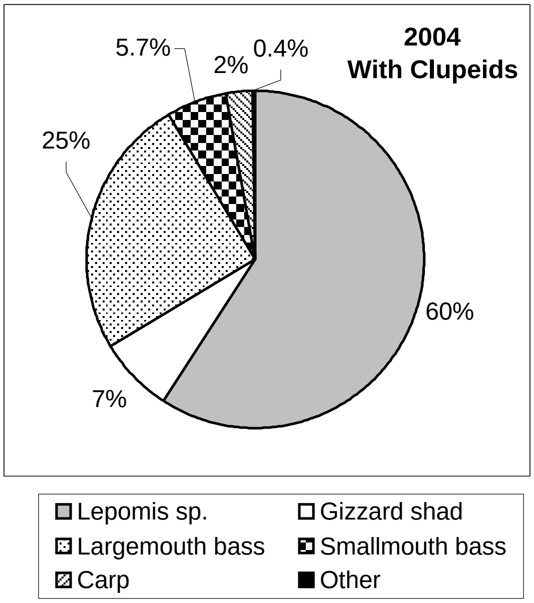


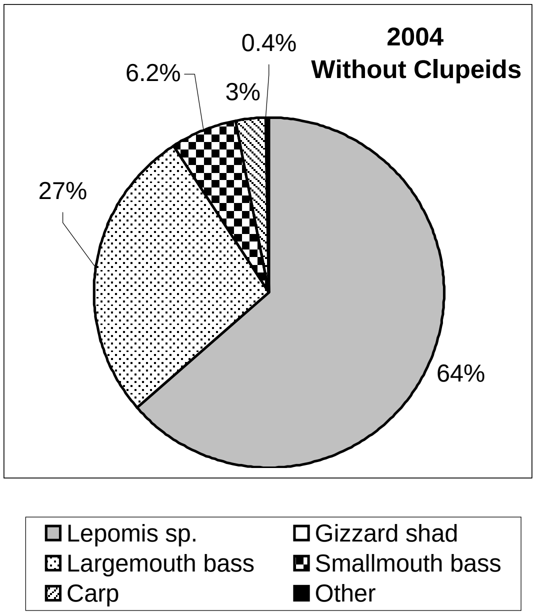


Historic nest distribution. 1993 and 1994 data from Arrigo 1998.

	1993	1994	2000	2001	2002	2003	2004
North Basin	75%	78%	92%	100%	96%	82%	66%
South Basin	25%	22%	8%	0%	4%	18%	34%

Figure A8-14. 2004 YOY Relative abundance with and without clupeids





Graph Data

CPUE W/Clupeids

Species	Entire Lake
Lepomis sp.	57.80%
Largemouth bass	25.17%
Gizzard shad	7.25%
Smallmouth bass	5.74%
Carp	2.36%
Bluegill	1.18%
Banded killifish	0.24%
Pumpkinseed	0.12%
White perch	0.08%
Longnose gar	0.04%

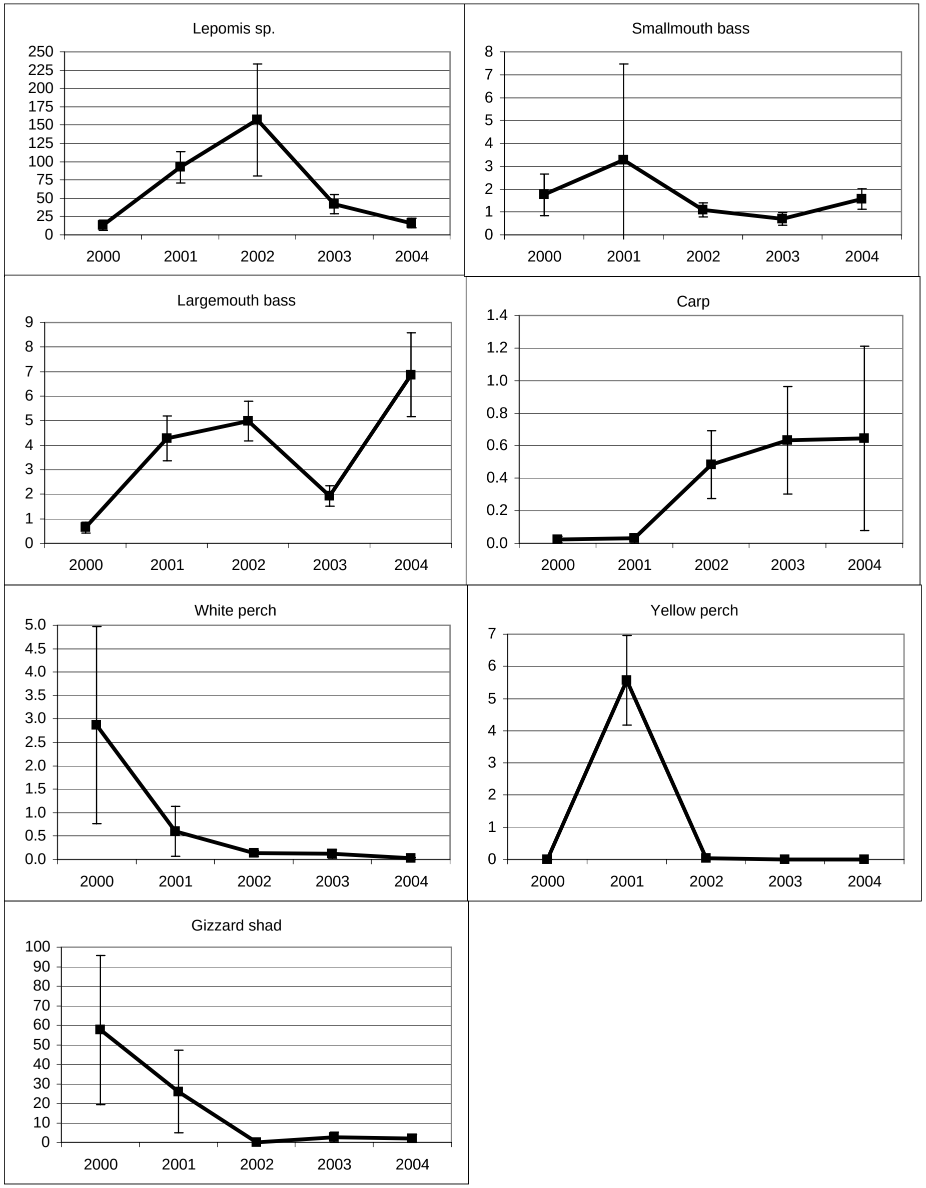
Species	Entire Lake
Lepomis sp.	59.10%
Gizzard shad	7.25%
Largemouth bass	25.17%
Smallmouth bass	5.74%
Carp	2.36%
Other	0.37%

CPUE W/O Clupeids

Species	Entire Lake
Lepomis sp.	62.32%
Largemouth bass	27.14%
Smallmouth bass	6.19%
Carp	2.55%
Bluegill	1.27%
Banded killifish	0.26%
Pumpkinseed	0.13%
White perch	0.09%
Longnose gar	0.04%
Gizzard shad	

Species	Entire Lake
Lepomis sp.	63.72%
Gizzard shad	-
Largemouth bass	27.14%
Smallmouth bass	6.19%
Carp	2.55%
Other	0.40%

Figure A8-15. 2004 YOY CPUE (#/haul) trends for select species since 2000.



Graph Data

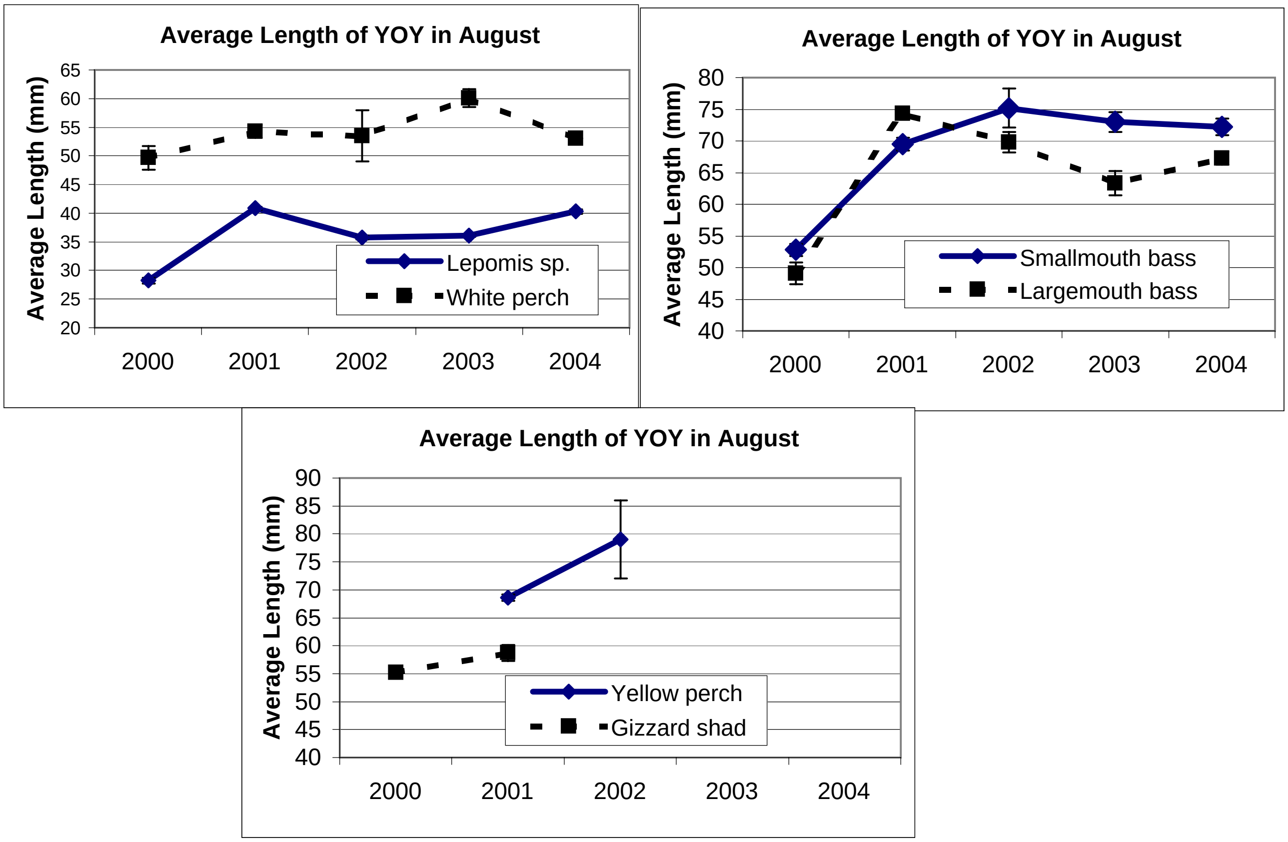
YOY Annual CPUE from 2000-2004

Species	**2000**	**2001**	**2002**	**2003**	**2004**
Lepomis sp.	12.96	92.48	156.93	42.13	16.12
Largemouth bass	0.64	4.27	4.98	1.94	6.87
Smallmouth bass	1.76	3.27	1.10	0.70	1.57
Carp	0.02	0.03	0.48	0.63	0.64
Bluegill		0.33	0.48	0.03	0.32
Pumpkinseed		0.93	0.25	0.06	0.03
White perch	2.87	0.6	0.13	0.12	0.02
Yellow perch	0.00	5.57	0.03	0.00	0.00
Brown bullhead		0.03	0.02	0.03	
Channel catfish			0.02		
White sucker		0.15	0.02		
Gizzard shad	57.56	26.05	0.03	2.68	1.98
Totals	**76**	**134**	**164**	48.31	

Standard Errors

Species	**2000**	**2001**	**2002**	**2003**	**2004**
Lepomis sp.	6.73	21.56	76.80	13.04	6.30
Largemouth bass	0.23	0.91	0.80	0.42	1.71
Smallmouth bass	0.91	4.20	0.31	0.29	0.45
Carp	0.02	0.03	0.21	0.33	0.57
Bluegill				0.02	0.32
Pumpkinseed				0.06	0.02
White perch	2.10	0.53	0.06	0.09	0.02
Yellow perch	0.00	1.4	0.03	0.00	
Brown bullhead				0.03	
Channel catfish					
White sucker					
Gizzard shad	38.32	21.05	0.03	2.62	1.91
Totals					

Figure A8-16. Mean length of select YOY species in August from 2000-2004



Graph Data

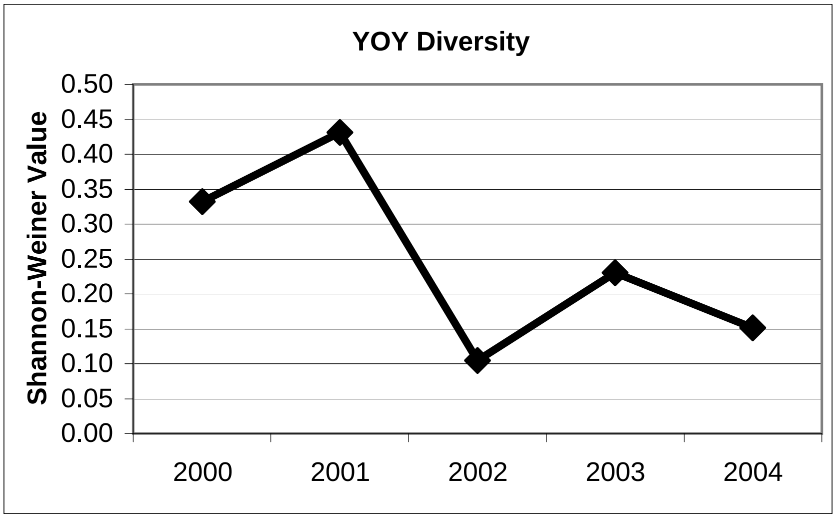
YOY mean length in August in the entire lake from 2000-2004

Species	2000	2001	2002	2003	2004
Lepomis sp.	28.2	40.9	35.7	36.09	40.30
White perch	49.7	54.3	53.5	60.10	53.00
Largemouth bass	49.1	74.3	69.8	63.33	67.29
Smallmouth bass	52.8	69.5	75.2	73.00	72.18
Gizzard shad	55.2	58.7		52.83	
Yellow perch		68.6	79.0		

Standard error of mean length in August in the entire lake from 2000-2004

Species	2000	2001	2002	2003	2004
Lepomis sp.	0.476	0.264	0.355	0.26	0.37
White perch	2.053	1.111	4.500	1.53	0.000
Largemouth bass	1.715	0.891	1.593	1.90	0.99
Smallmouth bass	0.989	1.006	3.071	1.56	1.31
Gizzard shad	0.497	1.402		1.45	
Yellow perch		0.534	7.000		

Figure A8-17. YOY whole lake diversity from 2000 to 2004

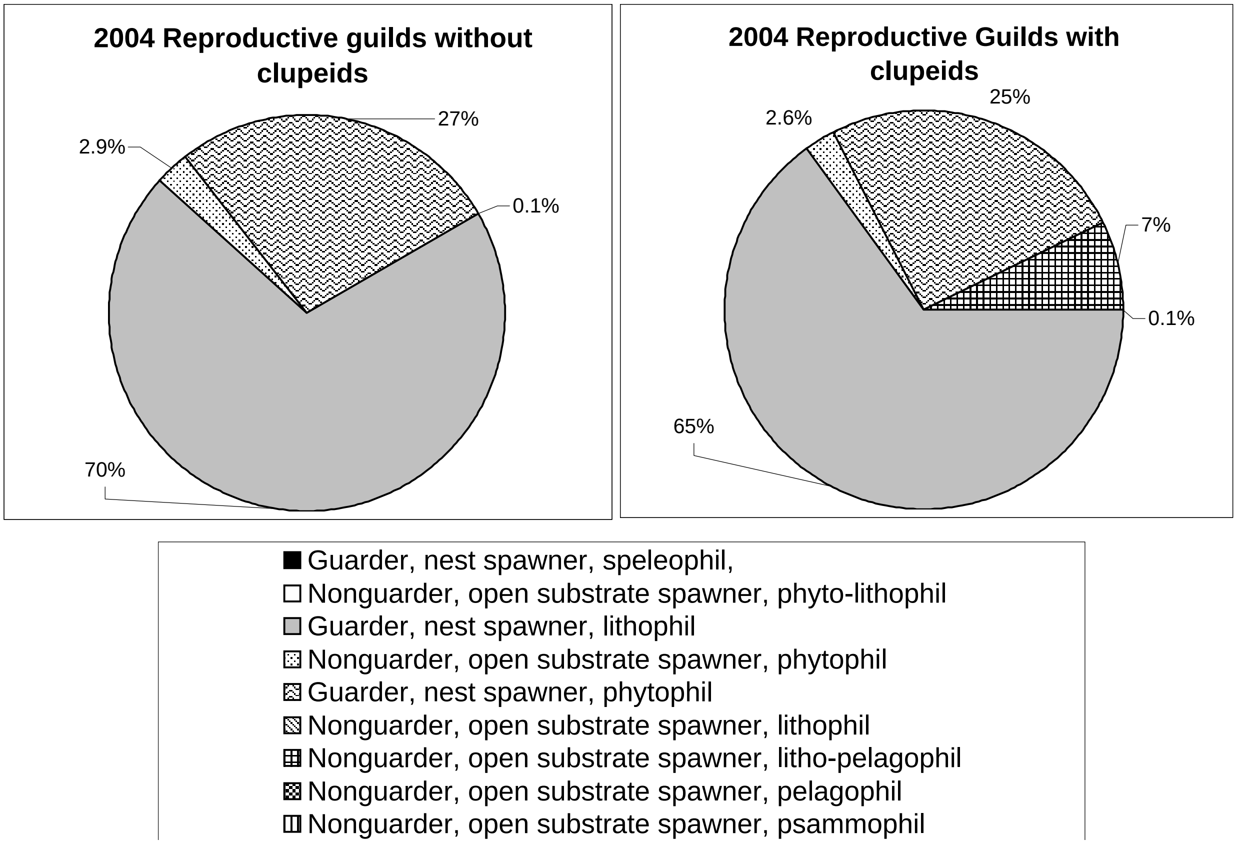


Graph Data

Seine diversity indices from 2000-2004

	2000	2001	2002	2003	2004
Shannon-Weiner value	0.332	0.431	0.104	0.230	0.15

Figure A8-18. Reproductive guild relative abundance juvenule seine data in 2004, with and without clupeids



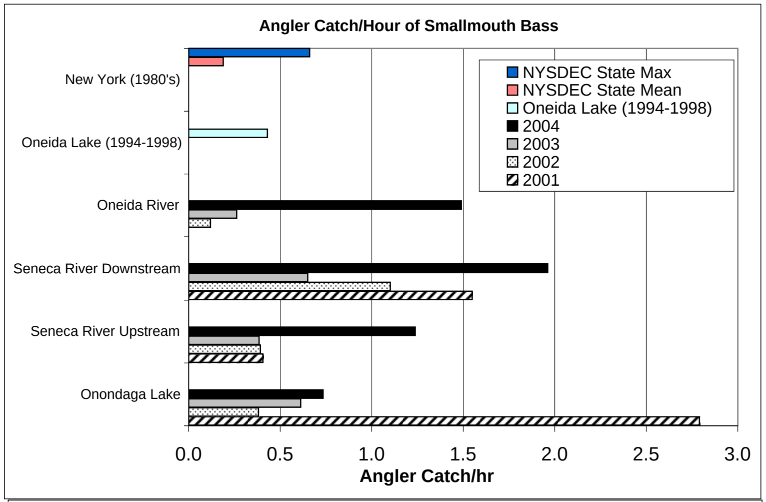
Reproductive guild relative abundance for the entire lake and each stratum in 2004 without clupeids

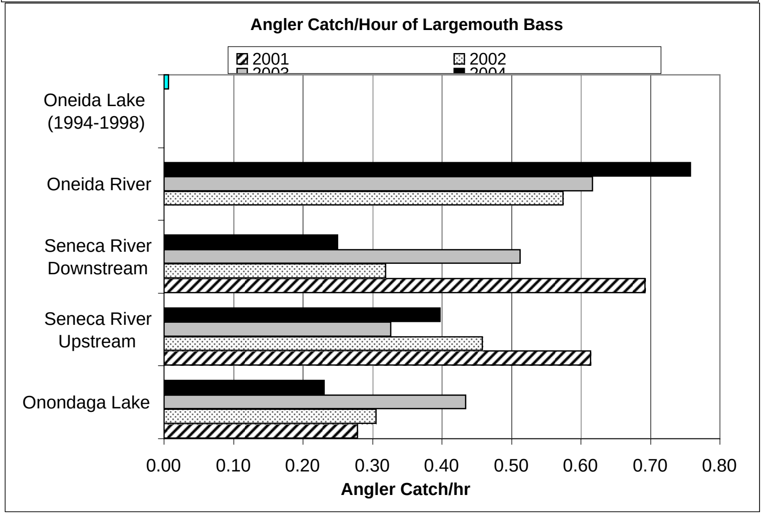
Repro Guild	Entire Lake	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Stratum 5
Guarder, nest spawner, speleophil,	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, phyto-lithophil	0.09%	0.12%	0.00%	0.00%	0.00%	0.17%
Guarder, nest spawner, lithophil	69.92%	90.00%	8.82%	41.75%	47.20%	83.91%
Nonguarder, open substrate spawner, phytophil	2.85%	0.62%	75.00%	0.35%	1.31%	0.17%
Guarder, nest spawner, phytophil	27.14%	9.26%	16.18%	57.89%	51.49%	15.74%
Nonguarder, open substrate spawner, lithophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, litho-pelagophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, pelagophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, psammophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Reproductive guild relative abundance for the entire lake and each stratum in 2004 with clupeids

Repro Guild	Entire Lake	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Stratum 5
Guarder, nest spawner, speleophil,	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, phyto-lithophil	0.08%	0.12%	0.00%	0.00%	0.00%	0.17%
Guarder, nest spawner, lithophil	64.85%	90.00%	2.49%	41.75%	46.77%	83.91%
Nonguarder, open substrate spawner, phytophil	2.65%	0.62%	21.16%	0.35%	1.29%	0.17%
Guarder, nest spawner, phytophil	25.17%	9.26%	4.56%	57.89%	51.02%	15.74%
Nonguarder, open substrate spawner, lithophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, litho-pelagophil	7.25%	0.00%	71.78%	0.00%	0.92%	0.00%
Nonguarder, open substrate spawner, pelagophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, psammophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Figure A8-19. 2004 Angler catch summary.





Graph Data

Smallmouth Bass

Year	Onondaga Lake	Seneca River Upstream	Seneca River Downstream	Oneida River	Oneida Lake (1994-1998)	New York (1980's)	NYSDEC State Max
2001	2.8	0.4	1.5				
2002	0.4	0.4	1.1	0.1			
2003	0.6	0.4	0.7	0.3			
2004	0.7	1.2	2.0	1.5			
Oneida Lake (1994-1998)					0.43		
NYSDEC State Mean						0.19	0.66
NYSDEC State Max						0.66	0.66

Largemouth Bass

Year	Onondaga Lake	Seneca River Upstream	Seneca River Downstream	Oneida River	Oneida Lake (1994-1998)
2001	0.28	0.61	0.69		
2002	0.31	0.46	0.32	0.57	
2003	0.43	0.33	0.51	0.62	
2004	0.23	0.40	0.25	0.76	
Oneida Lake (1994-1998)					0.01

Table A8-2. Guild and Tolerance Designations for Species Collected from Surveys in Onondaga Lake, 2000-2004.

Common name	Trophic Guild (Goldstein and Simon 1999)	Pollution Tolerance (Whittier and Hughes 1998)	Thermal Guild (Smith 1986 and Becker 1983)	Reproductive Guild (Tango 1999)
Alewife	Planktivore	Moderate	Cool	Nonguarder, open substrate spawner, phyto-lithophil
Banded killifish	Planktivore/invertivore	Moderate	Warm	Nonguarder, open substrate spawner, phytophil
Black crappie	Invertivore/Piscivore	Tolerant	Warm	Guarder, nest spawner, phytophil
Bluegill	Invertivore	Tolerant	Warm	Guarder, nest spawner, lithophil
Bluntnose minnow	Detritivore	Moderate	-	Guarder, nest spawner, speleophil
Bowfin	Piscivore	Tolerant[1]	Warm	Guarder, nest spawner, phytophil
Brook silverside	Planktivore/invertivore	-	-	Nonguarder, open substrate spawner, phyto-lithophil
Brook stickleback	Planktivore/invertivore	-	-	Guarder, nest spawner, ariadnophil
Brown bullhead	Invertivore/Piscivore	Tolerant	Warm	Guarder, nest spawner, speleophil
Brown trout	Invertivore/Piscivore	Moderately Intolerant	Cold	Nonguarder, brood hider, lithophil
Carp	Benthic Invertivore	Tolerant	Warm	Nonguarder, open substrate spawner, phytophil
Channel catfish	Invertivore/Piscivore	Moderately Tolerant	Warm	Guarder, nest spawner, speleophil
Emerald shiner	Planktivore	-	-	Nonguarder, open substrate spawner, pelagophil
Fathead minnow	Invertivore	Intolerant	-	Guarder, nest spawner, speleophil
Freshwater drum	Invertivore/Piscivore	Moderate[1]	Warm	Nonguarder, open substrate spawner, pelagophil
Gizzard shad	Detritivore	Moderately Tolerant[3]	Warm	Nonguarder, open substrate spawner, litho-pelagophil
Golden shiner	Planktivore/invertivore	Tolerant	Cool	Nonguarder, open substrate spawner, phytophil
Johnny darter	Invertivore	Moderate[1]	-	Guarder, nest spawner, speleophil
Lake Sturgeon	Benthic Invertivore	Moderate[1]	-	Nonguarder, open substrate spawner, lithophil
Largemouth bass	Piscivore	Tolerant	Warm	Guarder, nest spawner, phytophil
Logperch	Invertivore	Moderate[1]	-	Nonguarder, open substrate spawner, psammophil
Longnose dace	Planktivore/invertivore	Moderately Intolerant	Cool	Nonguarder, brood hider, lithophil
Longnose gar	Invertivore/Piscivore	Tolerant[1]	Warm	Nonguarder, open substrate spawner, phytophil
Northern hog sucker	Benthic Invertivore	Moderately Intolerant	Cool	Nonguarder, open substrate spawner, lithophil
Northern pike	Piscivore	Moderate	Cool	Nonguarder, open substrate spawner, phytophil
Pumpkinseed	Invertivore	Tolerant	Warm	Guarder, nest spawner, lithophil
Rainbow trout	Invertivore/Piscivore	Moderately Intolerant[3]	Cold	Nonguarder, brood hider, lithophil
Rock bass	Invertivore/Piscivore	Moderate	Warm	Guarder, nest spawner, lithophil
Shorthead redhorse	Benthic Invertivore	Moderately Tolerant[3]	Cool	Nonguarder, open substrate spawner, lithophil
Smallmouth bass	Piscivore	Moderate	Cool	Guarder, nest spawner, lithophil
Tessellated darter	Invertivore	Moderate	-	Guarder, nest spawner, speleophil
Tiger muskellunge	Piscivore	Moderate[1]	Cool	Sterile hybrid
Trout perch	Invertivore/Piscivore	-	-	Nonguarder, open substrate spawner, lithophil
Walleye	Piscivore	Moderately Tolerant[3]	Cool	Nonguarder, open substrate spawner, lithophil
White perch	Invertivore/Piscivore	Tolerant	Warm	Nonguarder, open substrate spawner, phyto-lithophil
White sucker	Benthic Invertivore	Moderately Tolerant	Cool	Nonguarder, open substrate spawner, lithophil
Yellow Bullhead	Invertivore/Piscivore	Tolerant	Warm	Guarder, nest spawner, speleophil
Yellow perch	Invertivore/Piscivore	Moderately Tolerant	Cool	Nonguarder, open substrate spawner, phyto-lithophil

* Notes: brown and rainbow trout trophic guilds are for lakes. Not all species were able to be grouped into tolerance categories or thermal guilds.

Reproductive guild substrate types: lithophils (sediment), phytophils (plant material, live or dead), speleophils (holes, crevices), pelagophils (openwater), psammophils (sand) and ariadnophils (specialised nest building that include some level of parental care)

1 EPA 1993

2 Smith 1986

3 Inferred from combination of EPA designation for these species and the designation of similar species in Whittier and Hughes.

Table A8-3(a-d). Whole Lake Electrofishing CPUE and relative abundance in 2004 for each sampling event (spring and fall).

Note: CPUE for gamefish (bolded) is calculated from all 24 transects. CPUE for non-gamefish are calculated from only the one-half of the transects where all fish are collected (every other transect). Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from a combination of fish that are boated and estimates of the number of fish missed. Because of their large size carp are not boated, instead carp within netting distance are counted while still in the water.

a.) 2004 Entire year

Species	Mean CPUE	SE	Total fish	Relative abundance with clupeids	Relative abundance without clupeids
Alewife	2737.6	594.6	15236	92.1%	-
White perch	67.9	13.1	368	2.3%	30.6%
Pumpkinseed	37.0	5.6	402	1.2%	16.7%
Bluegill	23.3	4.8	252	0.78%	10.5%
Yellow perch	20.9	2.8	225	0.70%	9.4%
Largemouth bass	19.4	2.4	208	0.65%	8.7%
White sucker	18.0	4.7	96	0.60%	8.1%
Gizzard shad	12.2	6.2	69	0.41%	-
Carp	8.8	1.6	48	0.30%	4.0%
Smallmouth bass	8.0	1.3	88	0.27%	3.6%
Freshwater drum	5.4	1.4	30	0.18%	2.4%
Brown bullhead	4.2	0.8	45	0.14%	1.9%
Shorthead redhorse	2.5	0.9	13	0.08%	1.1%
Channel catfish	2.2	0.6	25	0.08%	1.0%
Bowfin	1.1	0.5	6	0.04%	0.50%
Golden shiner	1.1	0.5	6	0.04%	0.49%
Longnose gar	0.6	0.3	3	0.02%	0.25%
Rock bass	0.4	0.2	4	0.012%	0.17%
Banded killifish	0.2	0.2	1	0.006%	0.08%
Logperch	0.2	0.2	1	0.006%	0.08%
Black crappie	0.1	0.1	1	0.003%	0.04%
Northern pike	0.1	0.1	1	0.003%	0.04%
Walleye	0.1	0.1	1	0.003%	0.04%
Brown trout	0.1	0.1	1	0.003%	0.04%
Tiger muskellunge	0.1	0.1	1	0.003%	0.04%
Yellow bullhead	0.1	0.1	1	0.003%	0.04%

b.) 2004 Spring (July al transects)

Species	Mean CPUE	SE	Total fish	Relative abundance with clupeids	Relative abundance without clupeids
Alewife	4561.6	977.0	12787	94.7%	-
White perch	68.9	14.3	189	1.4%	28.9%
Pumpkinseed	53.2	9.1	280	1.1%	22.3%
Bluegill	30.5	5.1	164	0.6%	12.8%
Yellow perch	24.7	4.9	129	0.5%	10.4%
Largemouth bass	16.5	2.8	87	0.3%	6.9%
Gizzard shad	15.8	10.4	47	0.3%	-
White sucker	14.9	4.1	41	0.3%	6.3%
Smallmouth bass	9.1	1.6	48	0.2%	3.8%
Carp	6.3	2.1	17	0.13%	2.7%
Freshwater drum	5.9	1.4	16	0.12%	2.5%
Brown bullhead	2.9	0.7	15	0.06%	1.2%
Golden shiner	1.7	1.1	4	0.03%	0.7%
Channel catfish	1.2	0.5	7	0.03%	0.5%
Shorthead redhorse	1.1	0.6	3	0.02%	0.5%
Bowfin	0.7	0.7	2	0.01%	0.3%
Banded killifish	0.4	0.4	1	0.01%	0.2%
Rock bass	0.2	0.2	1	0.00%	0.1%
Black crappie	0.2	0.2	1	0.004%	0.1%
Brown trout	0.2	0.2	1	0.003%	0.1%
Walleye	0.2	0.2	1	0.003%	0.1%

Table A8-3(a-d) cont'd. Whole Lake Electrofishing CPUE and relative abundance in 2004 for each sampling event (spring and fall).

Note: CPUE for gamefish (bolded) is calculated from all 24 transects. CPUE for non-gamefish are calculated from only the one-half of the transects where all fish are collected (every other transect). Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from a combination of fish that are boated and estimates of the number of fish missed. Because of their large size carp are not boated, instead carp within netting distance are counted while still in the water.

c) 2004 Spring June transects 13-19 only with comparison of July sample fro Transects 13-19 only

Species	Mean CPUE	SE	Relative abundance with clupeids	Relative abundance without clupeids	Mean CPUE July Transects 13-19 Only
Alewife	6890	2175.1	94.9%		4342
White perch	186	25.2	2.6%	50.3%	104
Pumpkinseed	62	5.7	0.86%	16.9%	61
Yellow perch	44	5.1	0.61%	11.9%	24
Bluegill	18	0.5	0.25%	5.0%	26
Largemouth bass	15	0.8	0.21%	4.0%	15
White sucker	14	7.2	0.19%	3.8%	26
Carp	9.2	5.9	0.13%	2.5%	9.7
Smallmouth bass	7.0	1.4	0.10%	1.9%	11
Brown bullhead	5.6	0.8	0.08%	1.5%	1.7
Shorthead redhorse	3.2	2.0	0.04%	0.87%	1.0
Gizzard Shad	3.1	1.4	0.04%		24
Bowfin	2.0	1.2	0.03%	0.55%	0
Golden shiner	1.1	1.1	0.02%	0.31%	0
Banded Killifish	0.8	0.9	0.01%	0.22%	0
Walleye	0.6	2.0	0.01%	0.15%	0
Black crappie	0.5	0.6	0.01%	0.14%	0.5

d.) 2004 Fall

Species	Mean CPUE	SE	Total fish	Relative abundance with clupeids	Relative abundance without clupeids
Alewife	885.0	265.9	2449	80.4%	-
White perch	68.5	19.1	179	6.2%	33.1%
Largemouth bass	21.9	3.8	121	2.0%	10.6%
White sucker	21.7	6.4	55	2.0%	10.5%
Pumpkinseed	21.3	4.4	122	1.9%	10.3%
Yellow perch	17.7	3.6	96	1.6%	8.5%
Bluegill	16.5	7.3	88	1.5%	8.0%
Carp	10.9	2.9	31	1.0%	5.3%
Gizzard shad	7.9	5.7	22	0.7%	-
Smallmouth bass	7.0	1.6	40	0.6%	3.4%
Brown bullhead	5.6	1.5	30	0.5%	2.7%
Freshwater drum	4.7	2.2	14	0.43%	2.3%
Shorthead redhorse	3.8	1.7	10	0.35%	1.8%
Channel catfish	3.1	1.0	18	0.28%	1.5%
Bowfin	1.4	0.8	4	0.13%	0.68%
Longnose gar	1.1	0.6	3	0.10%	0.52%
Golden shiner	0.7	0.5	2	0.06%	0.32%
Rock bass	0.5	0.3	3	0.05%	0.25%
Logperch	0.4	0.4	1	0.03%	0.18%
Northern pike	0.2	0.2	1	0.02%	0.09%
Tiger muskellunge	0.2	0.2	1	0.01%	0.08%
Yellow bullhead	0.2	0.2	1	0.01%	0.08%

Table A8-3(e-g). Whole Lake Electrofishing number netted and number missed in 2004 for each sampling event (spring and fall).

Note: Because of their large size carp are not boated, instead carp within netting distance are counted while still in the water therefore no carp within netting distance are ever "missed". Lepomis sp. include bluegill and pumpkinseed because these species cannot be distinguished while still in the water, at night when missed. Although most fish in the genus Micropterus sp. (black bass) are large enough to be readily distinguishable when missed, some are not, these are counted under the designation " Micropterus sp.". Bullhead that are missed are assumed to be brown bullhead. The "number netted" for shad and alewives (clupeids) differs from the "total number" depicted in Tables A8-3(a-c) because the totals in those tables include the both netted and missed fish (see note under Table A8-3(a-c) title). For the clupeids in Tables A8-3(d-f) the sum of the "netted fish" and "missed fish" will equal the total number for those species in Table A8-3(a-c).

e.) 2004 Entire year

Species	Number Netted	Number Missed
Alewife	1416	13820
Pumpkinseed	402	18
White perch	368	1037
Bluegill	252	20
Yellow perch	225	252
Largemouth bass	208	25
White sucker	96	124
Smallmouth bass	88	5
Carp	69	0
Brown bullhead	45	6
Freshwater drum	30	3
Gizzard shad	27	42
Channel catfish	25	12
Bowfin	20	4
Shorthead redhorse	13	0
Golden shiner	6	1
Longnose gar	6	8
Rock bass	4	0
Banded killifish	1	0
Black crappie	1	0
Brown trout	1	0
Logperch	1	0
Northern pike	1	5
Tiger muskellunge	1	0
Walleye	1	0
Yellow bullhead	1	0
Micropterus sp.	0	16
Lepomis sp.	0	1253

f.) 2004 Spring

Species	Number Netted	Number Missed
Alewife	1187	11600
Pumpkinseed	280	0
White perch	189	797
Bluegill	164	10
Yellow perch	129	183
Largemouth bass	87	16
Smallmouth bass	48	4
White sucker	41	81
Carp	38	0
Freshwater drum	16	2
Brown bullhead	15	0
Bowfin	9	3
Channel catfish	7	2
Gizzard shad	7	40
Golden shiner	4	0
Shorthead redhorse	3	0
Longnose gar	2	7
Banded killifish	1	0
Black crappie	1	0
Brown trout	1	0
Rock bass	1	0
Walleye	1	0
Lepomis sp.	0	729
Northern pike	0	1

g.) 2004 Fall

Species	Number Netted	Number Missed
Alewife	229	2220
White perch	179	240
Pumpkinseed	122	18
Largemouth bas	121	9
Yellow perch	96	69
Bluegill	88	10
White sucker	55	43
Smallmouth bas	40	1
Carp	31	0
Brown bullhead	30	6
Gizzard shad	20	2
Channel catfish	18	10
Freshwater drum	14	1
Bowfin	11	1
Shorthead redhor	10	0
Longnose gar	4	1
Rock bass	3	0
Golden shiner	2	1
Logperch	1	0
Northern pike	1	4
Tiger muskellun	1	0
Yellow bullhead	1	0
Micropterus sp.	0	16
Lepomis sp.	0	524

Table A8-4 (a-c). 2004 Individual Stratum Electrofishing CPUE.

Note: CPUE for gamefish (bolded) is calculated from all transects within the Stratum. CPUE for non-gamefish are calculated from only the transects where all fish are collected. Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from estimates of the number of fish.

a.) Entire year 2004	**Stratum 1**				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	2736.11	493.51	93.3%	-
	Banded killifish	0.73	0.73	0.02%	0.4%
	Bluegill	15.62	2.75	0.5%	8.0%
	Bowfin	1.45	1.45	0.05%	0.7%
	Brown bullhead	5.79	3.27	0.2%	3.0%
	Carp	8.29	4.43	0.3%	4.2%
	Channel catfish	2.78	1.69	0.1%	1.4%
	Freshwater drum	3.40	1.78	0.1%	1.7%
	Gizzard shad	0.73	0.73	0.02%	-
	Golden shiner	1.45	1.45	0.0%	0.7%
	Largemouth bass	26.76	4.06	0.9%	13.6%
	Northern pike	0.46	0.46	0.02%	0.2%
	Pumpkinseed	46.59	13.20	1.6%	23.7%
	Rock bass	1.35	0.56	0.0%	0.7%
	Shorthead redhorse	1.44	1.44	0.0%	0.7%
	Smallmouth bass	6.28	1.30	0.21%	3.2%
	Walleye	0.40	0.40	0.01%	0.2%
	White perch	42.96	6.51	1.5%	21.9%
	White sucker	11.28	4.56	0.38%	5.7%
	Yellow perch	19.58	9.60	0.7%	10.0%

b.) Spring 2004	**Stratum 1**				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	4419.41	729.29	95.5%	-
	Banded killifish	1.60	1.60	0.03%	0.8%
	Bluegill	25.53	5.22	0.6%	12.4%
	Bowfin	2.67	2.67	0.1%	1.3%
	Brown bullhead	3.66	1.74	0.1%	1.8%
	Carp	6.58	6.58	0.1%	3.2%
	Channel catfish	0.84	0.84	0.02%	0.4%
	Freshwater drum	1.33	1.33	0.03%	0.7%
	Gizzard shad	1.60	1.60	0.03%	-
	Golden shiner	3.19	3.19	0.1%	1.6%
	Largemouth bass	14.68	9.19	0.3%	7.1%
	Pumpkinseed	75.18	27.26	1.6%	36.5%
	Rock bass	0.99	0.99	0.02%	0.5%
	Smallmouth bass	9.93	1.83	0.2%	4.8%
	Walleye	0.80	0.80	0.02%	0.4%
	White perch	27.45	1.75	0.59%	13.3%
	White sucker	3.19	3.19	0.1%	1.6%
	Yellow perch	28.28	20.65	0.6%	13.7%

c.) Fall 2004	**Stratum 1**				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	1062.52	359.72	84.9%	-
	Bluegill	5.49	2.59	0.4%	2.9%
	Brown bullhead	8.23	5.18	0.7%	4.4%
	Carp	9.35	9.35	0.7%	5.0%
	Channel catfish	4.65	3.43	0.4%	2.5%
	Freshwater drum	5.62	2.82	0.4%	3.0%
	Largemouth bass	38.53	8.59	3.1%	20.4%
	Northern pike	0.88	0.88	0.1%	0.5%
	Pumpkinseed	18.12	4.42	1.4%	9.6%
	Rock bass	1.68	1.03	0.1%	0.9%
	Shorthead redhorse	2.67	2.67	0.2%	1.4%
	Smallmouth bass	2.41	2.41	0.2%	1.3%
	White perch	59.35	13.64	4.7%	31.5%
	White sucker	19.71	8.46	1.6%	10.4%
	Yellow perch	12.02	3.24	1.0%	6.4%

Table A8-4 (a-c). 2004 Individual Stratum Electrofishing CPUE.

Note: CPUE for gamefish (bolded) is calculated from all transects within the Stratum. CPUE for non-gamefish are calculated from only the transects where all fish are collected. Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from estimates of the number of fish.

a.) Entire Year 2004	Stratum 2				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	4735.62	2008.91	94.1%	-
	Bluegill	16.74	4.18	0.3%	6.4%
	Bowfin	1.40	1.40	0.03%	0.5%
	Brown bullhead	4.78	1.64	0.1%	1.8%
	Brown trout	0.33	0.33	0.01%	0.1%
	Carp	11.70	0.88	0.2%	4.5%
	Channel catfish	2.44	1.64	0.05%	0.9%
	Freshwater drum	9.94	4.41	0.2%	3.8%
	Gizzard shad	35.75	16.13	0.7%	-
	Golden shiner	0.70	0.70	0.01%	0.3%
	Largemouth bass	14.09	3.44	0.3%	5.4%
	Longnose gar	0.70	0.70	0.01%	0.3%
	Pumpkinseed	39.17	11.72	0.8%	14.9%
	Shorthead redhorse	3.03	2.10	0.1%	1.2%
	Smallmouth bass	13.39	3.16	0.3%	5.1%
	Tiger muskellunge	0.33	0.33	0.0%	0.1%
	White perch	93.64	37.39	1.9%	35.6%
	White sucker	23.74	13.60	0.5%	9.0%
	Yellow bullhead	0.33	0.33	0.01%	0.1%
	Yellow perch	26.29	4.91	0.5%	10.0%

b.) Spring 2004	Stratum 2				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	7740.78	3331.26	95.7%	-
	Bluegill	23.74	7.67	0.3%	8.2%
	Brown bullhead	0.67	0.67	0.01%	0.2%
	Brown trout	0.67	0.67	0.01%	0.2%
	Carp	8.40	2.34	0.1%	2.9%
	Channel catfish	0.76	0.76	0.01%	0.3%
	Freshwater drum	9.74	1.20	0.1%	3.4%
	Gizzard shad	61.78	30.97	0.8%	-
	Largemouth bass	19.13	5.15	0.2%	6.6%
	Pumpkinseed	47.32	14.02	0.6%	16.4%
	Smallmouth bass	14.13	4.08	0.2%	4.9%
	White perch	115.86	32.58	1.4%	40.1%
	White sucker	20.47	11.89	0.3%	7.1%
	Yellow perch	28.16	7.48	0.3%	9.7%

c.)Fall 2004	Stratum 2				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	1722.79	810.36	87.5%	-
	Bluegill	10.46	4.44	0.5%	4.4%
	Bowfin	2.53	2.53	0.1%	1.1%
	Brown bullhead	8.45	2.99	0.4%	3.6%
	Carp	14.79	0.67	0.8%	6.2%
	Channel catfish	3.93	2.40	0.2%	1.7%
	Freshwater drum	8.86	8.86	0.5%	3.7%
	Gizzard shad	8.33	2.78	0.4%	-
	Golden shiner	1.27	1.27	0.1%	0.5%
	Largemouth bass	9.07	3.52	0.5%	3.8%
	Longnose gar	1.27	1.27	0.1%	0.5%
	Pumpkinseed	31.70	11.57	1.6%	13.4%
	Shorthead redhorse	5.80	4.00	0.3%	2.5%
	Smallmouth bass	13.23	4.06	0.7%	5.6%
	Tiger muskellunge	0.65	0.65	0.03%	0.3%
	White perch	72.95	40.74	3.7%	30.8%
	White sucker	27.19	15.62	1.4%	11.5%
	Yellow bullhead	0.65	0.65	0.0%	0.3%
	Yellow perch	24.20	5.56	1.2%	10.2%

Table A8-4 (a-c). 2004 Individual Stratum Electrofishing CPUE.

Note: CPUE for gamefish (bolded) is calculated from all transects within the Stratum. CPUE for non-gamefish are calculated from only the transects where all fish are collected. Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from estimates of the number of fish.

a.) Entire Year 2004	Stratum 3				
	Species	Mean CPUE	SE	Relative abundance with clupeids	Relative abundance without clupeids
	Alewife	2138.10	613.34	91.2%	-
	Black crappie	0.58	0.58	0.02%	0.3%
	Bluegill	9.83	9.83	0.4%	5.3%
	Brown bullhead	2.69	1.31	0.1%	1.4%
	Carp	4.62	4.62	0.2%	2.5%
	Channel catfish	1.10	0.64	0.0%	0.6%
	Freshwater drum	2.23	0.11	0.1%	1.2%
	Gizzard shad	18.65	18.65	0.8%	-
	Largemouth bass	4.98	2.06	0.2%	2.7%
	Pumpkinseed	39.26	21.87	1.7%	21.0%
	Shorthead redhorse	5.79	3.46	0.2%	3.1%
	Smallmouth bass	5.28	3.96	0.2%	2.8%
	White perch	65.58	15.34	2.8%	35.0%
	White sucker	34.17	16.70	1.5%	18.2%
	Yellow perch	11.30	5.40	0.5%	6.0%

b.) Spring 2004	Stratum 3				
	Species	Mean CPUE	SE	Relative abundance with clupeids	Relative abundance without clupeids
	Alewife	3615.56	1104.35	93.9%	-
	Black crappie	1.05	1.05	0.03%	0.5%
	Bluegill	19.76	19.76	0.5%	8.5%
	Brown bullhead	3.31	2.17	0.1%	1.4%
	Carp	8.78	8.78	0.2%	3.8%
	Channel catfish	2.19	1.27	0.1%	0.9%
	Freshwater drum	2.04	2.04	0.1%	0.9%
	Largemouth bass	4.21	1.71	0.1%	1.8%
	Pumpkinseed	61.17	36.36	1.6%	26.2%
	Shorthead redhorse	2.04	2.04	0.1%	0.9%
	Smallmouth bass	6.78	4.37	0.2%	2.9%
	White perch	76.93	33.03	2.0%	33.0%
	White sucker	24.91	11.74	0.6%	10.7%
	Yellow perch	20.10	10.48	0.5%	8.6%

c.) Fall 2004	Stratum 3				
	Species	Mean CPUE	SE	Relative abundance with clupeids	Relative abundance without clupeids
	Alewife	356.83	191.00	67.0%	-
	Brown bullhead	2.05	1.19	0.4%	1.5%
	Freshwater drum	2.17	2.17	0.4%	1.6%
	Gizzard shad	34.78	34.78	6.5%	-
	Largemouth bass	5.31	4.13	1.0%	3.8%
	Pumpkinseed	18.42	10.74	3.5%	13.1%
	Shorthead redhorse	10.20	5.85	1.9%	7.3%
	Smallmouth bass	3.86	3.86	0.7%	2.7%
	White perch	49.66	6.86	9.3%	35.3%
	White sucker	45.64	23.90	8.6%	32.5%
	Yellow perch	3.27	1.95	0.6%	2.3%

Table A8-4 (a-c). 2004Individual Stratum Electrofishing CPUE.

Note: CPUE for gamefish (bolded) is calculated from all transects within the Stratum. CPUE for non-gamefish are calculated from only the transects where all fish are collected. Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from estimates of the number of fish.

a.) Entire Year 2004	**Stratum 4**				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	1015.00	445.83	83.4%	-
	Bluegill	28.75	6.98	2.4%	14.2%
	Bowfin	1.17	1.17	0.1%	0.6%
	Brown bullhead	4.69	0.95	0.4%	2.3%
	Carp	6.59	4.49	0.5%	3.3%
	Channel catfish	2.87	1.48	0.2%	1.4%
	Freshwater drum	8.07	1.42	0.7%	4.0%
	Golden shiner	2.23	2.23	0.2%	1.1%
	Largemouth bass	22.04	4.63	1.8%	10.9%
	Logperch	1.05	1.05	0.1%	0.5%
	Longnose gar	1.05	1.05	0.1%	0.5%
	Pumpkinseed	25.13	7.07	2.1%	12.5%
	Rock bass	0.43	0.43	0.04%	0.2%
	Shorthead redhorse	1.14	1.14	0.1%	0.6%
	Smallmouth bass	7.47	2.50	0.6%	3.7%
	White perch	57.80	4.27	4.7%	28.6%
	White sucker	9.33	4.90	0.8%	4.6%
	Yellow perch	22.04	6.31	1.8%	10.9%

b.) Spring 2004	**Stratum 4**				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	1823.37	633.71	87.5%	-
	Bluegill	54.04	11.22	2.6%	20.8%
	Brown bullhead	5.66	1.93	0.3%	2.2%
	Carp	4.28	4.28	0.2%	1.7%
	Channel catfish	2.46	1.65	0.1%	1.0%
	Freshwater drum	12.04	3.48	0.6%	4.6%
	Golden shiner	5.17	5.17	0.2%	2.0%
	Largemouth bass	20.63	5.36	1.0%	7.9%
	Pumpkinseed	37.80	12.20	1.8%	14.5%
	Shorthead redhorse	2.14	2.14	0.1%	0.8%
	Smallmouth bass	8.44	3.66	0.4%	3.2%
	White perch	77.05	47.09	3.7%	29.6%
	White sucker	15.07	10.79	0.7%	5.8%
	Yellow perch	15.42	2.23	0.7%	5.9%

c.) Fall 2004	**Stratum 4**				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	217.30	173.50	58.0%	-
	Bluegill	4.61	4.61	1.2%	2.9%
	Bowfin	2.30	2.30	0.6%	1.5%
	Brown bullhead	3.99	2.98	1.1%	2.5%
	Carp	9.09	4.71	2.4%	5.8%
	Channel catfish	3.20	1.46	0.9%	2.0%
	Freshwater drum	4.49	0.11	1.2%	2.9%
	Largemouth bass	23.15	5.66	6.2%	14.7%
	Logperch	2.19	2.19	0.6%	1.4%
	Longnose gar	2.19	2.19	0.6%	1.4%
	Pumpkinseed	12.71	8.47	3.4%	8.1%
	Rock bass	0.78	0.78	0.2%	0.5%
	Smallmouth bass	6.81	2.26	1.8%	4.3%
	White perch	48.28	48.28	12.9%	30.6%
	White sucker	4.49	0.11	1.2%	2.9%
	Yellow perch	29.37	14.28	7.8%	18.6%

Table A8-4 (a-c). 2004 Individual Stratum Electrofishing CPUE.

Note: CPUE for gamefish (bolded) is calculated from all transects within the Stratum. CPUE for non-gamefish are calculated from only the transects where all fish are collected. Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from estimates of the number of fish.

a.) Entire Year 2004	**Stratum 5**				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	2065.01	389.43	89.0%	-
	Bluegill	49.45	21.97	2.1%	19.5%
	Bowfin	1.24	1.24	0.1%	0.5%
	Brown bullhead	2.35	0.97	0.1%	0.9%
	Carp	11.55	4.11	0.5%	4.6%
	Channel catfish	1.68	1.07	0.1%	0.7%
	Freshwater drum	2.19	0.04	0.1%	0.9%
	Golden shiner	1.12	1.12	0.05%	0.4%
	Largemouth bass	29.07	4.19	1.3%	11.5%
	Longnose gar	1.24	1.24	0.1%	0.5%
	Pumpkinseed	34.31	12.19	1.5%	13.5%
	Shorthead redhorse	1.12	1.12	0.05%	0.4%
	Smallmouth bass	5.38	2.71	0.2%	2.1%
	White perch	79.06	67.88	3.4%	31.1%
	White sucker	11.72	7.24	0.5%	4.6%
	Yellow perch	22.49	2.59	1.0%	8.9%

b.)Spring 2004	**Stratum 5**				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	3690.19	1465.42	94.9%	-
	Bluegill	28.03	9.76	0.7%	14.0%
	Brown bullhead	1.17	1.17	0.03%	0.6%
	Carp	2.35	2.35	0.1%	1.2%
	Freshwater drum	4.70	0.00	0.1%	2.4%
	Largemouth bass	21.82	6.50	0.6%	10.9%
	Pumpkinseed	46.04	11.62	1.2%	23.0%
	Shorthead redhorse	2.35	2.35	0.1%	1.2%
	Smallmouth bass	3.64	2.35	0.1%	1.8%
	White perch	44.60	21.11	1.1%	22.3%
	White sucker	14.09	4.69	0.4%	7.0%
	Yellow perch	31.48	6.77	0.8%	15.7%

c.) Fall 2004	**Stratum 5**				
	Species	**Mean CPUE**	**SE**	**Relative abundance with clupeids**	**Relative abundance without clupeids**
	Alewife	557.71	557.71	64.3%	-
	Bluegill	70.75	34.35	8.2%	22.9%
	Bowfin	2.39	2.39	0.3%	0.8%
	Brown bullhead	3.39	1.15	0.4%	1.1%
	Carp	19.99	5.63	2.3%	6.5%
	Channel catfish	3.05	1.91	0.4%	1.0%
	Golden shiner	2.14	2.14	0.2%	0.7%
	Largemouth bass	35.57	9.30	4.1%	11.5%
	Longnose gar	2.39	2.39	0.3%	0.8%
	Pumpkinseed	23.40	13.23	2.7%	7.6%
	Smallmouth bass	6.99	3.16	0.8%	2.3%
	White perch	114.89	114.89	13.3%	37.2%
	White sucker	9.57	9.57	1.1%	3.1%
	Yellow perch	14.78	2.74	1.7%	4.8%

Table A8-5(a-d) Individual Transect Electrofishing CPUE in 2004.

Note: CPUE for non-gamefish are calculated from only the one-half of the transects where all fish are collected (every other transect, bolded). Cells with no data indicate a non-gamefish species in a gamefish only transect. Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from a combination of the number of fish netted and estimates of the number missed.

a.) 2004 entire year mean CPUE

Transect	Alewife	Banded killifish	Black crappie	Bluegill	Bowfin	Brown bullhead	Brown trout	Carp	Channel catfish	Freshwater drum	Gizzard shad	Golden shiner	Largemouth bass
1	2577.8	0.0	0.0	8.8	0.0	0.0	0.0	15.2	2.1	2.3	0.0	2.1	28.4
2	-	-	0.0	18.2	-	2.0	0.0	-	4.0	-	-	-	19.0
3	1670.1	0.0	0.0	69.0	2.4	4.7	0.0	7.2	0.0	2.3	0.0	0.0	40.5
4	-	-	0.0	101.6	-	2.4	0.0	-	0.0	-	-	-	26.9
5	3475.9	0.0	0.0	26.0	4.0	0.0	0.0	14.0	0.0	6.0	0.0	0.0	32.1
6	-	-	0.0	12.7	-	4.3	0.0	-	2.1	-	-	-	32.9
7	1734.7	0.0	0.0	10.4	0.0	0.0	0.0	9.9	0.0	0.0	0.0	0.0	16.2
8	-	-	0.0	11.7	-	18.6	0.0	-	2.8	-	-	-	34.0
9	3012.3	2.4	0.0	16.8	0.0	6.8	0.0	0.0	8.8	4.4	2.4	4.8	17.9
10	-	-	0.0	5.0	-	2.4	0.0	-	0.0	-	-	-	0.0
11	7589.2	0.0	0.0	13.7	0.0	5.9	2.0	9.9	0.0	4.0	46.4	0.0	15.9
12	-	-	0.0	7.1	-	7.3	0.0	-	0.0	-	-	-	21.6
13	5709.3	0.0	0.0	16.3	0.0	0.0	0.0	12.8	2.2	6.0	55.0	0.0	20.3
14	-	-	0.0	30.1	-	9.8	0.0	-	2.0	-	-	-	17.7
15	896.8	0.0	0.0	30.3	3.8	1.9	0.0	12.1	9.9	17.8	3.8	1.9	9.1
16	-	-	0.0	0.0	-	6.5	0.0	-	2.3	-	-	-	1.9
17	2442.9	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	2.0
18	-	-	2.1	0.0	-	0.0	0.0	-	2.1	-	-	-	4.2
19	1529.5	0.0	0.0	39.5	0.0	2.2	0.0	8.8	0.0	2.2	34.8	0.0	10.9
20	-	-	0.0	14.4	-	4.8	0.0	-	0.0	-	-	-	23.7
21	616.7	0.0	0.0	12.9	0.0	5.2	0.0	2.2	2.2	9.9	0.0	5.2	32.2
22	-	-	0.0	40.4	-	2.0	0.0	-	4.0	-	-	-	7.9
23	1423.9	0.0	0.0	32.1	2.3	4.4	0.0	11.2	0.0	6.6	0.0	0.0	15.5
24	-	-	0.0	46.7	-	7.7	0.0	-	8.0	-	-	-	30.1

Transect	Logperch	Longnose gar	Northern pike	Pumpkinseed	Rock bass	Shorthead redhorse	Smallmouth bass	Tiger muskellunge	Walleye	White perch	White sucker	Yellow bullhead	Yellow perch
1	0.0	0.0	0.0	20.5	0.0	2.3	0.0	0.0	0.0	11.7	4.7	0.0	29.9
2	-	-	0.0	14.8	0.0	-	2.0	0.0	0.0	-	-	0.0	21.9
3	0.0	2.4	0.0	35.3	0.0	0.0	7.1	0.0	0.0	147.7	19.0	0.0	23.7
4	-	-	0.0	68.2	0.0	-	12.1	0.0	0.0	-	-	0.0	17.0
5	0.0	0.0	0.0	48.0	2.0	4.0	10.0	0.0	2.0	42.1	2.0	0.0	4.0
6	-	-	0.0	21.3	2.2	-	4.2	0.0	0.0	-	-	0.0	10.6
7	0.0	0.0	0.0	35.7	2.5	0.0	2.5	0.0	0.0	56.1	16.5	0.0	13.2
8	-	-	0.0	28.4	0.0	-	7.0	0.0	0.0	-	-	0.0	13.5
9	0.0	0.0	2.2	99.8	0.0	0.0	7.2	0.0	0.0	32.0	15.8	0.0	59.5
10	-	-	0.0	4.9	0.0	-	2.4	0.0	0.0	-	-	0.0	22.5
11	0.0	0.0	0.0	41.7	0.0	2.0	25.8	2.0	0.0	65.9	9.9	2.0	25.7
12	-	-	0.0	26.2	0.0	-	9.6	0.0	0.0	-	-	0.0	33.8
13	0.0	0.0	0.0	16.8	0.0	6.7	13.0	0.0	0.0	166.9	51.3	0.0	41.9
14	-	-	0.0	79.2	0.0	-	13.8	0.0	0.0	-	-	0.0	5.9
15	0.0	1.9	0.0	68.2	0.0	0.0	17.4	0.0	0.0	50.4	10.2	0.0	27.3
16	-	-	0.0	109.8	0.0	-	16.9	0.0	0.0	-	-	0.0	29.0
17	0.0	0.0	0.0	16.9	0.0	10.1	0.0	0.0	0.0	76.4	53.1	0.0	4.7
18	-	-	0.0	19.3	0.0	-	0.0	0.0	0.0	-	-	0.0	4.2
19	0.0	0.0	0.0	13.1	0.0	2.2	4.4	0.0	0.0	50.2	17.5	0.0	8.8
20	-	-	0.0	18.8	1.9	-	2.4	0.0	0.0	-	-	0.0	19.3
21	2.2	2.2	0.0	12.5	0.0	0.0	16.9	0.0	0.0	62.1	15.1	0.0	16.9
22	-	-	0.0	14.2	0.0	-	3.9	0.0	0.0	-	-	0.0	23.9
23	0.0	0.0	0.0	47.4	0.0	2.1	6.7	0.0	0.0	63.3	4.4	0.0	45.7
24	-	-	0.0	33.4	0.0	-	8.1	0.0	0.0	-	-	0.0	6.2

Table A8-5(a-d) cont'd. Individual Transect Electrofishing CPUE in 2004.

Note: CPUE for non-gamefish are calculated from only the one-half of the transects where all fish are collected (every other transect, bolded). Cells with no data indicate a non-gamefish species in a gamefish only transect. Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from a combination of the number of fish netted and estimates of the number missed.

b.) Entire year SE of the mean for table a.

Transect	Alewife	Banded killifish	Black crappie	Bluegill	Bowfin	Brown bullhead	Brown trout	Carp	Channel catfish	Freshwater drum	Gizzard shad	Golden shiner	Largemouth bass
1	548.5	0.0	0.0	1.0	0.0	0.0	0.0	2.5	0.5	0.5	0.0	0.5	3.5
2	-	-	0.0	0.0	-	0.5	0.0	-	1.0	-	-	-	2.5
3	120.5	0.0	0.0	6.5	0.5	0.0	0.0	1.5	0.0	0.5	0.0	0.0	3.5
4	-	-	0.0	11.0	-	0.5	0.0	-	0.0	-	-	-	2.5
5	435.5	0.0	0.0	3.5	1.0	0.0	0.0	3.5	0.0	0.5	0.0	0.0	7.0
6	-	-	0.0	2.0	-	0.0	0.0	-	0.5	-	-	-	5.5
7	254.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	2.0
8	-	-	0.0	2.5	-	1.5	0.0	-	0.5	-	-	-	4.0
9	423.5	0.5	0.0	3.5	0.0	0.5	0.0	0.0	2.0	1.0	0.5	1.0	3.0
10	-	-	0.0	1.0	-	0.5	0.0	-	0.0	-	-	-	0.0
11	1354.0	0.0	0.0	3.5	0.0	0.5	0.5	1.5	0.0	1.0	10.5	0.0	1.0
12	-	-	0.0	1.5	-	1.5	0.0	-	0.0	-	-	-	1.5
13	735.5	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.5	1.5	10.5	0.0	4.0
14	-	-	0.0	2.5	-	2.5	0.0	-	0.5	-	-	-	0.0
15	156.0	0.0	0.0	3.0	1.0	0.5	0.0	1.0	1.5	2.5	1.0	0.5	2.0
16	-	-	0.0	0.0	-	0.5	0.0	-	0.5	-	-	-	0.5
17	564.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.5
18	-	-	0.5	0.0	-	0.0	0.0	-	0.5	-	-	-	1.0
19	223.0	0.0	0.0	9.0	0.0	0.5	0.0	2.0	0.0	0.5	8.0	0.0	1.5
20	-	-	0.0	3.0	-	1.0	0.0	-	0.0	-	-	-	0.5
21	110.0	0.0	0.0	2.5	0.0	1.0	0.0	0.5	0.5	1.0	0.0	1.0	3.0
22	-	-	0.0	10.0	-	0.5	0.0	-	0.0	-	-	-	1.0
23	244.5	0.0	0.0	7.5	0.5	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.5
24	-	-	0.0	5.5	-	2.0	0.0	-	0.0	-	-	-	1.5

Transect	Logperch	Longnose gar	Northern pike	Pumpkinseed	Rock bass	Shorthead redhorse	Smallmouth bass	Tiger muskellunge	Walleye	White perch	White sucker	Yellow bullhead	Yellow perch
1	0.0	0.0	0.0	1.5	0.0	0.5	0.0	0.0	0.0	2.5	1.0	0.0	3.5
2	-	-	0.0	2.0	0.0	-	0.5	0.0	0.0	-	-	0.0	2.5
3	0.0	0.5	0.0	4.5	0.0	0.0	0.5	0.0	0.0	17.0	0.0	0.0	1.0
4	-	-	0.0	1.0	0.0	-	0.5	0.0	0.0	-	-	0.0	0.5
5	0.0	0.0	0.0	4.0	0.5	1.0	0.5	0.0	0.5	4.5	0.5	0.0	1.0
6	-	-	0.0	2.0	0.5	-	1.0	0.0	0.0	-	-	0.0	1.5
7	0.0	0.0	0.0	3.0	0.5	0.0	0.5	0.0	0.0	4.5	3.0	0.0	0.5
8	-	-	0.0	5.0	0.0	-	1.5	0.0	0.0	-	-	0.0	1.5
9	0.0	0.0	0.5	17.0	0.0	0.0	1.5	0.0	0.0	1.0	1.5	0.0	10.5
10	-	-	0.0	0.0	0.0	-	0.5	0.0	0.0	-	-	0.0	3.5
11	0.0	0.0	0.0	1.5	0.0	0.5	1.5	0.5	0.0	4.5	0.5	0.5	2.5
12	-	-	0.0	4.5	0.0	-	0.0	0.0	0.0	-	-	0.0	1.0
13	0.0	0.0	0.0	1.0	0.0	1.5	1.0	0.0	0.0	5.5	1.0	0.0	3.0
14	-	-	0.0	1.0	0.0	-	1.0	0.0	0.0	-	-	0.0	1.5
15	0.0	0.5	0.0	4.0	0.0	0.0	2.0	0.0	0.0	6.5	0.5	0.0	0.5
16	-	-	0.0	12.0	0.0	-	0.0	0.0	0.0	-	-	0.0	4.5
17	0.0	0.0	0.0	3.0	0.0	1.0	0.0	0.0	0.0	9.5	2.0	0.0	0.0
18	-	-	0.0	3.5	0.0	-	0.0	0.0	0.0	-	-	0.0	1.0
19	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.0	0.0	1.5	1.0	0.0	2.0
20	-	-	0.0	3.0	0.5	-	0.5	0.0	0.0	-	-	0.0	0.5
21	0.5	0.5	0.0	1.5	0.0	0.0	0.5	0.0	0.0	12.0	2.0	0.0	0.5
22	-	-	0.0	3.5	0.0	-	1.0	0.0	0.0	-	-	0.0	2.0
23	0.0	0.0	0.0	9.0	0.0	0.5	0.5	0.0	0.0	7.0	0.0	0.0	8.0
24	-	-	0.0	3.5	0.0	-	1.0	0.0	0.0	-	-	0.0	1.5

Table A8-5(a-d) cont'd. Individual Transect Electrofishing CPUE in 2004.

Note: CPUE for non-gamefish are calculated from only the one-half of the transects where all fish are collected (every other transect, bolded). Cells with no data indicate a non-gamefish species in a gamefish only transect. Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from a combination of the number of fish netted and estimates of the number missed.

c.) 2004 spring CPUE (July)

Transect	Alewife	Banded killifish	Black crappie	Bluegill	Bowfin	Brown bullhead	Brown trout	Carp	Channel catfish	Freshwater drum	Gizzard shad	Golden shiner	Largemouth bass
1	5155.6	0.0	0.0	4.7	0.0	0.0	0.0	4.7	0.0	4.7	0.0	0.0	14.1
2	-	-	0.0	20.5	-	0.0	0.0	-	0.0	-	-	-	10.3
3	2224.8	0.0	0.0	37.5	0.0	4.7	0.0	0.0	0.0	4.7	0.0	0.0	23.5
4	-	-	0.0	49.3	-	0.0	0.0	-	0.0	-	-	-	39.5
5	5216.0	0.0	0.0	40.0	8.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	4.0
6	-	-	0.0	20.9	-	4.2	0.0	-	4.2	-	-	-	8.4
7	2963.0	0.0	0.0	9.9	0.0	0.0	0.0	19.8	0.0	0.0	0.0	0.0	4.9
8	-	-	0.0	23.3	-	9.3	0.0	-	0.0	-	-	-	51.3
9	5079.3	4.8	0.0	33.5	0.0	4.8	0.0	0.0	0.0	0.0	4.8	9.6	4.8
10	-	-	0.0	10.1	-	0.0	0.0	-	0.0	-	-	-	0.0
11	13084.3	0.0	0.0	0.0	0.0	4.0	4.0	4.0	0.0	8.1	88.8	0.0	12.1
12	-	-	0.0	14.2	-	0.0	0.0	-	0.0	-	-	-	28.5
13	8515.3	0.0	0.0	28.2	0.0	0.0	0.0	12.1	0.0	12.1	96.5	0.0	36.2
14	-	-	0.0	44.5	-	0.0	0.0	-	0.0	-	-	-	19.8
15	1622.7	0.0	0.0	45.5	0.0	0.0	0.0	9.1	4.5	9.1	0.0	0.0	18.2
16	-	-	0.0	0.0	-	9.2	0.0	-	4.6	-	-	-	0.0
17	4719.9	0.0	0.0	0.0	0.0	4.1	0.0	0.0	0.0	4.1	0.0	0.0	4.1
18	-	-	4.2	0.0	-	0.0	0.0	-	4.2	-	-	-	8.4
19	2511.2	0.0	0.0	79.0	0.0	0.0	0.0	17.6	0.0	0.0	0.0	0.0	4.4
20	-	-	0.0	28.9	-	9.6	0.0	-	0.0	-	-	-	24.1
21	1189.7	0.0	0.0	25.9	0.0	10.3	0.0	0.0	0.0	15.5	0.0	10.3	20.7
22	-	-	0.0	80.9	-	4.0	0.0	-	4.0	-	-	-	4.0
23	2457.1	0.0	0.0	64.2	0.0	4.3	0.0	8.6	0.0	8.6	0.0	0.0	17.1
24	-	-	0.0	70.3	-	0.0	0.0	-	8.3	-	-	-	37.2

Transect	Pumpkinseed	Rock bass	Shorthead redhorse	Smallmouth bass	Walleye	White perch	White sucker	Yellow perch
1	28.2	0.0	4.7	0.0	0.0	23.5	9.4	47.0
2	25.7	0.0	-	0.0	0.0	-	-	35.9
3	56.3	0.0	0.0	4.7	0.0	65.7	18.8	28.2
4	74.0	0.0	-	9.9	0.0	-	-	14.8
5	64.0	0.0	0.0	8.0	4.0	24.0	0.0	0.0
6	29.3	0.0	-	8.4	0.0	-	-	16.7
7	49.4	4.9	0.0	4.9	0.0	29.6	0.0	9.9
8	51.3	0.0	-	14.0	0.0	-	-	4.7
9	181.9	0.0	0.0	14.4	0.0	28.7	9.6	110.1
10	5.0	0.0	-	0.0	0.0	-	-	40.2
11	36.3	0.0	0.0	20.2	0.0	84.8	8.1	16.1
12	47.5	0.0	-	9.5	0.0	-	-	28.5
13	20.1	0.0	0.0	8.0	0.0	181.0	44.2	52.3
14	84.1	0.0	-	19.8	0.0	-	-	0.0
15	90.9	0.0	0.0	27.3	0.0	81.8	9.1	31.8
16	169.5	0.0	-	18.3	0.0	-	-	50.4
17	28.5	0.0	4.1	0.0	0.0	110.0	36.7	4.1
18	33.5	0.0	-	0.0	0.0	-	-	8.4
19	13.2	0.0	0.0	8.8	0.0	43.9	13.2	17.6
20	33.7	0.0	-	4.8	0.0	-	-	19.3
21	20.7	0.0	0.0	20.7	0.0	124.1	25.9	20.7
22	28.3	0.0	-	0.0	0.0	-	-	16.2
23	85.6	0.0	4.3	4.3	0.0	30.0	4.3	8.6
24	20.7	0.0	-	12.4	0.0	-	-	12.4

Table A8-5(a-d) cont'd. Individual Transect Electrofishing CPUE in 2004.

Note: CPUE for non-gamefish are calculated from only the one-half of the transects where all fish are collected (every other transect, bolded). Cells with no data indicate a non-gamefish species in a gamefish only transect. Because of the difficulty in netting clupeids (shad and alewives), the CPUE for these species is calculated from a combination of the number of fish netted and estimates of the number missed.

c.) 2004 spring CPUE, partial June smpling event only.

Transect	Alewife	Banded Killifish	Black crappie	Bluegill	Bowfin	Brown bullhead	Carp	Gizzard Shad	Golden shiner	Largemouth bass	Pumpkinseed	Shorthead redhorse	Smallmouth bass
12	-	-	0.00	8.29	-	0.00	-		-	8.28	74.57	-	16.57
13	11273.55705	0.00	0.00	0.00	0.00	0.00	0.00	4.83	0.00	4.83	48.32	0.00	14.50
14	-	0.00	0.00	36.32	-	4.04	-		-	40.36	40.36	-	4.04
15	3483.87	4.00	0.00	28.03	4.00	16.02	12.01	0.00	0.00	8.01	124.14	0.00	4.00
16	-	-	0.00	16.76		12.57	-		-	0.00	46.10	-	0.00
17	9970.99	0.00	0.00	4.58	0.00	0.00	0.00	4.58	4.58	0.00	22.90	4.58	4.58
18	-	-	0.00	8.43	-	4.22	-		-	21.08	84.31	-	4.22
19	2832.38	0.00	4.10	45.15	4.10	8.21	24.63		0.00	36.94	57.47	8.21	8.21

Transect	Walleye	White perch	White sucker	Yellow perch
12	0.00	-	-	24.86
13	0.00	130.47	33.83	19.33
14	0.00	-	-	56.50
15	0.00	188.21	8.01	64.07
16	0.00	-	-	4.19
17	4.58	251.91	13.74	54.96
18	0.00	-	-	71.66
19	0.00	172.41	0.00	57.47

d.) 2004 fall CPUE

Transect	Alewife	Bluegill	Bowfin	Brown bullhead	Carp	Channel catfish	Freshwater drum	Gizzard shad	Golden shiner	Largemouth bass	Logperch	Longnose gar	Northern pike
1	0.0	12.8	0.0	0.0	25.6	4.3	0.0	0.0	4.3	42.7	0.0	0.0	0.0
2	-	15.8	-	4.0	-	7.9	-	-	-	27.7	-	-	0.0
3	1115.4	100.5	4.8	4.8	14.4	0.0	0.0	0.0	0.0	57.4	0.0	4.8	0.0
4	-	153.8	-	4.8	-	0.0	-	-	-	14.4	-	-	0.0
5	1735.9	12.0	0.0	0.0	28.1	0.0	8.0	0.0	0.0	60.1	0.0	0.0	0.0
6	-	4.4	-	4.4	-	0.0	-	-	-	57.4	-	-	0.0
7	506.4	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.5	0.0	0.0	0.0
8	-	0.0	-	27.9	-	5.6	-	-	-	16.7	-	-	0.0
9	945.3	0.0	0.0	8.8	0.0	17.7	8.8	0.0	0.0	30.9	0.0	0.0	4.4
10	-	0.0	-	4.9	-	0.0	-	-	-	0.0	-	-	0.0
11	2094.1	27.5	0.0	7.8	15.7	0.0	0.0	3.9	0.0	19.6	0.0	0.0	0.0
12	-	0.0	-	14.7	-	0.0	-	-	-	14.7	-	-	0.0
13	2903.4	4.5	0.0	0.0	13.5	4.5	0.0	13.5	0.0	4.5	0.0	0.0	0.0
14	-	15.7	-	19.6	-	3.9	-	-	-	15.7	-	-	0.0
15	170.9	15.2	7.6	3.8	15.2	15.2	26.6	7.6	3.8	0.0	0.0	3.8	0.0
16	-	0.0	-	3.9	-	0.0	-	-	-	3.9	-	-	0.0
17	165.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	-	0.0	-	0.0	-	0.0	-	-	-	0.0	-	-	0.0
19	547.8	0.0	0.0	4.3	0.0	0.0	4.3	69.6	0.0	17.4	0.0	0.0	0.0
20	-	0.0	-	0.0	-	0.0	-	-	-	23.3	-	-	0.0
21	43.8	0.0	0.0	0.0	4.4	4.4	4.4	0.0	0.0	43.8	4.4	4.4	0.0
22	-	0.0	-	0.0	-	3.9	-	-	-	11.8	-	-	0.0
23	390.8	0.0	4.6	4.6	13.8	0.0	4.6	0.0	0.0	13.8	0.0	0.0	0.0
24	-	23.1	-	15.4	-	7.7	-	-	-	23.1	-	-	0.0

Transect	Pumpkinseed	Rock bass	Shorthead redhorse	Smallmouth bass	Tiger muskellunge	White perch	White sucker	Yellow bullhead	Yellow perch
1	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8
2	4.0	0.0	-	4.0	0.0	-	-	0.0	7.9
3	14.4	0.0	0.0	9.6	0.0	229.8	19.1	0.0	19.1
4	62.5	0.0	-	14.4	0.0	-	-	0.0	19.2
5	32.1	4.0	8.0	12.0	0.0	60.1	4.0	0.0	8.0
6	13.2	4.4	-	0.0	0.0	-	-	0.0	4.4
7	22.0	0.0	0.0	0.0	0.0	82.6	33.0	0.0	16.5
8	5.6	0.0	-	0.0	0.0	-	-	0.0	22.3
9	17.7	0.0	0.0	0.0	0.0	35.3	22.1	0.0	8.8
10	4.9	0.0	-	4.9	0.0	-	-	0.0	4.9
11	47.1	0.0	3.9	31.4	3.9	47.1	11.8	3.9	35.3
12	4.9	0.0	-	9.8	0.0	-	-	0.0	39.1
13	13.5	0.0	13.5	18.0	0.0	152.8	58.4	0.0	31.5
14	74.3	0.0	-	7.8	0.0	-	-	0.0	11.7
15	45.6	0.0	0.0	7.6	0.0	19.0	11.4	0.0	22.8
16	50.2	0.0	-	15.4	0.0	-	-	0.0	7.7
17	5.3	0.0	16.0	0.0	0.0	42.8	69.5	0.0	5.3
18	5.1	0.0	-	0.0	0.0	-	-	0.0	0.0
19	13.0	0.0	4.3	0.0	0.0	56.5	21.7	0.0	0.0
20	3.9	3.9	-	0.0	0.0	-	-	0.0	19.4
21	4.4	0.0	0.0	13.1	0.0	0.0	4.4	0.0	13.1
22	0.0	0.0	-	7.9	0.0	-	-	0.0	31.6
23	9.2	0.0	0.0	9.2	0.0	96.6	4.6	0.0	82.8
24	46.1	0.0	-	3.8	0.0	-	-	0.0	0.0

Table A8-6. Electrofishing species richness in "all fish" transects in 2004.

	Whole Lake	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Stratum 5
Entire Year	26	20	20	17	18	16
Spring	22	18	14	16	15	12
Fall	22	16	19	11	16	14

* Note; Richness does not include the fish identified in the field as "Lepomis sp" as these are likely either bluegill or pumpkinseed which are included in the richness calculation.

Table A8-7. Electrofishing Shannon-Weiner Index with and without Clupeids from "all-fish" Electrofishing transects in 2004.

Season	Stratum	With Clupeids H'	Without Clupeids H'
Whole year	1	0.223	0.957
Whole year	2	0.200	0.961
Whole year	3	0.279	0.902
Whole year	4	0.525	0.955
Whole year	5	0.330	0.875
Whole year	Whole lake	0.265	0.964
Spring	1	0.165	0.857
Spring	2	0.145	0.862
Spring	3	0.214	0.889
Spring	4	0.415	0.902
Spring	5	0.192	0.838
Spring	Whole lake	0.193	0.911
Fall	1	0.377	0.943
Fall	2	0.384	1.028
Fall	3	0.600	0.785
Fall	4	0.836	0.925
Fall	5	0.692	0.844
Fall	Whole lake	0.513	1.002

Table A8-8. Whole Lake Pollution Tolerance in 2004.

Percent of species in each tolerance category, based on presence of species. Tolerance designations based on Whittier and Hughes (1998)

Area	Time	Tolerant	Moderately Tolerant	Moderate	Moderately Intolerant	Intolerant
Whole Lake	Spring	43%	29%	24%	5%	0%
	Fall	45%	23%	32%	0%	0%
	Entire Year	42%	23%	31%	4%	0%
Stratum 1	Spring	44%	28%	28%	0%	0%
	Fall	35%	24%	29%	0%	0%
	Entire Year	40%	30%	30%	0%	0%
Stratum 2	Spring	43%	29%	21%	7%	0%
	Fall	53%	26%	21%	0%	0%
	Entire Year	50%	25%	20%	5%	0%
Stratum 3	Spring	50%	29%	21%	0%	0%
	Fall	36%	36%	27%	0%	0%
	Entire Year	47%	33%	20%	0%	0%
Stratum 4	Spring	50%	29%	21%	0%	0%
	Fall	50%	19%	31%	0%	0%
	Entire Year	50%	22%	28%	0%	0%
Stratum 5	Spring	50%	25%	25%	0%	0%
	Fall	64%	21%	14%	0%	0%
	Entire Year	53%	24%	18%	0%	0%

Table A8-9(a-b). Trophic Guild CPUE and Relative Abundance from electrofishing data in 2004 with and without Clupeids

a) Clupeids Included

Area	Time	Planktivore		Benthic Invertivore		Invertiviroe/Piscivore		Piscivore		Invertivore		Planktivore/Invertivore		Detritivore	
		CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance
Whole Lake	Spring	4562	95%	22	0.5%	104	2%	26	1%	84	2%	2	0.04%	16	0%
	Fall	885	86%	36	4%	33	3%	31	3%	38	4%	1	0.07%	8	1%
	Entire Year	2738	92%	29	1%	102	3%	29	1%	60	2%	1	0.04%	12	0%
Stratum 1	Spring	4419	96%	10	0.2%	63	1%	28	1%	101	2%	5	0.1%	2	0%
	Fall	1063	85%	32	3%	92	7%	42	3%	24	2%	0	0%	0	0%
	Entire Year	2736	93%	21	1%	76	3%	35	1%	62	2%	2	0.1%	1	0%
Stratum 2	Spring	7741	96%	29	0.4%	156	2%	33	0.4%	71	1%	0	0%	62	1%
	Fall	1723	88%	48	2%	120	6%	25	1%	42	2%	1	0.06%	8	0%
	Entire Year	4736	94%	38	1%	138	3%	29	1%	56	1%	1	0.01%	36	1%
Stratum 3	Spring	3616	94%	36	1%	106	3%	11	0.3%	81	2%	0	0%	0	0%
	Fall	357	67%	56	10%	57	11%	9	2%	18	3%	0	0%	35	7%
	Entire Year	2138	91%	45	2%	83	4%	10	0.4%	49	2%	0	0%	19	1%
Stratum 4	Spring	1823	88%	21	1%	113	5%	29	1%	92	4%	5	0.2%	0	0%
	Fall	217	58%	14	4%	92	25%	32	9%	20	5%	0	0%	0	0%
	Entire Year	1015	83%	17	1%	97	8%	31	3%	55	5%	2	0.2%	0	0%
Stratum 5	Spring	3690	95%	19	0.5%	82	2%	25	1%	74	2%	0	0%	0	0%
	Fall	558	64%	30	3%	139	16%	45	5%	94	11%	2	0.2%	0	0%
	Entire Year	2065	89%	24	1%	109	5%	36	2%	84	4%	0	0%	0	0%

b) Clupeids Excluded

Area	Time	Planktivore		Benthic Invertivore		Invertiviroe/Piscivore		Piscivore		Invertivore		Planktivore/Invertivore		Detritivore	
		CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance
Whole Lake	Spring	0	0%	22	9%	104	44%	26	11%	84	35%	2	0.9%	0	0%
	Fall	0	0%	36	26%	33	24%	31	22%	38	28%	1	0.5%	0	0%
	Entire Year	0	0%	29	13%	102	46%	29	13%	60	27%	1	0.6%	0	0%
Stratum 1	Spring	0	0%	10	5%	63	30%	28	14%	101	49%	5	2.3%	0	0%
	Fall	0	0%	32	17%	92	49%	42	22%	24	13%	0	0%	0	0%
	Entire Year	0	0%	21	11%	76	39%	35	18%	62	32%	2	1.1%	0	0%
	Spring	0	0%	29	10%	156	54%	33	12%	71	25%	0	0%	0	0%
	Fall	0	0%	48	20%	120	51%	25	11%	42	18%	1	0.5%	0	0%
	Entire Year	0	0%	38	15%	138	53%	29	11%	56	21%	1	0.3%	0	0%
Stratum 3	Spring	0	0%	36	15%	106	45%	11	5%	81	35%	0	0%	0	0%
	Fall	0	0%	56	40%	57	41%	9	7%	18	13%	0	0%	0	0%
	Entire Year	0	0%	45	24%	83	45%	10	5%	49	26%	0	0%	0	0%
Stratum 4	Spring	0	0%	21	8%	113	43%	29	11%	92	35%	5	2.0%	0	0%
	Fall	0	0%	14	9%	92	59%	32	20%	20	12%	0	0%	0	0%
	Entire Year	0	0%	17	8%	97	48%	31	15%	55	27%	2	1.1%	0	0%
Stratum 5	Spring	0	0%	19	9%	82	41%	25	13%	74	37%	0	0%	0	0%
	Fall	0	0%	30	10%	139	45%	45	15%	94	30%	2	0.7%	0	0%
	Entire Year	0	0%	24	10%	109	43%	36	14%	84	33%	0	0%	0	0%

Table A8-10(a-b). Thermal Guild CPUE and Relative Abundance from electrofishing data in 2004 with and without Clupeids

a) Clupeids Included

Area	Time	Warm		Cool		Cold	
		CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance
Whole Lake	Spring	203	4%	4613	96%	0.17	0.003%
	Fall	164	15%	936	85%	0	0%
	Entire Year	183	6%	2788	94%	0.08	0.003%
Stratum 1	Spring	162	4%	4465	96%	0	0%
	Fall	151	12%	1100	88%	0	0%
	Entire Year	156	79%	41	21%	0	0%
Stratum 2	Spring	287	4%	7804	96%	0.33	0.13%
	Fall	173	9%	1795	91%	0	0%
	Entire Year	231	5%	4803	95%	0	0%
Stratum 3	Spring	179	5%	3669	95%	0	0%
	Fall	112	21%	420	79%	0	0%
	Entire Year	150	6%	2195	94%	0	0%
Stratum 4	Spring	214	10%	1870	90%	0	0%
	Fall	115	31%	258	69%	0	0%
	Entire Year	159	13%	1057	87%	0	0%
Stratum 5	Spring	149	4%	3742	96%	0	0%
	Fall	276	32%	591	68%	0	0%
	Entire Year	212	9%	2107	91%	0	0%

b) Clupeids Excluded

Area	Time	Warm		Cool		Cold	
		CPUE	Relative Abundance	CPUE	Relative Abundance	CPUE	Relative Abundance
Whole Lake	Spring	187	78%	52	22%	0.17	0.07%
	Fall	156	75%	51	25%	0	0%
	Entire Year	171	77%	51	23%	0.08	0.04%
Stratum 1	Spring	161	78%	45	22%	0	0%
	Fall	151	80%	38	20%	0	0%
	Entire Year	156	79%	41	21%	0	0%
Stratum 2	Spring	226	78%	63	22%	0.3	0.13%
	Fall	165	69%	72	31%	0	0%
	Entire Year	195	74%	67	26%	0	0%
Stratum 3	Spring	179	77%	54	23%	0	0%
	Fall	78	55%	63	45%	0	0%
	Entire Year	131	70%	57	30%	0	0%
Stratum 4	Spring	214	82%	46	18%	0	0%
	Fall	115	74%	41	26%	0	0%
	Entire Year	159	79%	42	21%	0	0%
Stratum 5	Spring	149	74%	52	26%	0	0%
	Fall	276	89%	33	11%	0	0%
	Entire Year	212	84%	42	16%	0	0%

Table A8-11. Length frequency in Fall 2004 electrofishing and gill netting combined for species where n>20.

Alewife

Total Length (mm)	Frequency
60 - 79	0
80 - 99	0
100 - 119	2
120 - 139	22
140 - 159	161
160 - 179	20
180 - 199	0
200 - 219	0
220 - 239	0
240 - 259	0
260 - 279	0
280 - 299	0
300 - 319	0

Bluegill

Total Length (mm)	Frequency
60 - 79	0
80 - 99	4
100 - 119	15
120 - 139	7
140 - 159	21
160 - 179	23
180 - 199	16
200 - 219	2
220 - 239	0
240 - 259	0
260 - 279	0
280 - 299	0
300 - 319	0

Brown bullhead

Total Length (mm)	Frequency
60 - 79	1
80 - 99	0
100 - 119	0
120 - 139	1
140 - 159	0
160 - 179	2
180 - 199	5
200 - 219	1
220 - 239	1
240 - 259	1
260 - 279	4
280 - 299	3
300 - 319	2
320 - 339	5
340 - 359	1
360 - 379	3
380 - 399	0
400 - 419	0
420 - 439	0
440 - 459	0
460 - 479	0
480 - 499	0
500 - 519	0
520 - 539	0
> 539	0

Channel catfish

Total Length (mm)	Frequency
80 - 99	0
100 - 119	0
120 - 139	0
140 - 159	0
160 - 179	0
180 - 199	0
200 - 219	0
220 - 239	0
240 - 259	0
260 - 279	0
280 - 299	0
300 - 319	0
320 - 339	0
340 - 359	0
360 - 379	1
380 - 399	0
400 - 419	1
420 - 439	1
440 - 459	4
460 - 479	4
480 - 499	2
500 - 519	2
520 - 539	3
540 - 559	2
560 - 579	0
> 579	2

Gizzard shad

Total Length (mm)	Frequency
60 - 79	0
80 - 99	8
100 - 119	6
120 - 139	3
140 - 159	1
160 - 179	3
180 - 199	0
200 - 219	0
220 - 239	0
240 - 259	0
260 - 279	0
280 - 299	0
300 - 319	1
320 - 339	0
340 - 359	1
360 - 379	0
380 - 399	3
400 - 419	0
420 - 439	0
440 - 459	1
460 - 479	0
480 - 499	0
500 - 519	0
520 - 539	0
> 539	0

Yellow perch

Total Length (mm	Frequency
60 - 79	0
80 - 99	0
100 - 119	0
120 - 139	0
140 - 159	0
160 - 179	2
180 - 199	11
200 - 219	40
220 - 239	29
240 - 259	14
260 - 279	4
280 - 299	0
300 - 319	0
> 319	0

Table A8-11 (Cont.). Length frequency in Fall 2003 electrofishing and gill netting combined for species where n>20.

Largemouth bass

Total Length (mm)	Frequency
60 - 79	0
80 - 99	8
100 - 119	3
120 - 139	4
140 - 159	1
160 - 179	0
180 - 199	0
200 - 219	3
220 - 239	11
240 - 259	2
260 - 279	5
280 - 299	10
300 - 319	18
320 - 339	8
340 - 359	16
360 - 379	16
380 - 399	2
400 - 419	6
420 - 439	4
440 - 459	3
460 - 479	1
480 - 499	0
500 - 519	0
520 - 539	0
> 539	0

Pumpkinseed

Total Length (mm)	Frequency
60 - 79	0
80 - 99	7
100 - 119	50
120 - 139	19
140 - 159	19
160 - 179	20
180 - 199	6
200 - 219	1
220 - 239	0
240 - 259	0
260 - 279	0
280 - 299	0
300 - 319	0
> 319	0

Smallmouth bass

Total Length (mm)	Frequency
60 - 79	1
80 - 99	3
100 - 119	2
120 - 139	0
140 - 159	0
160 - 179	4
180 - 199	6
200 - 219	4
220 - 239	7
240 - 259	6
260 - 279	1
280 - 299	2
300 - 319	1
320 - 339	2
340 - 359	1
360 - 379	2
380 - 399	3
400 - 419	3
420 - 439	1
440 - 459	1
460 - 479	0
480 - 499	0
500 - 519	0
520 - 539	0
> 539	0

White perch

Total Length (mm)	Frequency
60 - 79	0
80 - 99	1
100 - 119	0
120 - 139	37
140 - 159	40
160 - 179	37
180 - 199	56
200 - 219	26
220 - 239	9
240 - 259	0
260 - 279	0
280 - 299	0
300 - 319	0
> 319	0

White sucker

Total Length (mm)	Frequency
80 - 99	0
100 - 119	0
120 - 139	0
140 - 159	0
160 - 179	0
180 - 199	0
200 - 219	0
220 - 239	0
240 - 259	0
260 - 279	0
280 - 299	1
300 - 319	1
320 - 339	0
340 - 359	2
360 - 379	2
380 - 399	2
400 - 419	4
420 - 439	6
440 - 459	10
460 - 479	13
480 - 499	10
500 - 519	6
520 - 539	5
540 - 559	1
560 - 579	0
> 579	0

Table A8-12(a-c). Mean Lengths of large and smallmouth bass in each stratum and the whole lake for each sampling event and the whole year from electrofishing, and mean lengths of all species in each event and the whole year.

a) 2004 Smallmouth bass mean length in each strata during each event and for the entire year

Season	Species	Stratum	Mean Total Length (mm)	Standard Error	N
Whole Year	Smallmouth Bass	1	319.21	31.20	14
Whole Year	Smallmouth Bass	2	258.32	14.79	38
Whole Year	Smallmouth Bass	3	254.80	22.77	10
Whole Year	Smallmouth Bass	4	256.24	32.81	17
Whole Year	Smallmouth Bass	5	201.00	20.85	9
Whole Year	Smallmouth Bass	Whole Lake	261.34	11.06	88
Spring	Smallmouth Bass	1	354.64	31.45	11
Spring	Smallmouth Bass	2	280.79	24.16	19
Spring	Smallmouth Bass	3	262.00	38.93	6
Spring	Smallmouth Bass	4	322.89	38.94	9
Spring	Smallmouth Bass	5	203.67	29.87	3
Spring	Smallmouth Bass	Whole Lake	298.44	15.60	48
Fall	Smallmouth Bass	1	189.33	25.83	3
Fall	Smallmouth Bass	2	235.84	16.13	19
Fall	Smallmouth Bass	3	244.00	5.87	4
Fall	Smallmouth Bass	4	181.25	41.97	8
Fall	Smallmouth Bass	5	199.67	29.39	6
Fall	Smallmouth Bass	Whole Lake	216.83	12.45	40

b) 2004 Largemouth bass mean length in each strata during each event and for the entire year

Season	Species	Stratum	Mean Total Length (mm)	SE	N
Whole Year	Largemouth bass	1	313.32	10.60	59
Whole Year	Largemouth bass	2	332.90	11.27	39
Whole Year	Largemouth bass	3	240.67	39.41	9
Whole Year	Largemouth bass	4	317.55	10.68	51
Whole Year	Largemouth bass	5	309.58	13.73	50
Whole Year	Largemouth bass	Whole Lake	313.99	5.90	208
Spring	Largemouth bass	1	333.06	18.66	16
Spring	Largemouth bass	2	337.54	13.48	26
Spring	Largemouth bass	3	311.75	27.32	4
Spring	Largemouth bass	4	330.30	10.94	23
Spring	Largemouth bass	5	346.83	18.29	18
Spring	Largemouth bass	Whole Lake	335.54	7.12	87
Fall	Largemouth bass	1	305.98	12.73	43
Fall	Largemouth bass	2	323.62	20.94	13
Fall	Largemouth bass	3	183.80	57.67	5
Fall	Largemouth bass	4	307.07	17.19	28
Fall	Largemouth bass	5	288.63	17.97	32
Fall	Largemouth bass	Whole Lake	298.49	8.51	121

Table A8-12(a-c) Cont.. Mean total lengths of large and smallmouth bass in each stratum and the whole lake for each sampling event and the whole year from electrofishing, and mean lengths of all other species in each event and the whole year.

c) 2004 Whole lake mean length for all other species

Season	Species	Mean Total Length (mm)	SE	N
Whole Year	Alewife	144.89	0.41	566
Whole Year	Banded killifish	75.00	NA	1
Whole Year	Black crappie	248.00	NA	1
Whole Year	Bluegill	160.65	1.63	252
Whole Year	Bowfin	537.30	22.12	20
Whole Year	Brown bullhead	274.31	10.13	45
Whole Year	Brown trout	212.00	NA	1
Whole Year	Channel catfish	500.60	9.73	25
Whole Year	Freshwater drum	380.20	11.06	30
Whole Year	Gizzard shad	217.93	26.95	27
Whole Year	Golden shiner	122.83	16.42	6
Whole Year	Logperch	120.00	NA	1
Whole Year	Longnose gar	609.17	87.07	6
Whole Year	Northern pike	635.00	NA	1
Whole Year	Pumpkinseed	141.51	1.27	402
Whole Year	Rock bass	189.50	7.01	4
Whole Year	Shorthead redhorse	463.92	7.41	13
Whole Year	Tiger muskellunge	735.00	NA	1
Whole Year	Walleye	570.00	NA	1
Whole Year	White perch	169.65	1.69	362
Whole Year	White sucker	451.22	5.48	96
Whole Year	Yellow bullhead	234.00	NA	1
Whole Year	Yellow perch	213.76	1.65	225
Spring	Alewife	142.74	0.50	362
Spring	Banded killifish	75.00	NA	1
Spring	Black crappie	248.00	NA	1
Spring	Bluegill	164.88	1.77	164
Spring	Bowfin	593.33	13.00	9
Spring	Brown bullhead	301.93	8.24	15
Spring	Brown trout	212.00	NA	1
Spring	Channel catfish	498.71	17.97	7
Spring	Freshwater drum	384.44	16.90	16
Spring	Gizzard shad	383.71	16.54	7
Spring	Golden shiner	120.25	25.51	4
Spring	Longnose gar	700.00	30.00	2
Spring	Pumpkinseed	145.79	1.38	280
Spring	Rock bass	175.00	NA	1
Spring	Shorthead redhorse	453.67	18.78	3
Spring	Walleye	570.00	NA	1
Spring	White perch	167.10	2.58	189
Spring	White sucker	445.46	8.51	41
Spring	Yellow perch	208.80	2.31	129
Fall	Alewife	148.71	0.65	204
Fall	Bluegill	152.77	3.16	88
Fall	Bowfin	491.46	33.36	11
Fall	Brown bullhead	260.50	14.06	30
Fall	Channel catfish	501.33	11.89	18
Fall	Freshwater drum	375.36	14.32	14
Fall	Gizzard shad	159.90	25.05	20
Fall	Golden shiner	128.00	10.00	2
Fall	Logperch	120.00	NA	1
Fall	Longnose gar	563.75	129.39	4
Fall	Northern pike	635.00	NA	1
Fall	Pumpkinseed	131.67	2.56	122
Fall	Rock bass	194.33	7.17	3
Fall	Shorthead redhorse	467.00	8.19	10
Fall	Tiger muskellunge	735.00	NA	1
Fall	White perch	172.44	2.11	173
Fall	White sucker	455.51	7.17	55
Fall	Yellow bullhead	234.00	NA	1
Fall	Yellow perch	220.44	2.12	96

Table A8-13. Proportional Stock Density (PSD) & Relative Stock Density (RSD) of select species captured during Fall 2004 electrofishing.

Species	**PSD or RSD**	**Value**
Bluegill	PSD	57.95
	RSD8	2.27
Gizzard shad	PSD	100.00
Largemouth bass	PSD	60.95
	RSD15	15.24
	RSD18	0.95
Pumpkinseed	PSD	28.69
	RSD8	0.82
Lepomis sp.	PSD	40.95
	RSD8	1.43
Smallmouth bass	PSD	20.00
	RSD12	13.33
	RSD14	6.67
	RSD18	0.00

* Number after "PSD" or "RSD" designates fish size in inches. So RSD8 is the RSD of fish 8 inches and larger.

Table A8-14(a-b). Relative weights and condition factor of select species captured during electrofishing in the fall of 2004.

a) 2004 Relative Weights

Species	Mean Relative Weight	SE	N
Bluegill	100.81	2.46	71
Gizzard shad	107.32	2.50	20
Largemouth bass	110.12	1.51	108
Pumpkinseed	119.25	3.80	108
Smallmouth bass	95.03	3.23	36
White perch	93.02	1.65	158
Yellow perch	84.60	1.10	94

b) 2004 Condition Factors

Species	Condition Factor
Bluegill	2.03
Gizzard shad	1.22
Largemouth bass	1.69
Pumpkinseed	2.34
Smallmouth bass	1.23
White perch	1.34
Yellow perch	1.19

Table A8-15(a-b). Largemouth and smallmouth bass catch rates from electrofishing in 2004.

a) Largemouth bass

Season	CPUE	Category*
Spring	0.94	yearling
	0.56	yearling to 10 inch
	14.85	> 10 inch
	11.47	> 12 inch
Fall	2.93	fingerling
	2.93	fingerling to 10 inch
	16.29	> 10 inch
	11.72	> 12 inch

b) Smallmouth bass

Season	CPUE	Category*
Spring	2.44	yearling
	1.88	yearling to 10 inch
	4.70	> 10 inch
	3.76	> 12 inch
Fall	1.10	fingerling
	4.76	fingerling to 10 inch
	1.46	> 10 inch
	0.73	> 12 inch

* Note: Yearlings are less than or equal to 200 mm total length. Fingerlings are less than or equal to 150 mm total length. These sizes are based on length frequency data from the OCDWEP database.

Table A8-16(a-b). Summary of DELT results in 2004.

a) 2004 Electrofishing/Gill netting DELTFM Summary

Stratum	Number of fish with DELTFM
1	13
2	8
3	3
4	6
5	8
Whole Lake	38

b) Whole lake electrofishing/gill netting DELTFM abnormalities by type and species for adults in 2004.

Species	DELTFM	Number
Bluegill	Tumors: caudal peduncle	2
Bluegill	Tumors: dorsal	1
Brown bullhead	Deformity: burnt barbels	4
Brown bullhead	Deformity: right barbel missing.	1
Brown bullhead	Lesions: red spot all over body	1
Brown bullhead	Malignancies and lesions (head and dorsal region on one)	2
Brown bullhead	Malignancies: head	1
Brown bullhead	Tumors	1
Channel catfish	Deformity: burnt barbels	7
Channel catfish	Deformity: missing barbel	1
Channel catfish	Lesions: lower mandible	1
Freshwater drum	Tumors: ventral	1
Largemouth bass	Deformity: mandible	1
Largemouth bass	Deformity: opercle	1
Largemouth bass	Erosions: abrasions on tail and upper caudal fin	2
Largemouth bass	Lesions: caudal	3
Largemouth bass	Tumors and abrasions on tail	1
Largemouth bass	Tumors: gill plate, and by recapture tag	2
Pumpkinseed	Erosions: tail	1
Pumpkinseed	Tumors: tail	1
Shorthead redhorse	Tumors: jaw	1
White perch	Deformities: top of tail fin torn	1
White sucker	Erosions: abrasion on caudal peduncle	1

c) Whole lake DELTFM abnormalities by type and species for juveniles in 2004.

Species	DELTFM	Number
Banded killifish	Lesions	3
Bluegill	Tumors	1
Largemouth bass	Fungal: infections on caudal fin	1

* Note: Juveile DELTFM are not included in the count by stratum above.

Table A8-17(a-d). Gill net CPUE for 2004 by location, time period, and species.

a) Gill net CPUE for 2004 by location, time period, and species.

Year	Location	Season	Species	Mean CPUE
2004	Stratum 1	Fall	Shorthead redhorse	0.50
2004	Stratum 1	Fall	Smallmouth bass	1.00
2004	Stratum 1	Fall	White sucker	0.50
2004	Stratum 1	Fall	Yellow perch	0.50
2004	Stratum 2	Fall	Channel catfish	1.00
2004	Stratum 2	Fall	Gizzard shad	0.50
2004	Stratum 2	Fall	Smallmouth bass	1.50
2004	Stratum 2	Fall	White perch	3.50
2004	Stratum 2	Fall	White sucker	0.50
2004	Stratum 2	Fall	Yellow perch	1.50
2004	Stratum 3	Fall	Alewife	0.50
2004	Stratum 3	Fall	Channel catfish	1.00
2004	Stratum 3	Fall	Gizzard shad	2.50
2004	Stratum 3	Fall	Smallmouth bass	0.50
2004	Stratum 3	Fall	White perch	13.00
2004	Stratum 3	Fall	White sucker	1.00
2004	Stratum 4	Fall	Smallmouth bass	0.40
2004	Stratum 4	Fall	Walleye	0.40
2004	Stratum 4	Fall	White sucker	1.60
2004	Stratum 5	Fall	Gizzard shad	0.50
2004	Stratum 5	Fall	Smallmouth bass	1.50
2004	Stratum 1	Spring	Smallmouth bass	0.50
2004	Stratum 1	Spring	White perch	1.00
2004	Stratum 2	Spring	Sturgeon	0.50
2004	Stratum 2	Spring	White perch	38.00
2004	Stratum 2	Spring	Yellow perch	2.50
2004	Stratum 3	Spring	Freshwater drum	0.44
2004	Stratum 3	Spring	White perch	33.78
2004	Stratum 3	Spring	White sucker	0.89
2004	Stratum 3	Spring	Yellow perch	8.00
2004	Stratum 4	Spring	Walleye	0.50
2004	Stratum 4	Spring	White perch	1.00
2004	Stratum 5	Spring	Smallmouth bass	1.00
2004	Stratum 5	Spring	White perch	1.50
2004	Stratum 5	Spring	Yellow perch	0.50

b) Whole year gill net CPUE for 2004 by location and species.

Year	Location	Species	Mean CPUE
2004	Stratum 1	Shorthead redhorse	0.25
2004	Stratum 1	Smallmouth bass	0.75
2004	Stratum 1	White perch	0.50
2004	Stratum 1	White sucker	0.25
2004	Stratum 1	Yellow perch	0.25
2004	Stratum 2	Channel catfish	0.50
2004	Stratum 2	Gizzard shad	0.25
2004	Stratum 2	Smallmouth bass	0.75
2004	Stratum 2	Sturgeon	0.25
2004	Stratum 2	White perch	20.75
2004	Stratum 2	White sucker	0.25
2004	Stratum 2	Yellow perch	2.00
2004	Stratum 3	Alewife	0.24
2004	Stratum 3	Channel catfish	0.47
2004	Stratum 3	Freshwater drum	0.24
2004	Stratum 3	Gizzard shad	1.18
2004	Stratum 3	Smallmouth bass	0.24
2004	Stratum 3	White perch	24.00
2004	Stratum 3	White sucker	0.94
2004	Stratum 3	Yellow perch	4.24
2004	Stratum 4	Smallmouth bass	0.22
2004	Stratum 4	Walleye	0.44
2004	Stratum 4	White perch	0.44
2004	Stratum 4	White sucker	0.89
2004	Stratum 5	Gizzard shad	0.25
2004	Stratum 5	Smallmouth bass	1.25
2004	Stratum 5	White perch	0.75
2004	Stratum 5	Yellow perch	0.25

Table A8-17(a-d) Cont.. Gill net CPUE for 2004 by location, time period, and species.

c) Gillnet CPUE for 2004 by time period and species.

Year	Season	Species	Mean CPUE	Relative Abundance
2004	Spring	Freshwater drum	0.09	0.5%
2004	Spring	Smallmouth bass	0.30	1.7%
2004	Spring	Sturgeon	0.10	0.6%
2004	Spring	Walleye	0.10	0.6%
2004	Spring	White perch	15.06	83.5%
2004	Spring	White sucker	0.18	1.0%
2004	Spring	Yellow perch	2.20	12.2%
2004	Fall	Alewife	0.10	1.5%
2004	Fall	Channel catfish	0.40	5.9%
2004	Fall	Gizzard shad	0.70	10.3%
2004	Fall	Shorthead redhorse	0.10	1.5%
2004	Fall	Smallmouth bass	0.98	14.5%
2004	Fall	Walleye	0.08	1.2%
2004	Fall	White perch	3.30	48.7%
2004	Fall	White sucker	0.72	10.6%
2004	Fall	Yellow perch	0.40	5.9%

d) Gillnet CPUE for 2004 for entire year

Species	Mean CPUE	Relative Abundance
Alewife	0.05	0.4%
Channel catfish	0.19	1.5%
Freshwater drum	0.05	0.4%
Gizzard shad	0.34	2.7%
Shorthead redhorse	0.05	0.4%
Smallmouth bass	0.64	5.1%
Sturgeon	0.05	0.4%
Walleye	0.09	0.7%
White perch	9.29	74.0%
White sucker	0.47	3.7%
Yellow perch	1.35	10.7%

Table A8-18. Species richness from gill nets in 2004

Season	Whole Lake	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Stratum 5
Entire Year	11	5	7	8	4	4
Spring	7	2	3	4	2	3
Fall	9	4	6	6	3	2

Table A8-19. Shannon-Weaver Diversity Index from gill nets in 2004.

Season	Stratum	With Clupeids H'
Entire Year	1	0.649
Entire Year	2	0.293
Entire Year	3	0.381
Entire Year	4	0.553
Entire Year	5	0.507
Entire Year	Whole lake	0.445
Spring	1	0.276
Spring	2	0.128
Spring	3	0.274
Spring	4	0.276
Spring	5	0.439
Spring	Whole lake	0.264
Fall	1	0.579
Fall	2	0.679
Fall	3	0.447
Fall	4	0.377
Fall	5	0.244
Fall	Whole lake	0.707

Table A8-20(a-d). 2004 Nesting survey results by species and transect.

a) 2004 Nesting survey results by species and transect (1-16)

Transect	Species	Number of Nests
1	No Nests	
2	Bluegill	1
2	Lepomis sp.	2
2	Pumpkinseed	1
3	Largemouth bass	1
3	Lepomis sp.	27
4	Largemouth bass	4
4	Lepomis sp.	63
5	Largemouth bass	1
5	Lepomis sp.	294
6	Lepomis sp.	147
7	Largemouth bass	2
7	Lepomis sp.	179
7	Species unknown	30
8	Lepomis sp.	350
8	Species unknown	14
9	Lepomis sp.	277
9	Species unknown	16
10		No Nests
11	Lepomis sp.	14
11	Species unknown	3
12	Lepomis sp.	79
12	Species unknown	3
13	Largemouth bass	2
13	Lepomis sp.	17
14	Largemouth bass	6
14	Lepomis sp.	142
14	Species unknown	10
15	Lepomis sp.	50
15	Species unknown	13
15	Smallmouth bass	2

Table A8-20(a-d). 2004 Nesting survey results by species and transect.

A-continued) 2004 Nesting survey results by species and transect (16-24)

Transect	Species	Number of Nests
16	Lepomis sp.	2
16	Species unknown	3
16	Smallmouth bass	1
17		No Nests
18		No Nests
19	Species unknown	6
20	Lepomis sp.	155
20	Species unknown	22
21		No Nests
22	Largemouth bass	1
22	Species unknown	1
23	Lepomis sp.	120
23	Species unknown	9
24	Lepomis sp.	72
24	Species unknown	4

Table A8-20(a-d) Cont.. 2004 Nesting survey results by species and transect, with comparison of north vs. south.

b) 2004 total number of nests in each transect and relative abundance

Transect	Total Number of Nests	Percent of Total
1	0	0.0%
2	4	0.2%
3	28	1.3%
4	67	3.1%
5	295	13.7%
6	147	6.8%
7	211	9.8%
8	364	17.0%
9	293	13.7%
10	0	0.0%
11	17	0.8%
12	82	3.8%
13	19	0.9%
14	158	7.4%
15	65	3.0%
16	6	0.3%
17	0	0.0%
18	0	0.0%
19	6	0.3%
20	177	8.2%
21	0	0.0%
22	2	0.1%
23	129	6.0%
24	76	3.5%

c) 2004 nest distribution

Basin	Total Number of Nests	Percent of Total
North Basin	1409	65.7%
South Basin	737	34.3%

d) 2004 species contribution

Species	Total Number of Nests	Percent of Total
Bluegill	1	0.05%
Largemouth bass	17	0.79%
Lepomis sp.	1990	92.73%
Pumpkinseed	1	0.05%
Smallmouth bass	3	0.14%
Species unknown	134	6.24%

Table A8-21(a-c). Pelagic larvae catch summary for 2004.

a) Whole year CPUE by species

Species	Basin	Mean (#/m^3)	SE
Alewife	North Basin	0.0044	0.0044
	South Basin	0.0038	0.0038
	Whole Lake	0.0041	0.0027
Brook Silverside	North Basin	0	0
	South Basin	0.0040	0.0040
	Whole Lake	0.0020	0.0020
Gizzard shad	North Basin	0.0204	0.0049
	South Basin	0.0337	0.0193
	Whole Lake	0.0271	0.0096
Herring Family (Cluepeidae)	North Basin	0.0039	0.0039
	South Basin	0.0037	0.0037
	Whole Lake	0.0038	0.0025
Lepomis sp.	North Basin	0.0039	0.0039
	South Basin	0	0
	Whole Lake	0.0019	0.0019

b) Species richness in 2004

Location	Number of Species*
North Basin	3
South Basin	3
Whole Lake	4

* Clupeidae are not counted as a separate species if either gizzard shad or alewives were caught within a sampling unit.

c) Sampling Event CPUE by species and location
* Note: four other sample periods had no fish captured.

Sample Period	Species	Basin	Mean (#/m^3)	SE
Mid June	Gizzard shad	North Basin	0.0302	0.0302
		South Basin	0.0867	0.0558
		Whole Lake	0.0584	0.0313
	Herring Family (Cluepeidae)	North Basin	0.0302	0.0302
		South Basin	0.0292	0.0292
		Whole Lake	0.0297	0.0195
	Lepomis sp.	North Basin	0.0293	0.0293
		South Basin	0	0
		Whole Lake	0.0147	0.0147
Early July	Alewife	North Basin	0	0
		South Basin	0.0275	0.0275
		Whole Lake	0.0137	0.0137
	Brook Silverside	North Basin	0	0
		South Basin	0.0314	0.0314
		Whole Lake	0.0157	0.0157
	Gizzard shad	North Basin	0.0861	0.0545
		South Basin	0.1574	0.0776
		Whole Lake	0.1217	0.0459
Mid July	Alewife	North Basin	0.0367	0.0367
		South Basin	0	0
		Whole Lake	0.0183	0.0183
	Gizzard shad	North Basin	0.0445	0.0445
		South Basin	0	0
		Whole Lake	0.0222	0.0222
Early August	Gizzard shad	North Basin	0	0
		South Basin	0.0279	0.0279
		Whole Lake	0.0139	0.0139

Table A8-22. 2004 YOY CPUE (#/haul) for each species for the whole year from each stratum and the entire lake.

	Entire Lake		**Stratum 1**		**Stratum 2**		**Stratum 3**		**Stratum 4**		**Stratum 5**	
Species	**Mean CPUE**	**SE**	**Mean CPUE**	**SE**	**Mean CPUE**	**SE**	**Mean CPUE**	**SE**	**Mean CPUE**	**SE**	**Mean CPUE**	**SE**
Banded killifish	0.07	0.03	0.22	0.13					0.11	0.11		
Bluegill	0.32	0.32					1.61	1.61				
Carp	0.64	0.57	0.06	0.06	2.83	2.83	0.06	0.06	0.22	0.17	0.06	0.06
Gizzard shad	1.98	1.91			9.61	9.55			0.28	0.28		
Largemouth bass	6.87	1.71	4.17	1.36	0.61	0.41	9.17	6.25	15.33	5.03	5.06	1.55
Lepomis sp.	15.77	5.96	36.78	19.28			4.44	2.49	12.72	7.61	24.89	20.98
Longnose gar	0.01	0.01							0.06	0.06		
Pumpkinseed	0.03	0.02	0.06	0.06			0.06	0.06			0.06	0.06
Smallmouth bass	1.57	0.45	3.67	1.77	0.33	0.28	0.50	0.39	1.33	0.54	2.00	1.09
White perch	0.02	0.02	0.06	0.06							0.06	0.06
Total	**27.28**	**11.00**	**45.00**	**22.71**	**13.39**	**13.07**	**15.83**	**10.85**	**30.06**	**13.80**	**32.11**	**23.80**

Table A8-23(a-b). 2004 YOY Relative abundance for each species for the whole year from each stratum and the entire lake with and without clupeids

a) With Clupeids

Species	Entire Lake	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Stratum 5
Banded killifish	0.24%	0.24%	0.24%	0.24%	0.24%	0.24%
Bluegill	1.18%	1.18%	1.18%	1.18%	1.18%	1.18%
Carp	2.36%	2.36%	2.36%	2.36%	2.36%	2.36%
Gizzard shad	7.25%	7.25%	7.25%	7.25%	7.25%	7.25%
Largemouth bass	25.17%	25.17%	25.17%	25.17%	25.17%	25.17%
Lepomis sp.	57.80%	57.80%	57.80%	57.80%	57.80%	57.80%
Longnose gar	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%
Pumpkinseed	0.12%	0.12%	0.12%	0.12%	0.12%	0.12%
Smallmouth bass	5.74%	5.74%	5.74%	5.74%	5.74%	5.74%
White perch	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%

b) Without Clupeids

Species	Entire Lake	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Stratum 5
Banded killifish	0.26%	0.26%	0.26%	0.26%	0.26%	0.26%
Bluegill	1.27%	1.27%	1.27%	1.27%	1.27%	1.27%
Carp	2.55%	2.55%	2.55%	2.55%	2.55%	2.55%
Gizzard shad						
Largemouth bass	27.14%	27.14%	27.14%	27.14%	27.14%	27.14%
Lepomis sp.	62.32%	62.32%	62.32%	62.32%	62.32%	62.32%
Longnose gar	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%
Pumpkinseed	0.13%	0.13%	0.13%	0.13%	0.13%	0.13%
Smallmouth bass	6.19%	6.19%	6.19%	6.19%	6.19%	6.19%
White perch	0.09%	0.09%	0.09%	0.09%	0.09%	0.09%

Table A8-24. 2004 YOY CPUE (#/haul) for each species from each site for whole year.

Species	Stratum	Site	Mean CPUE	SE
Carp	Stratum 1	Site 1	0.17	0.17
Largemouth bass	Stratum 1	Site 1	3.67	2.17
Lepomis sp.	Stratum 1	Site 1	3.00	2.25
Smallmouth bass	Stratum 1	Site 1	8.17	4.78
White perch	Stratum 1	Site 1	0.17	0.17
Banded killifish	Stratum 1	Site 2	0.33	0.21
Largemouth bass	Stratum 1	Site 2	5.33	3.05
Lepomis sp.	Stratum 1	Site 2	89.50	52.24
Smallmouth bass	Stratum 1	Site 2	0.33	0.21
Banded killifish	Stratum 1	Site 3	0.33	0.33
Largemouth bass	Stratum 1	Site 3	3.50	2.13
Lepomis sp.	Stratum 1	Site 3	17.83	14.21
Smallmouth bass	Stratum 1	Site 3	2.50	1.59
Carp	Stratum 2	Site 1	8.50	8.50
Gizzard shad	Stratum 2	Site 1	28.67	28.67
Largemouth bass	Stratum 2	Site 1	0.67	0.42
Smallmouth bass	Stratum 2	Site 1	1.00	0.82
Largemouth bass	Stratum 2	Site 2	1.17	1.17
Gizzard shad	Stratum 2	Site 3	0.17	0.17
Largemouth bass	Stratum 3	Site 1	2.67	2.29
Lepomis sp.	Stratum 3	Site 1	0.67	0.67
Pumpkinseed	Stratum 3	Site 1	0.17	0.17
Smallmouth bass	Stratum 3	Site 1	0.17	0.17
Largemouth bass	Stratum 3	Site 2	5.83	4.90
Lepomis sp.	Stratum 3	Site 2	7.17	5.28
Smallmouth bass	Stratum 3	Site 2	0.17	0.17
Bluegill	Stratum 3	Site 3	4.83	4.83
Carp	Stratum 3	Site 3	0.17	0.17
Largemouth bass	Stratum 3	Site 3	19.00	18.41
Lepomis sp.	Stratum 3	Site 3	5.50	5.50
Smallmouth bass	Stratum 3	Site 3	1.17	1.17
Carp	Stratum 4	Site 1	0.17	0.17
Largemouth bass	Stratum 4	Site 1	22.83	10.97
Lepomis sp.	Stratum 4	Site 1	2.50	1.75
Smallmouth bass	Stratum 4	Site 1	1.17	0.54
Largemouth bass	Stratum 4	Site 2	5.33	4.36
Lepomis sp.	Stratum 4	Site 2	14.83	14.24
Longnose gar	Stratum 4	Site 2	0.17	0.17
Smallmouth bass	Stratum 4	Site 2	1.17	0.98
Banded killifish	Stratum 4	Site 3	0.33	0.33
Carp	Stratum 4	Site 3	0.50	0.50
Gizzard shad	Stratum 4	Site 3	0.83	0.83
Largemouth bass	Stratum 4	Site 3	17.83	9.30
Lepomis sp.	Stratum 4	Site 3	20.83	18.70
Smallmouth bass	Stratum 4	Site 3	1.67	1.28
Carp	Stratum 5	Site 1	0.17	0.17
Largemouth bass	Stratum 5	Site 1	6.00	3.12
Lepomis sp.	Stratum 5	Site 1	74.50	61.26
Pumpkinseed	Stratum 5	Site 1	0.17	0.17
Smallmouth bass	Stratum 5	Site 1	1.00	0.82
Largemouth bass	Stratum 5	Site 2	5.00	2.50
Smallmouth bass	Stratum 5	Site 2	4.83	3.00
Largemouth bass	Stratum 5	Site 3	4.17	2.88
Lepomis sp.	Stratum 5	Site 3	0.17	0.17
Smallmouth bass	Stratum 5	Site 3	0.17	0.17
White perch	Stratum 5	Site 3	0.17	0.17

Table A8-25. 2004 YOY CPUE (#/haul) in each stratum during each sampling event for each species.

Sample period	Species	Stratum	CPUE	SE
early July	Carp	Stratum 3	0.33	0.33
	Largemouth bass	Stratum 3	1.00	1.00
	Longnose gar	Stratum 4	0.33	0.33
	Smallmouth bass	Stratum 4	0.33	0.33
late July	Bluegill	Stratum 3	9.67	9.67
	Carp	Stratum 1	0.33	0.33
		Stratum 2	17.00	17.00
		Stratum 4	1.33	0.88
		Stratum 5	0.33	0.33
	Gizzard shad	Stratum 2	57.67	57.17
		Stratum 4	1.67	1.67
	Largemouth bass	Stratum 1	0.33	0.33
		Stratum 2	3.00	2.08
		Stratum 3	51.67	30.02
		Stratum 4	40.67	10.37
		Stratum 5	8.67	4.70
	Lepomis sp.	Stratum 3	21.67	10.84
		Stratum 4	32.67	26.77
		Stratum 5	1.67	1.67
	Smallmouth bass	Stratum 1	1.33	0.88
		Stratum 2	1.67	1.67
		Stratum 3	2.67	2.19
		Stratum 4	5.67	1.45
		Stratum 5	0.67	0.33
August	Banded killifish	Stratum 1	0.67	0.67
	Largemouth bass	Stratum 1	13.33	2.40
		Stratum 4	29.00	15.31
		Stratum 5	9.67	2.91
	Lepomis sp.	Stratum 1	36.00	25.58
		Stratum 4	42.67	35.74
		Stratum 5	18.33	17.84
	Smallmouth bass	Stratum 1	11.00	7.77
		Stratum 4	1.33	0.33
		Stratum 5	4.00	3.51
	White perch	Stratum 5	0.33	0.33
September	Banded killifish	Stratum 4	0.67	0.67
	Largemouth bass	Stratum 1	10.00	1.00
		Stratum 2	0.67	0.67
		Stratum 3	2.33	1.45
		Stratum 4	22.33	12.60
		Stratum 5	10.67	5.21
	Lepomis sp.	Stratum 1	18.67	8.69
		Stratum 3	5.00	3.21
		Stratum 4	1.00	0.58
		Stratum 5	126.00	126.00
	Smallmouth bass	Stratum 1	9.67	5.55
		Stratum 2	0.33	0.33
		Stratum 3	0.33	0.33
		Stratum 4	0.67	0.67
		Stratum 5	7.33	5.04
	White perch	Stratum 1	0.33	0.33
early October	Banded killifish	Stratum 1	0.33	0.33
	Largemouth bass	Stratum 1	1.00	0.58
		Stratum 5	1.00	0.58
	Lepomis sp.	Stratum 1	100.33	99.83
		Stratum 5	1.67	1.67
late October	Banded killifish	Stratum 1	0.33	0.33
	Largemouth bass	Stratum 1	0.33	0.33
		Stratum 5	0.33	0.33
	Lepomis sp.	Stratum 1	65.67	65.67
		Stratum 5	1.67	1.67
	Pumpkinseed	Stratum 3	0.33	0.33
		Stratum 5	0.33	0.33

Table A8-26. CPUE (#/haul) for whole year and entire lake in 2004 of incidental catch of non-YOY species.

Species	Mean CPUE	SE
Banded killifish	19.10	10.82
Bluegill	0.30	0.14
Pumpkinseed	0.28	0.07
Golden shiner	0.18	0.12
Largemouth bass	0.13	0.05
Fathead minnow	0.10	0.10
Smallmouth bass	0.10	0.05
Tesselated darter	0.07	0.03
Bluntnose minnow	0.04	0.03
Johnny darter	0.02	0.02
White perch	0.02	0.02
Freshwater drum	0.01	0.01
Lepomis sp.	0.01	0.01
Yellow perch	0.01	0.01

Table A8-27 (a-d). Mean length of YOY fish for each stratum and whole lake by sample period in 2004.

a) By stratum and sampling period

Sample period	Stratum	Species	Mean total length (mm)	SE	N
early July	Stratum 3	Carp	34.00	NA	1
		Largemouth bass	39.00	6.03	3
	Stratum 4	Longnose gar	78.00	NA	1
		Smallmouth bass	34.00	NA	1
late July	Stratum 1	Carp	60.00	NA	1
		Largemouth bass	52.00	NA	1
		Smallmouth bass	52.25	1.55	4
	Stratum 2	Carp	67.12	1.11	51
		Gizzard shad	71.06	1.68	31
		Largemouth bass	55.33	2.01	9
		Smallmouth bass	66.20	0.97	5
	Stratum 3	Largemouth bass	57.01	0.92	76
		Lepomis sp.	35.26	0.20	65
		Smallmouth bass	56.25	1.69	8
	Stratum 4	Carp	46.00	6.72	4
		Gizzard shad	48.00	3.08	5
		Largemouth bass	51.16	0.75	122
		Lepomis sp.	32.98	0.27	42
		Smallmouth bass	50.44	1.87	16
	Stratum 5	Carp	68.00	NA	1
		Largemouth bass	54.65	1.15	26
		Lepomis sp.	23.00	1.00	5
		Smallmouth bass	50.50	0.50	2
August	Stratum 1	Banded killifish	66.00	5.00	2
		Largemouth bass	65.45	1.80	40
		Lepomis sp.	41.83	0.56	52
		Smallmouth bass	71.48	1.80	33
	Stratum 4	Largemouth bass	67.49	1.40	63
		Lepomis sp.	38.57	0.54	44
		Smallmouth bass	72.00	3.89	4
	Stratum 5	Largemouth bass	69.38	2.24	29
		Lepomis sp.	40.19	0.79	32
		Smallmouth bass	74.17	1.72	12
		White perch	53.00	NA	1
September	Stratum 1	Largemouth bass	69.83	2.86	30
		Lepomis sp.	45.23	0.59	56
		Smallmouth bass	82.36	1.97	28
		White perch	75.00	NA	1
	Stratum 2	Largemouth bass	85.00	0.00	2
		Smallmouth bass	87.00	NA	1
	Stratum 3	Largemouth bass	72.71	3.30	7
		Lepomis sp.	49.13	1.37	15
		Smallmouth bass	105.00	NA	1
	Stratum 4	Banded killifish	68.00	NA	1
		Largemouth bass	87.19	1.94	67
		Lepomis sp.	47.67	0.88	3
		Smallmouth bass	81.67	6.64	3
	Stratum 5	Largemouth bass	77.81	1.73	32
		Lepomis sp.	48.30	1.14	30
		Smallmouth bass	85.05	1.73	22
early October	Stratum 1	Banded killifish	38.00	NA	1
		Largemouth bass	73.25	1.80	4
		Lepomis sp.	47.32	0.97	31
	Stratum 5	Largemouth bass	102.75	9.78	4
		Lepomis sp.	46.20	1.24	5
late October	Stratum 1	Banded killifish	39.00	NA	1
		Largemouth bass	67.00	NA	1
		Lepomis sp.	42.13	0.65	30
	Stratum 3	Pumpkinseed	65.00	NA	1
	Stratum 5	Largemouth bass	71.00	NA	1
		Lepomis sp.	39.80	3.12	5
		Pumpkinseed	57.00	NA	1

Table A8-27 (a-d) Cont.. Mean length of YOY fish for each stratum and whole lake by sample period in 2004.

b) Whole Lake by sampling period

Sample period	Species	Mean total length (mm)	SE	N
early July	Carp	34.00	NA	1
early July	Largemouth bass	39.00	6.03	3
early July	Longnose gar	78.00	NA	1
early July	Smallmouth bass	34.00	NA	1
late July	Carp	65.53	1.30	57
late July	Gizzard shad	67.86	2.01	36
late July	Largemouth bass	53.62	0.54	234
late July	Lepomis sp.	33.86	0.29	112
late July	Smallmouth bass	54.23	1.32	35
August	Banded killifish	66.00	5.00	2
August	Largemouth bass	67.29	0.99	132
August	Lepomis sp.	40.30	0.37	128
August	Smallmouth bass	72.18	1.31	49
August	White perch	53.00	NA	1
September	Banded killifish	68.00	NA	1
September	Largemouth bass	80.48	1.35	138
September	Lepomis sp.	46.75	0.52	104
September	Smallmouth bass	83.89	1.32	55
September	White perch	75.00	NA	1
early October	Banded killifish	38.00	NA	1
early October	Largemouth bass	88.00	7.23	8
early October	Lepomis sp.	47.17	0.85	36
late October	Banded killifish	39.00	NA	1
late October	Largemouth bass	69.00	2.00	2
late October	Lepomis sp.	41.80	0.70	35
late October	Pumpkinseed	61.00	4.00	2

c) Whole lake entire year

Species	Mean length (mm)	SE	N
Banded killifish	55.40	7.09	5
Carp	64.98	1.39	58
Gizzard shad	67.86	2.01	36
Largemouth bass	64.78	0.73	517
Lepomis sp.	40.90	0.33	415
Longnose gar	78.00	NA	1
Pumpkinseed	61.00	4.00	2
Smallmouth bass	72.02	1.27	140
White perch	64.00	11.00	2

Table A8-27 (a-d) Cont.. Mean length of YOY fish for each stratum and whole lake by sample period in 2004.

d) Whole year by stratum

Stratum	Species	Mean total length (mm)	SE	N
Stratum1	Banded killifish	52.25	8.20	4
	Carp	60.00	NA	1
	Largemouth bass	67.43	1.50	76
	Lepomis sp.	44.02	0.37	169
	Smallmouth bass	74.98	1.58	65
	White perch	75.00	NA	1
Stratum2	Carp	67.12	1.11	51
	Gizzard shad	71.06	1.68	31
	Largemouth bass	60.73	3.97	11
	Smallmouth bass	69.67	3.56	6
Stratum3	Carp	34.00	NA	1
	Largemouth bass	57.66	1.06	86
	Lepomis sp.	37.86	0.68	80
	Pumpkinseed	65.00	NA	1
	Smallmouth bass	61.67	5.62	9
Stratum4	Banded killifish	68.00	NA	1
	Carp	46.00	6.72	4
	Gizzard shad	48.00	3.08	5
	Largemouth bass	64.83	1.19	252
	Lepomis sp.	36.24	0.48	89
	Longnose gar	78.00	NA	1
	Smallmouth bass	57.25	3.08	24
Stratum5	Carp	68.00	NA	1
	Largemouth bass	69.62	1.60	92
	Lepomis sp.	42.60	0.94	77
	Pumpkinseed	57.00	NA	1
	Smallmouth bass	79.50	1.89	36
	White perch	53.00	NA	1

Table A8-28. YOY mean length in August in each stratum and the entire lake in 2004.

Species	Stratum	Mean total length (mm)	SE	N
Banded killifish	Stratum 1	66.00	5.00	2
	Whole Lake	66.00	5.00	2
Largemouth bass	Stratum 1	65.45	1.80	40
	Stratum 4	67.49	1.40	63
	Stratum 5	69.38	2.24	29
	Whole Lake	67.29	0.99	132
Lepomis sp.	Stratum 1	41.83	0.56	52
	Stratum 4	38.57	0.54	44
	Stratum 5	40.19	0.79	32
	Whole Lake	40.30	0.37	128
Smallmouth bass	Stratum 1	71.48	1.80	33
	Stratum 4	72.00	3.89	4
	Stratum 5	74.17	1.72	12
	Whole Lake	72.18	1.31	49
White perch	Stratum 5	53.00	-	1
	Whole Lake	53.00	-	1

Table A8-29. Growth rates of YOY in 2004 between all sampling periods.

Species	Stratum	Time period	Growth rate (ln(Wt/Wo))	N
Largemouth bass	Whole Lake	early July to late October	0.57	5
Largemouth bass	Stratum1	late July to August	0.23	41
Largemouth bass	Stratum4	late July to August	0.28	185
Largemouth bass	Stratum5	late July to August	0.24	55
Largemouth bass	Whole Lake	late July to August	0.23	366
Lepomis sp.	Stratum4	late July to August	0.16	86
Lepomis sp.	Stratum5	late July to August	0.56	37
Lepomis sp.	Whole Lake	late July to August	0.17	240
Smallmouth bass	Stratum1	late July to August	0.31	37
Smallmouth bass	Stratum4	late July to August	0.36	20
Smallmouth bass	Stratum5	late July to August	0.38	14
Smallmouth bass	Whole Lake	late July to August	0.29	84
Largemouth bass	Stratum1	late July to September	0.29	31
Largemouth bass	Stratum2	late July to September	0.43	11
Largemouth bass	Stratum3	late July to September	0.24	83
Largemouth bass	Stratum4	late July to September	0.53	189
Largemouth bass	Stratum5	late July to September	0.35	58
Largemouth bass	Whole Lake	late July to September	0.41	372
Lepomis sp.	Stratum3	late July to September	0.33	80
Lepomis sp.	Stratum4	late July to September	0.37	45
Lepomis sp.	Stratum5	late July to September	0.74	35
Lepomis sp.	Whole Lake	late July to September	0.32	216
Smallmouth bass	Stratum1	late July to September	0.46	32
Smallmouth bass	Stratum2	late July to September	0.27	6
Smallmouth bass	Stratum3	late July to September	0.62	9
Smallmouth bass	Stratum4	late July to September	0.48	19
Smallmouth bass	Stratum5	late July to September	0.52	24
Smallmouth bass	Whole Lake	late July to September	0.44	90
Largemouth bass	Stratum1	late July to early October	0.34	5
Largemouth bass	Stratum5	late July to early October	0.63	30
Largemouth bass	Whole Lake	late July to early October	0.50	242
Lepomis sp.	Stratum5	late July to early October	0.70	10
Lepomis sp.	Whole Lake	late July to early October	0.33	148
Largemouth bass	Stratum1	late July to late October	0.25	2
Largemouth bass	Stratum5	late July to late October	0.26	27
Largemouth bass	Whole Lake	late July to late October	0.25	236
Lepomis sp.	Stratum5	late July to late October	0.55	10
Lepomis sp.	Whole Lake	late July to late October	0.21	147
Banded killifish	Whole Lake	August to September	0.03	3
Largemouth bass	Stratum1	August to September	0.06	70
Largemouth bass	Stratum4	August to September	0.26	130
Largemouth bass	Stratum5	August to September	0.11	61
Largemouth bass	Whole Lake	August to September	0.18	270
Lepomis sp.	Stratum1	August to September	0.08	108
Lepomis sp.	Stratum4	August to September	0.21	47
Lepomis sp.	Stratum5	August to September	0.18	62
Lepomis sp.	Whole Lake	August to September	0.15	232
Smallmouth bass	Stratum1	August to September	0.14	61
Smallmouth bass	Stratum4	August to September	0.13	7
Smallmouth bass	Stratum5	August to September	0.14	34
Smallmouth bass	Whole Lake	August to September	0.15	104
White perch	Whole Lake	August to September	0.35	2

Table A8-29 (continued). Growth rates of YOY in 2004 between all sampling periods.

Species Stratum Time period Growth rate (ln(Wt/Wo)) N

Species	Stratum	Time period	Growth rate (ln(Wt/Wo))	N
Banded killifish	Stratum1	August to early October	-0.55	3
Banded killifish	Whole Lake	August to early October	-0.55	3
Largemouth bass	Stratum1	August to early October	0.11	44
Largemouth bass	Stratum5	August to early October	0.39	33
Largemouth bass	Whole Lake	August to early October	0.27	140
Lepomis sp.	Stratum1	August to early October	0.12	83
Lepomis sp.	Stratum5	August to early October	0.14	37
Lepomis sp.	Whole Lake	August to early October	0.16	164
Banded killifish	Stratum1	August to late October	-0.53	3
Banded killifish	Whole Lake	August to late October	-0.53	3
Largemouth bass	Stratum1	August to late October	0.02	41
Largemouth bass	Stratum5	August to late October	0.02	30
Largemouth bass	Whole Lake	August to late October	0.03	134
Lepomis sp.	Stratum1	August to late October	0.01	82
Lepomis sp.	Stratum5	August to late October	-0.01	37
Lepomis sp.	Whole Lake	August to late October	0.04	163
Banded killifish	Whole Lake	September to early October	-0.58	2
Largemouth bass	Stratum1	September to early October	0.05	34
Largemouth bass	Stratum5	September to early October	0.28	36
Largemouth bass	Whole Lake	September to early October	0.09	146
Lepomis sp.	Stratum1	September to early October	0.05	87
Lepomis sp.	Stratum5	September to early October	-0.04	35
Lepomis sp.	Whole Lake	September to early October	0.01	140
Banded killifish	Whole Lake	September to late October	-0.56	2
Largemouth bass	Stratum1	September to late October	-0.04	31
Largemouth bass	Stratum5	September to late October	-0.09	33
Largemouth bass	Whole Lake	September to late October	-0.15	140
Lepomis sp.	Stratum1	September to late October	-0.07	86
Lepomis sp.	Stratum5	September to late October	-0.19	35
Lepomis sp.	Whole Lake	September to late October	-0.11	139
Banded killifish	Stratum1	early October to late October	0.03	2
Banded killifish	Whole Lake	early October to late October	0.03	2
Largemouth bass	Stratum1	early October to late October	-0.09	5
Largemouth bass	Stratum5	early October to late October	-0.37	5
Largemouth bass	Whole Lake	early October to late October	-0.24	10
Lepomis sp.	Stratum1	early October to late October	-0.12	61
Lepomis sp.	Stratum5	early October to late October	-0.15	10
Lepomis sp.	Whole Lake	early October to late October	-0.12	71

Table A8-30. YOY relative weight of bass.

a) 2004 YOY Relative weight

Stratum	Sample perio	Species	Relative weight	SE	N
Stratum3	early July	Largemouth bass	147.58	10.56	3
Stratum4	early July	Smallmouth bass	160.85	NA	1
Stratum1	late July	Largemouth bass	103.83	NA	1
Stratum2	late July	Largemouth bass	107.46	3.75	9
Stratum3	late July	Largemouth bass	108.04	2.49	76
Stratum4	late July	Largemouth bass	125.06	1.77	122
Stratum5	late July	Largemouth bass	115.14	2.09	26
Stratum1	late July	Smallmouth bass	121.64	4.51	4
Stratum2	late July	Smallmouth bass	111.02	1.52	5
Stratum3	late July	Smallmouth bass	136.83	3.39	8
Stratum4	late July	Smallmouth bass	137.97	3.27	16
Stratum5	late July	Smallmouth bass	117.60	15.06	2
Stratum1	August	Largemouth bass	110.17	4.58	40
Stratum4	August	Largemouth bass	117.79	2.78	63
Stratum5	August	Largemouth bass	117.59	2.07	29
Stratum1	August	Smallmouth bass	112.59	7.68	33
Stratum4	August	Smallmouth bass	137.72	10.31	4
Stratum5	August	Smallmouth bass	122.48	2.46	12
Stratum1	September	Largemouth bass	122.30	2.68	30
Stratum2	September	Largemouth bass	111.10	4.33	2
Stratum3	September	Largemouth bass	116.06	1.94	7
Stratum4	September	Largemouth bass	104.31	4.87	67
Stratum5	September	Largemouth bass	116.74	2.06	32
Stratum1	September	Smallmouth bass	126.55	2.25	28
Stratum2	September	Smallmouth bass	120.66	NA	1
Stratum3	September	Smallmouth bass	118.41	NA	1
Stratum4	September	Smallmouth bass	92.52	46.38	3
Stratum5	September	Smallmouth bass	123.87	2.43	22
Stratum1	early Octobe	Largemouth bass	110.23	3.29	4
Stratum5	early Octobe	Largemouth bass	105.41	5.43	4
Stratum1	late October	Largemouth bass	114.08	NA	1
Stratum5	late October	Largemouth bass	120.43	NA	1
Whole Lake	early July	Largemouth bass	147.58	10.56	3
Whole Lake	early July	Smallmouth bass	160.85	NA	1
Whole Lake	late July	Largemouth bass	117.66	1.36	234
Whole Lake	late July	Smallmouth bass	130.83	2.55	35
Whole Lake	August	Largemouth bass	115.43	1.98	132
Whole Lake	August	Smallmouth bass	117.06	5.34	49
Whole Lake	September	Largemouth bass	111.79	2.55	138
Whole Lake	September	Smallmouth bass	123.37	2.76	55
Whole Lake	early Octobe	Largemouth bass	107.82	3.08	8
Whole Lake	late October	Largemouth bass	117.25	3.18	2

Table A8-31. Shannon-Weiner index for YOY fish in 2004 with and without clupeids

Diversity

Stratum	With Clupeids H'	Without Clupeids H'
Stratum 1	0.30	0.30
Stratum 2	0.02	0.02
Stratum 3	0.64	0.64
Stratum 4	0.03	0.03
Stratum 5	0.81	0.81
Whole Lake	0.15	0.15

Table A8-32(a-c). Reproductive guilds based on abundance of YOY taxa in 2003, with and without clupeids.

a) Reproductive guild CPUE for the entire lake and each stratum in 2004

Repro Guild	Entire Lake	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Stratum 5
Guarder, nest spawner, speleophil,	0.00	0.00	0.00	0.00	0.00	0.00
Nonguarder, open substrate spawner, phyto-lithophil	0.02	0.06	0.00	0.00	0.00	0.06
Guarder, nest spawner, lithophil	17.69	40.50	0.33	6.61	14.06	26.94
Nonguarder, open substrate spawner, phytophil	0.72	0.28	2.83	0.06	0.39	0.06
Guarder, nest spawner, phytophil	6.87	4.17	0.61	9.17	15.33	5.06
Nonguarder, open substrate spawner, lithophil	0.00	0.00	0.00	0.00	0.00	0.00
Nonguarder, open substrate spawner, litho-pelagophil	1.98	0.00	9.61	0.00	0.28	0.00
Nonguarder, open substrate spawner, pelagophil	0.00	0.00	0.00	0.00	0.00	0.00
Nonguarder, open substrate spawner, psammophil	0.00	0.00	0.00	0.00	0.00	0.00
Total	27.28	45.00	13.39	15.83	30.06	32.11

b) Reproductive guild relative abundance for the entire lake and each stratum in 2004 with clupeids

Repro Guild	Entire Lake	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Stratum 5
Guarder, nest spawner, speleophil,	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, phyto-lithophil	0.08%	0.12%	0.00%	0.00%	0.00%	0.17%
Guarder, nest spawner, lithophil	64.85%	90.00%	2.49%	41.75%	46.77%	83.91%
Nonguarder, open substrate spawner, phytophil	2.65%	0.62%	21.16%	0.35%	1.29%	0.17%
Guarder, nest spawner, phytophil	25.17%	9.26%	4.56%	57.89%	51.02%	15.74%
Nonguarder, open substrate spawner, lithophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, litho-pelagophil	7.25%	0.00%	71.78%	0.00%	0.92%	0.00%
Nonguarder, open substrate spawner, pelagophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, psammophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

* note relative abundance of repro guilds based on CPUE of YOY data

c) Reproductive guild relative abundance for the entire lake and each stratum in 2004 without clupeids

Repro Guild	Entire Lake	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Stratum 5
Guarder, nest spawner, speleophil,	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, phyto-lithophil	0.09%	0.12%	0.00%	0.00%	0.00%	0.17%
Guarder, nest spawner, lithophil	69.92%	90.00%	8.82%	41.75%	47.20%	83.91%
Nonguarder, open substrate spawner, phytophil	2.85%	0.62%	75.00%	0.35%	1.31%	0.17%
Guarder, nest spawner, phytophil	27.14%	9.26%	16.18%	57.89%	51.49%	15.74%
Nonguarder, open substrate spawner, lithophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, litho-pelagophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, pelagophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nonguarder, open substrate spawner, psammophil	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table A8-33. Presence/Absence of Early Life History Stages and Adults in 2004.

	Species	Life Stages Present
1	Bluegill	L/Y/A
2	Brook silverside	L/Y/A
3	Gizzard shad	L/Y/A
4	Pumpkinseed	L/Y/A
5	Alewife	L/A
6	Banded killifish	Y/A
7	Bluntnose minnow	Y/A
8	Carp	Y/A
9	Fathead minow	Y/A
10	Golden shiner	Y/A
11	Johnny darter	Y/A
12	Largemouth bass	Y/A
13	Logperch	Y/A
14	Smallmouth bass	Y/A
15	Tessellated darter	Y/A
16	White perch	Y/A
17	Longnose gar	Y
18	Yellow perch	A
19	Black crappie	A
20	Brown bullhead	A
21	Brown trout	A
22	Bowfin	A
23	Channel catfish	A
24	Lake sturgeon	A
25	Freshwater drum	A
26	Northern pike	A
27	Rock bass	A
28	Shorthead redhorse	A
29	Tiger muskellunge	A
30	Walleye	A
31	White sucker	A

A= Adult stage present, L= Larvae present (captured during larvae sampling), Y= YOY present (captured during YOY seining).

Table A8-34(a-c). Presence/absence and CPUE of larval and YOY fishes in samples collected from Onondaga Lake from 2000-2004. Shaded cells indicate presence.

a) Larvae Seines (# per seine haul). Note littoral sampling for larval fish was discontinued after 2003.

	Species	2000	2001	2002	2003
1	Alewife	0.03			0.01
2	Banded killifish	0.06		0.27	0.45
3	Brook silverside	16.9	3.8	43.6	2.8
4	Carp	1.1	15.8	1.9	18.9
5	Crappie sp.	0.01			0.01
6	Fathead minnow	0.10			
7	Freshwater drum	0.58		<0.01	
8	Gizzard shad	0.36		0.02	
9	Golden shiner	0.93	0.1	0.45	0.47
10	Johnny darter	<0.01	0.1		
11	Largemouth bass	0.01		<0.01	
12	Lepomis[1]	17.22	3.2	36.2	45.3
13	Logperch	0.02			
14	Longnose dace	<0.01			
15	Shorthead redhorse	<0.01			
16	Tessellated darter	<0.01			
17	Trout perch			0.03	
18	White perch	0.19		<0.01	
19	White sucker	1.4	3.7		
20	Yellow perch	0.66	0.5	0.20	1.8
	Richness [2]	**20**	**8**	**12**	**9**

1 *Lepomis* are likely a combination of both bluegill and pumpkinseed.
2 Richness assumes *Lepomis* is composed both bluegill and pumpkinseed

b) Larvae Trawls (#/ m^3)

	Species	2000	2001	2002	2003	2004
1	Alewife					0.0041
2	Brook silverside					0.002
3	Carp			0.005		
4	Freshwater drum	0.31	0.01	0.031		
5	Gizzard shad	2.47[2]	0.49	0.85	0.059	0.0271
6	Lepomis[1]	0.382	0.01	0.344	0.095	0.0019
7	Logperch	<0.01				
8	White perch	0.027	0.04	0.048		
9	White sucker		0.07			
10	Yellow perch		0.14	0.019		
	Richness [3]	**6**	**7**	**7**	**3**	**5**

1 *Lepomis* are considered a combination of both bluegill and pumpkinseed.
2 Gizzard shad cpue in 2000 trawls is a combination of gizzard shad (0.017) and herring family (2.46).
3 Richness assumes *Lepomis* is composed both bluegill and pumpkinseed
Note: trawls in 2000 were done at night. Trawls in 2001 and 2002 were done during the day.

c) Young-of-the-Year (# per seine haul)

	Species	2000	2001	2002	2003	2004
1	Banded killifish*	▨	▨	▨	▨	0.07
2	Bluntnose minnow*		▨	▨	▨	▨
3	Brook silverside*	▨	▨	▨	▨	
4	Brook stickleback*		▨			
5	Brown bullhead		0.03	0.02	0.03	
6	Carp	0.02	0.03	0.48	0.63	0.64
7	Channel catfish			0.02		
8	Emerald shiner*		▨	▨	▨	
9	Fathead minnow*					▨
10	Gizzard shad	70.3	26.1	0.03	2.7	1.98
11	Golden shiner*	▨	▨		▨	▨
12	Johnny darter*		▨	▨		▨
13	Largemouth bass	1.5	4.3	5.0	1.9	6.87
14	Lepomis[1]	25.2	92.4	157.0	42.2	16.12
15	Logperch*	▨			▨	
16	Longnose gar	0.02				0.01
17	Northern hogsucker	0.02				
18	Smallmouth bass	2.7	3.3	1.1	0.7	1.57
19	Tessellated darter*		▨	▨	▨	▨
20	White perch	2.6	0.60	0.13	0.12	0.02
21	White sucker	0.06	0.15	0.02		
21	Yellow perch		5.6	0.03		
	Richness [2]	**14**	**18**	**17**	**15**	**14**

1 Lepomis are considered a combination of both bluegill and pumpkinseed.
2 Richness assumes Lepomis is composed both bluegill and pumpkinseed
* denotes species that are difficult to distinguish in the YOY stage due to their small size as adults. These species are assumed to be present as YOY if captured in littoral seines, but a CPUE is not included because the catch may include both YOY and adults.

Table A8-35(a-b). 2004 Angler Diary Summary.

a) Number of hours fished by section in 2004

Zone	Location	Total hours
1	Onondaga Lake	274.4
2	Seneca River Upstream	42.8
3	Seneca River Downstrean	144.1
4	Oneida River	120.1
	Total	461.4

b) Catch-per-unit-effort of fish species by zone in 2004.

Zone	Species	Total	CPUE
1	Channel Catfish	4	0.015
1	Largemouth Bass	63	0.230
1	Other	16	0.058
1	Pumpkinseed/Bluegill	22	0.080
1	Smallmouth Bass	201	0.733
1	Yellow Perch	12	0.044
1	All	318	1.159
2	Channel Catfish	4	0.093
2	Largemouth Bass	17	0.397
2	Other	15	0.350
2	Pumpkinseed/Bluegill	10	0.233
2	Smallmouth Bass	53	1.237
2	Walleye	2	0.047
2	Yellow Perch	1	0.023
2	All	102	2.381
3	Channel Catfish	2	0.014
3	Largemouth Bass	36	0.25
3	Other	23	0.16
3	Pumpkinseed/Bluegill	1	0.007
3	Smallmouth Bass	283	1.963
3	Yellow Perch	4	0.028
3	All	349	2.421
4	Largemouth Bass	91	0.758
4	Other	17	0.142
4	Pumpkinseed/Bluegill	4	0.033
4	Smallmouth Bass	179	1.491
4	Walleye	9	0.075
4	All	300	2.499

Table A-36(a-g). Length (mm) at age for smallmouth bass in 1991-1993 and 2000-2004.

a) Length (mm) at age in 1991 (Gandino 1996)

Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 9
196	256	225	320	380	451	428
256	302	294	332	321	382	479
245	245	306	355	347	376	
209	278	324	311	344	415	
198	272	320	328	369	385	
208	239	315	238	311	405	
146	266	326	359	331	375	
157	267	319	306	363	340	
165	279	275	320	352		
141	288	292	330	406		
166	200	305	257	337		
169	201	255	328	344		
170	211	246	322	390		
172	209	316	307			
179	295	270	310			
170	257	254	326			
188	237	213	343			
193	200	316	346			
195	200	305	320			
	237	277	335			
	195	312				
	210	278				
	239	315				
	265	325				
	225	320				
	261	283				
	285	286				
	266	285				
	249	325				
	246	295				
	210	312				
	214	304				
	194	312				
	176	311				
		300				

b) Length (mm) at age in 1992 (Gandino 1996)

Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9
206	293	220	355	385	396	414
217	351	342	272	371	343	381
	276	335	351	360	409	384
	250	328	356	332	358	407
	306	330	363	333	405	431
	288	298	351	368	398	
		325	344	393	382	
		263	338			
		326	355			
		285	346			
		278	314			
		320	348			
		299	353			
		321				
		350				
		302				
		345				
		295				

c) Length (mm) at age in 1994 (Gandino 1996)

Age 2	Age 3	Age 4	Age 5	Age 6	Age7	Age 8	Age 9
181	274	320	335	336	395	395	433
190	257	270	350	341	367	395	397
235	235	273	328	401	386	375	403
178	257	275	291	373	382	372	455
206	235	302	336	359	390	380	
	213	275	322	321	392	400	
	317	297	319	325	378		
	256	300	331	349	366		
	267	201	343	331	258		
		312	231	349	393		
		290	243	320	352		
		308	321	341	353		
		273	323	347	374		
			320	361	365		
			330	358	380		
			350	365	388		
					390		

Table A-36(a-g) cont'd. Length (mm) at age for smallmouth bass in 1991-1993 and 2000-2004.

d) Length (mm) at age in 2000 (AMP)							
Age 1	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**	**Age 8**
148	191	230	268	317	372	370	400
181	194	247	288	326			400
186	195	252	291				407
190	198	258	315				416
189	203						416
	203						
	206						
	215						
	219						
	225						

e) Length (mm) at age in 2001 (AMP)							
Age 1	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**	**Age 8**
203	219	240	281	311	342	362	395
185	220	240	286	312	358	362	398
174	225	240	290	316		367	403
203	233	247	292	319		369	
193		260	299	321		370	
198		265	304	322			
		268		325			
		269		336			
		272		337			
		274		337			
		274					

Table A8-37(a-d). Length (mm) at age for largemouth bass in 1993 and 2000-2003.

c) Length (mm) at age in 1994 (Gandino 1996)

Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age >10
142	205	201	306	340	348	365	390	407	415
144	222	232	308	344	348	380	391		475
163	229	246	311	349	362	394	394		
166	236	273	315	359	362	395	409		
170	250	300	316	366	365	399	414		
178	251	305	317	373	366	405	436		
182	252	322	320	377	372	455			
184	259	324	326		378				
191	265		328		378				
192	268				383				
	270				390				
	283								
	285								
	331								

b) Length (mm) at age in 2000 (AMP)

Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9
181	181	234	274	307	350	380	395	410
204	182	238	275	328	360	385	399	410
182	187	244	275	329	365	386	412	410
130	192	249	285	330	368	387	412	411
	192	254	297	330	372	390	414	415
	195	258	300	330	380	390	418	416
	196	258	300	338	382	390		422
	198	266	305	340	384	392		422
	203	269	310	342	387			428
	204		313	343				431
	206		314	345				472
	206		320	345				
	210		325	354				
	210		332	356				
	212		335	360				
	212		358					
	216							
	216							
	220							
	220							
	220							
	220							
	223							
	224							
	225							
	226							
	230							
	230							
	230							
	230							
	232							
	235							
	235							
	235							
	235							
	238							
	240							
	240							
	241							
	245							
	247							

Table A8-37(a-d) cont'd. Length (mm) at age for largemouth bass in 1993 and 2000-2003.

c) Length (mm) at age in 2001 (AMP)

Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age >10
201	201	275	288	309	331	370	389	420	420	443
	222	277	292	315	334	375	392		426	446
			295	318	336	382	394		432	459
			297	318	337	396	402		437	460
			298	321	340	400	404			483
			302	321	344	411	411			
			307	322	347		412			
				325	354					
					368					
					369					

c) Length (mm) at age in 2002 (AMP)

Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age >10
145	189	220	296	296	341	368	366	472		417
147	190	232	240	304	338	358		461		449
148	191	238	299	312	350	390				
150	192	240	304	315	343	373				
150	193	241		321	356					
151	197	241		328						
152	197	242		330						
152	200	243								
154	202	247								
156	202	247								
172	202	251								
178	207	252								
180	208	256								
186	209	257								
194	213	258								
195	216									
196	216									
	216									
	217									
	217									
	217									
	217									
	218									
	221									
	222									
	222									
	223									
	224									
	226									
	227									
	227									
	228									
	232									
	237									
	243									
	243									
	246									
	247									
	248									
	253									

Table A8-37(a-d) cont'd. Length (mm) at age for largemouth bass in 1993 and 2000-2003.

d) Length (mm) at age in 2003 (AMP)										
Age 1	**Age 2**	**Age 3**	**Age 4**	**Age 5**	**Age 6**	**Age 7**	**Age 8**	**Age 9**	**Age 10**	**Age >10**
119	196	215	262	290	350	356	382	438	400	400
122	209	221	273	291	320	392	383		405	412
128	209	225	274	292	345	367	382			410
129	209	227	275	300	312	369	378			403
130	212	228	280	301	325	361				403
131	219	230	285	302		362				
132	226	232	290	303						
133	229	234	304	308						
135	229	241		308						
138	230	242		309						
139	235	243		309						
139		244		310						
140		245		313						
143		245		321						
147		248		325						
150		251		329						
151		252		336						
155		252								
161		253								
142		254								
		257								
		257								
		267								
		288								
		292								

TABLE A8-38. Comparison of catch rates in electrofishing transects 13-19 in June and July 2004

Species	Mean CPUE June Transects 13-19 Only	Mean CPUE July Transects 13-19 Only	Two Tailed P value
Alewife	6890	4342	0.38
White perch	186	104	0.08
Pumpkinseed	62	61	0.95
Bluegill	18	26	0.51
White sucker	14	26	0.33
Gizzard shad	3	24	0.45
Yellow perch	44	24	0.10
Largemouth bass	15	15	1.00
Smallmouth bass	7	11	0.29
Carp	9.2	9.7	0.94
Freshwater drum	0.0	6.3	0.10
Channel catfish	0.0	1.7	0.08
Brown bullhead	5.6	1.7	0.14
Shorthead redhorse	3.2	1.0	0.38
Black crappie	0.5	0.5	0.99
Golden shiner	1.1	0	0.39
Bowfin	2.0	0.0	0.18
Banded killifish	0.8	0.0	0.39
Walleye	0.6	0.0	0.35

APPENDIX 9:
Data Analysis and Interpretation Plan

APPENDIX 9

DATA ANALYSIS AND INTERPRETATION PLAN
ONONDAGA LAKE AND WATERSHED
AMBIENT MONITORING PROGRAM

Onondaga County Department of Water Environment Protection
650 Hiawatha Boulevard West
Syracuse, New York 13204-1194

Version 2.3
October 2005

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A9-1 Objective of the Data Analysis and Interpretation Plan

Each year Onondaga County Department of Water Environment Protection (OCDWEP) collects and analyzes more than 20,000 water quality samples and hundreds of biological samples collected from Onondaga Lake and its watershed. Results are used to evaluate water quality conditions and assess whether the waters are in compliance with applicable standards, criteria, and guidance values. The biological samples are used to evaluate the nature of the biological community and assess change.

This Data Analysis and Interpretation Plan (DAIP) was prepared to guide program managers and advisors regarding how these thousands of measurements will be analyzed and interpreted. It is a roadmap of how data become information (refer to Figure 1-1 in the 2004 Annual AMP report) This document will be revised and updated as new information becomes available, new issues emerge, or new tools are developed to help with data analysis and interpretation.

A9-2 Regulatory Background

A9-2.1 The Amended Consent Judgment

In January 1998, Onondaga County signed an Amended Consent Judgment (ACJ) committing to a phased program of upgrades and improvements to the County's wastewater collection and treatment system. The ACJ includes three major elements:

1. Improvements to the wastewater and stormwater collection systems to abate Combined Sewer Overflows (CSOs).

2. Improvements to the Metropolitan Syracuse Wastewater Treatment Plant (Metro) to reduce the concentration of ammonia N, phosphorus, BOD, solids, and bacteria in treated effluent prior to discharge.

3. Monitoring Onondaga Lake, the lake tributaries, and the Seneca River to track their response to the pollution abatement actions.

Improvements to Metro and the CSOs are phased over a 15-year period. One of the factors considered in developing the phasing plan was uncertainty regarding how Onondaga Lake would respond to reductions in the loading of wastewater-related contaminants. Onondaga County was required to design, fund, and implement a monitoring program that would provide the data and information needed to support key decisions regarding adequacy of the pollution abatement measures and the need for additional actions. These key decisions relate to the level of treatment and the location of the Metro discharge; results will provide the foundation for the Metro SPDES permit, which will include the CSOs.

A9-2.2 Required Actions by Onondaga County and NYSDEC

Specific compliance requirements for Onondaga Lake and its watershed are referenced in the ACJ. The following summary was prepared by John Ferrante of Central New York Regional Planning and Development Board; he is working under contract to NYSDEC on Onondaga Lake issues.

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COMPLIANCE REQUIREMENTS FOR THE AMENDED CONSENT JUDGMENT

The following list contains the primary legal and programmatic actions that are required in the Amended Consent Judgment. This list is not meant to be comprehensive of all ACJ requirements but identifies only those of a technical nature. The Party responsible for implementing each action and bringing it to an acceptable conclusion is identified after each requirement. The source document is the Amended Consent Judgment signed and entered into the Court on January 20, 1998.

SOURCE	**REQUIREMENT**
Page 4-5:	Insure that Onondaga Lake and its tributaries achieve best usage designated for Class B and C water pursuant to 6 New York Code of Rules and Regulations (NYCRR) Parts 701 and 703. Applicable NY State Water Quality Standards and Guidelines: 1. Dissolved Oxygen : 6NYCRR Sec. 703.3 2. Ammonia: 6 NYCRR Sec. 703.5 3. Turbidity: 6 NYCRR Sec. 703.2 4. Floatable Solids: 6 NYCRR Sec. 703.2 5. Phosphorus: 6 NYCRR Sec. 703.2 6. Technical & Operational Guidance Series (TOGS) 1.1.1 Water Quality Standards and Guidelines 7. Nitrogen: 6 NYCRR Sec. 703.2 8. Bacteria: 6 NYCRR Sec. 703.4 **Responsible Party: New York State Department of Environmental Conservation**
Page 5:	The State is required "…to determine, as soon as sufficient data and other information are available, whether water quality standards and guidelines for Onondaga Lake can be achieved with the continued discharge of Metro's effluent into the Lake;…" **Responsible Party: New York State Department of Environmental Conservation**
Paragraph 9:	Onondaga County is responsible for complying with the following Stage III effluent discharge limits from the Metro wastewater treatment plant: 1. Ammonia: 1.2 mg/l (June 1 – October 31 [30 day average]) 2.4 mg/l (November 1 – May 31 [30 day average]) 2. Phosphorus: 0.02 mg/l [12 month rolling average] **Responsible Party: Onondaga County**
Paragraph 10:	Report on the ability of the County (based on demonstrated information) to achieve compliance with effluent limitations specified in ACJ, paragraph 9.

Responsible Party: Onondaga County

Paragraph 11: Failure to demonstrate ability (per paragraph 10) by February 1, 2009, cease causing or contributing to the violation of water quality standards in Onondaga Lake by diverting Metro's effluent to the Seneca River or by implementing another engineering alternative which fully complies with the water quality standards no later than December 1,2012.

Responsible Party: Onondaga County

Paragraph 12: Reassess Total Maximum Daily Load (TMDL) allocation for Onondaga Lake "on or about" January 1, 2009.

Responsible Party: New York State Department of Environmental Conservation

Paragraph 13: Metro construction compliance requirements and schedule per paragraphs 5 – 11, Appendix A

Responsible Party: Onondaga County

Paragraph 14: Design, construct, and maintain and modify and/or supplement, as necessary, a CSO control and upgrade program in accordance with DEC CSO guidance, as set forth in TOGS 1.6.3 (CSO Control Strategy).

Responsible Party: Onondaga County

Paragraph 15: Develop and implement an oxygenation demonstration project in Onondaga Lake.

Responsible Party: Onondaga County

Paragraph 16: Monitor conditions in the Lake and its tributaries, and evaluate the effect that alterations in Metro and CSO operations are having on the water quality.

Responsible Party: Onondaga County

Paragraph 24: Enter into an agreement with CNYRPDB and provide funding for an Environmental Benefits Project (as set forth in Paragraph 25.C)

Responsible Party: Onondaga County

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A9-2.3 Water quality classification and designated use

Lakes and streams are classified according to their designated best use (for example, water supply, swimming, fish propagation, aesthetic enjoyment, and fish survival). Onondaga Lake is classified as B and C waters (Figure A9-1 and Table A9-1) The Class B segment encompasses the northern basin; the Class C segments include much of the southern basin and a small area around the mouth of Ninemile Creek. Both B and C waters must exhibit water quality conditions suitable for fish survival and propagation. Class B waters are to be suitable for primary water contact recreation (e.g. swimming) and secondary water contact recreation (e.g. boating). Class C waters shall be

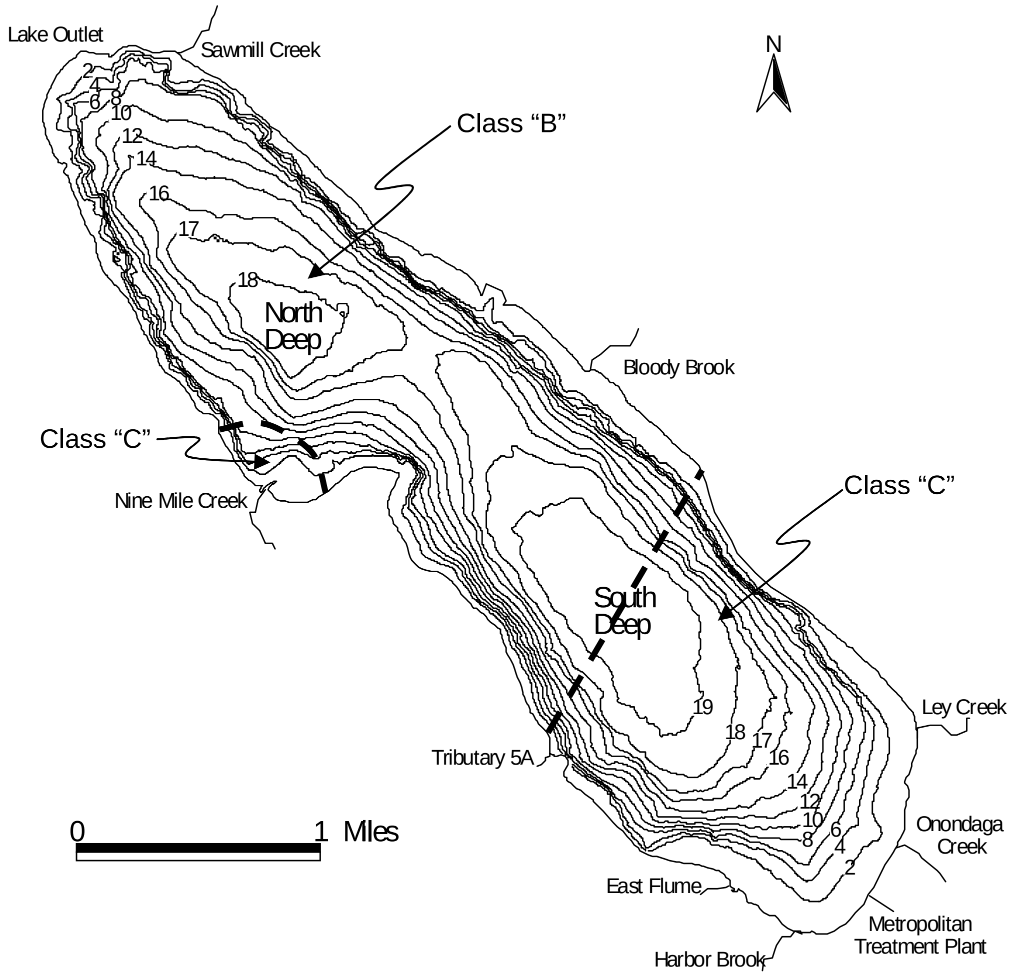


Figure A9-1. Regulatory Classifications and Bathymetry of Onondaga Lake. (Note: Contour lines are in meters).

suitable for primary and secondary water contact recreation, although other factors may limit the use for these purposes.

The main stems of the lake tributaries are primarily classified as C waters (suitable for fish propagation and secondary water contact recreation) but several small segments are Class B. The Seneca River segment in the vicinity of the Onondaga Lake outflow and downstream is Class B. As summarized in Table A9-1, several Class C stream segments within the subwatersheds are required to comply with Class C (T) water quality standards, meaning that dissolved oxygen and ammonia levels shall be suitable for salmonids.

TABLE A9-1

Summary of Regulatory Classification of Onondaga Lake and Tributary Streams

Water body	Description of Segment	Regulatory Classification	Standards
Onondaga Creek	From mouth 0.85 miles to upper end of barge canal	C	C
	Upper end of Barge Canal 1.7 miles to Temple St.	C	C
	Temple Street 4.4 miles to Tributary 5B	B	B
	From Tributary 5B 1.9 miles to Commissary Creek	C	C
	From Commissary Creek to source	C	C(T)
Ninemile Creek	From mouth 3.4 miles to point mid-way between Airport Rd and Rt. 173	C	C
	From point mid-way between Airport Rd and Rt. 173 to Otisco Lake	C	C(T)
Harbor Brook	From mouth 1.9 miles to upper end of underground section	C	C
	From upper end of underground section 1.3 miles to City of Syracuse Line	B	B
	From City of Syracuse City line to source	C	C(T)
Ley Creek	From mouth to sewage treatment outfall	C	C
	From sewage outfall to South Branch of Ley Creek	B	B
Bloody Brook	From mouth to first tributary (approximately 0.37 miles from mouth)	B	B
	From first tributary to source	C	C
Onondaga Lake (1)	Northwest of a line extending from a point located on the west shore 0.25 miles northwest of the mouth of trib. 5A to a point on the east shore located at a point 0.6 miles southeast of the mouth of Bloody Brook, except portions of the lake designated as items no. 2 and 3.	B	B
Onondaga Lake (2)	Southeast of a line extending from a point located on the west shore 0.25 miles northwest of the mouth of trib. 5A to a point on the east shore located at a point 0.6 miles southeast of the mouth of Bloody Brook, except portions of the lake designated as items numbered 1 and 3.	C	C
Onondaga Lake (3)	Area within 0.25 mile radius of the mouth of Ninemile Creek, except portions designated as items numbered 1 and 2.	C	C

A9-3 Compliance Assessment

The regulatory goal of the ACJ is to bring Onondaga Lake and its tributaries into compliance with best usage designated for Class B and C water pursuant to 6 NYCRR Parts 701 and 703. Applicable NY State Water Quality Standards and Guidelines that will be used to assess the extent to which these actions are successful include the following:

1. Dissolved Oxygen: 6NYCRR Sec. 703.3
2. Ammonia: 6 NYCRR Sec. 703.5
3. Turbidity: 6 NYCRR Sec. 703.2
4. Floatable Solids in CSO Discharges: 6 NYCRR Sec. 703.2
5. Phosphorus: 6 NYCRR Sec. 703.2
6. Water Quality Standards & Guidelines (NYSDEC Technical & Operational Guidance Series TOGS 1.1.1)
7. Nitrogen: 6 NYCRR Sec. 703.2
8. Bacteria: 6 NYCRR Sec. 703.4

A9-4 Summary of the Onondaga County Ambient Monitoring Program (AMP)

Onondaga County is required to design and implement an annual monitoring program of the lake, the lake tributaries, and portions of the Seneca River adjacent to the Onondaga Lake Outlet. The objective of the Ambient Monitoring Program (AMP) is to provide the data and information needed to assess the effectiveness of the controls at Metro and the CSOs and determine if additional remedial measures are required to bring the waters into compliance with applicable state standards and guidelines and federal criteria.

The AMP will provide the data and information needed to support the following decisions.

Can ambient water quality standards be met with continued Metro discharge to Onondaga Lake? Decision date: February 1, 2009
Must Metro effluent meet the Stage III phosphorus and ammonia limits for discharge to Onondaga Lake or the Seneca River in order for the receiving water to comply with ambient water quality standards? Decision date: February 1, 2009
Can lake-wide oxygenation be used as an interim measure for meeting dissolved oxygen standards at fall mixing pending compliance with Stage III effluent limits? If Stage III effluent limits are not achievable, would lake-wide oxygenation bring the lake into compliance with dissolved oxygen at fall mixing? Decision date: Dec.1, 2012

Onondaga County and its partners rely on an integrated program of monitoring and modeling to determine whether the planned improvements to the Onondaga County wastewater collection and treatment infrastructure are effective in bringing the surface water system into compliance with state and federal requirements. Monitoring is used to measure conditions over the 15-year period of phased improvements to the wastewater collection and treatment system. Modeling is used to describe the interrelationships between physical, chemical, and biological characteristics of the lake and watershed. Models are also valuable tools for interpreting data and understanding underlying mechanisms. Once verified, models can be used to predict future conditions under a range of management scenarios and environmental conditions.

The interrelationship between the management questions, monitoring and modeling, and the spatial and temporal designation of compliance is summarized in Table A9-2.

A9-4.1 History of Onondaga County Monitoring Efforts

The AMP is not Onondaga County's first monitoring effort. Following completion of a baseline State of the Lake Report in 1970, Onondaga County conducted an annual program from 1970 – 1997 to monitor tributaries, quantify external loading, and track lake water quality conditions and trends in response to pollution abatement efforts. When the ACJ was signed in 1998, Onondaga County modified its historical monitoring program to ensure that the data collected would be adequate to evaluate the response of the lake, streams, and river to the planned improvements to the CSOs and Metro. This process of evaluation and modification was a collaborative effort of Onondaga County, Onondaga Lake Technical Advisory Committee (OLTAC), U.S. Geological Survey (USGS), New York State Department of Environmental Conservation (NYSDEC), Environmental Protection Agency (EPA) and Atlantic States Legal Foundation (ASLF). The AMP began in August 1998 and is scheduled to continue through 2012.

The AMP differs from the historical program in several important ways. First, the AMP incorporated a storm event program on the CSO-affected tributaries (Onondaga Creek, Harbor Brook, Ley Creek), plus Ninemile Creek. Storm event data are used to evaluate the effectiveness of the CSO remedial measures. A stream mapping component was added to the AMP to document habitat quality along the CSO-affected tributaries; this program will support evaluation of the effectiveness of CSO controls and has provided additional information regarding nonpoint sources of pollution (particularly sediment).

The AMP was expanded to include monitoring for indices of recreational quality (bacteria and water transparency) at a network of eight nearshore stations. A monitoring buoy has been placed at the South Deep station to provide high-frequency measurements of water temperature, dissolved oxygen and related parameters. Onondaga County has expanded its network of precipitation gauging stations. The most significant change, however, has been the addition of an extensive biological monitoring program.

A9-4.2 Design of the AMP: Required Elements

The AMP was designed to provide the data and information needed to guide management decisions regarding the level of treatment of municipal wastewater (including CSOs) and the location of the Metro discharge.

The AMP includes Onondaga Lake, the lake's tributaries, and the Seneca River in the region of the Onondaga Lake outlet. The program includes measures to evaluate physical and habitat conditions, chemical water quality, and the nature of the biota as summarized in the language from the ACJ listing the required elements of the AMP.

These required elements from Appendix D of the ACJ include measures to:

- Assess compliance with ambient water quality standards in the lake and tributary streams

TABLE A9-2
Summary of Management Questions and Decision Analysis

Management Question:	**Decision Analysis Components and Regulatory References**	**Spatial and Temporal Scale of Assessment**	**Tools for Assessment**
Can ambient water quality standards be achieved with continued Metro discharge to Onondaga Lake? Decision date: February 1, 2009	Dissolved Oxygen: 6NYCRR Sec. 703.3 Ammonia: 6 NYCRR Sec. 703.5 Turbidity: 6 NYCRR Sec. 703.2 Floatables: 6 NYCRR Sec. 703.2 Phosphorus: 6 NYCRR Sec. 703.2 TOG 1.1.1 Water Quality Standards & Guidelines Nitrogen: 6 NYCRR Sec. 703.2 Bacteria: 6 NYCRR Sec. 703.4	Dissolved Oxygen: Upper waters, fall mixing, South Deep Ammonia and nitrite: Upper waters; South Deep, year-round Bacteria: all Class B portions of lake	Monitoring: AMP data Modeling CSOs: use SWMM to confirm: system-wide annual average capture of 85% of combined sewage. Modeling: Onondaga Lake model (begin in 2005)
Must Metro effluent meet the Stage III phosphorus and ammonia limits for discharge to Onondaga Lake or the Seneca River in order for the receiving water to achieve compliance with ambient water quality standards? Decision date: February 1, 2009	Phosphorus: 6 NYCRR Sec. 703.2 (*possibly modified by site-specific guidance value)* Trophic state indicators: frequency, intensity and duration of algal blooms Ammonia: TOG 1.1.1 Water Quality Standards & Guidelines (*latest revision to NYS standards*) NYSDEC revised TMDL for phosphorus and ammonia: January 1, 2009	Phosphorus and other trophic state parameters: summer average, upper waters, South Deep (per NYSDEC guidance). Dissolved Oxygen: Upper waters, fall mixing, South Deep Ammonia: Upper waters; South Deep, year-round	For lake discharge: • AMP data: Ammonia: effects of Stage 3 limits, met in 2004; TP: effects of Stage 2 limits, to be met in 2005 • Lake model, project compliance under critical conditions For Seneca River discharge: TRWQM
• Can lake-wide oxygenation be used as an interim measure pending compliance with Stage III effluent limits? • If Stage III effluent limits are not achievable, will lake-wide oxygenation bring the lake into compliance? Decision date: Dec.1, 2012	Feasibility analysis (ENSR 2004)	Focus of compliance for dissolved oxygen: fall mixing, upper waters	• AMP data • Mass-balance model • Onondaga Lake model (begin 2005)

- Estimate loading of materials to the lake, including the volume and loading of materials from the combined sewer overflows
- Evaluate physical habitat conditions in the lake and tributaries
- Evaluate the lake’s trophic state (level of productivity)
- Model the assimilative capacity of the Seneca River in the region of the Onondaga Lake outlet to support a decision regarding diversion of Metro effluent
- Characterize the lake’s biological community.

In addition to these specific measures, Appendix D includes requirements to document data integrity (for example, preparation of a detailed Quality Assurance Project Plan). Onondaga County is required to consult with technical experts to ensure that the AMP is designed and implemented in a defensible manner. Data interpretation and reporting is to be open and subject to rigorous technical review. Finally, Appendix D includes specific requirements to ensure that Onondaga County’s monitoring program collects data related to habitat quality. The addition of attributes to measure habitat quality highlights the expansion of the program from a traditional water quality monitoring program to one that aims at a more holistic assessment of ecological integrity.

OCDWEP has an expanded monitoring program on the Seneca River that is not part of the AMP; this program extends into the Oneida River and is used to evaluate performance of other Onondaga County wastewater treatment plants.

AMBIENT MONITORING PROGRAM REQUIREMENTS
(Appendix D of the ACJ)

Note: This is abstracted from the Amended Consent Judgment, January 1998

I. Tributaries and Lake Water Quality Monitoring Program

1. Assess compliance with ambient water quality standards and progress toward use attainment.
2. Assess physical habitat for stream and lake biota, and indicators of the biotic response.
3. Incorporate flexibility to assess additional chemicals or potential sources as needed
4. Concentrate data collection during critical ecological periods (e.g. spring spawning of dominant lake fishes, onset of thermal stratification, fall mixing).
5. Define monitoring as a priority at the Department and commit adequate resources
6. Increase participation of outside technical experts, e.g., Onondaga Lake Technical Advisory Committee in design and implementation of AMP and interpretation of results.
7. Incorporate appropriate QA/QC.
8. Maintain data in an electronic format that facilitates summarizing data, reporting results, and depicting results (including graphical depiction)

II. Tributary Monitoring Program

1. Quantify external loadings of phosphorus, nitrogen, suspended solids, indicator bacteria, heavy metals, and salts. Utilize FLUX. Events-based schedule.
2. High flow monitoring to partition point and nonpoint sources of phosphorus to the Lake (minimum of 5 days).
3. Collect storm event data upstream and downstream of CSO discharges to Onondaga Creek, Harbor Brook and Ley Creek.
4. Assess compliance with water quality standards in Onondaga Cr, Harbor Br, and Ley Cr.
5. Measure attributes of the physical environment in tributaries: (a) velocity, (b) cross-sectional area to map erosional and depositional sections. Survey for (c) presence and character of sludge deposits in depositional areas and map, (d) map physical characteristics of the stream bed that could affect spawning habitat from mouth to first barrier, (e) sample macroinvertebrate communities and calculate NYSDEC rapid field biotic index throughout tributaries' length.
6. Continue cooperative arrangements with USGS to gauge discharge of the major tributaries.
7. Continue data collection, analysis and reporting consistent with historical database (1970 to 1997) to enable statistical trend analysis.

III. Onondaga Lake Monitoring Program

1. Assess compliance with ambient water quality standards including bacterial concentrations in nearshore areas.
2. Assess trophic status of the Lake.
3. Continue data collection, analysis, and reporting consistent with the long-term lake database (1970 – 1997) to enable statistical trend analysis.
4. Complement chemical program with a biological monitoring effort to assess the densities and species composition of phytoplankton, zooplankton, macrophytes, macroinvertebrate, and fish.
5. Evaluate success of walleye, bass, and sunfish propagation (quantitative lake-wide nest surveys, recruitment estimates, and juvenile community structure). Coordinate with NYSDEC fisheries management activities on the lake.
6. Establish sharing protocols with NYSDEC for County to track contaminants in fish flesh.
7. Acquire and track data by others regarding nature of littoral (shallow area) sediments in Onondaga Lake.

IV. Seneca River Program

1. Evaluate current water quality of the Seneca River and compliance with water quality standards upstream and downstream of the Onondaga Lake outlet.
2. Evaluate and quantify the assimilative capacity of the Seneca River and quantify effects of zebra mussels.
3. Monitor critical conditions of warm weather and low flows.
4. Test temporal and spatial variability (e.g., diurnal variations in river water quality, and the extent of chemical stratification).

An overview of how the AMP is designed to meet these ACJ requirements is provided in Table A9-3. While the AMP is designed to assure compliance with the specific requirements in the ACJ, Onondaga County collects and analyzes additional data to meet related program objectives. In many cases, additional data are collected that enable a more integrated analysis of water quality conditions and the response of the biota. Details of how data collected through the AMP are used and interpreted is included in Table A9-4.

Table A9-3
Elements of the AMP In relation to ACJ-Required Monitoring Objectives

ACJ Statement of Required Program Objective:
Quantify external loading of phosphorus, nitrogen, suspended solids, indicator bacteria, and salts. Assess the reduction in loading achieved by the CSO improvements. Design program to evaluate the relative contribution of point and nonpoint sources of pollution to the lake.

Ambient Monitoring Program Elements	Data Used To
(Annual program) • Tributary monitoring: biweekly and high flows events – Includes locations upstream and downstream of CSOs, urban and rural segments of subwatersheds. • Storm event program: higher frequency sampling on CSO-affected streams during storms.	Estimate annual external loading to Onondaga Lake Calculate loading from CSO-affected tributaries and compare pre-and post-remedial load of phosphorus, suspended sediment, and bacteria

ACJ Statement of Required Program Objective:
Assess the tributaries' physical habitat and macroinvertebrate community.

Ambient Monitoring Program Elements	Data Used To
(Baseline, 2000 and 2002; post-improvements scheduled for 2006 and 2012) **note: may be modified based on CSO construction schedule or major hydrologic event** • Stream mapping using NRCS Visual Stream Assessment Protocol in CSO-subwatersheds: Onondaga, Ley and Harbor Brook	Quantify baseline conditions and provide basis to measure change. Calculate standard indices (using NYSDEC protocols) that use numbers and types of benthic macroinvertebrates to indicate status of water quality and habitat conditions. Test for improvement over time.

Table A9-3 Continued
Elements of the AMP In relation to ACJ-Required Monitoring Objectives

(Every 2 years) • Macroinvertebrate surveys of CSO-affected subwatersheds	Quantify baseline conditions and provide basis to measure change Calculate standard indices (using NYSDEC protocols) that use numbers and types of benthic macroinvertebrates to indicate status of water quality and habitat conditions. Test for improvement over time

ACJ Statement of Required Program Objective:
Gather data on an adequate temporal and spatial scale to assess compliance with ambient water quality standards.

Ambient Monitoring Program Elements	**Data Used To**
(Annual program) • Lake monitoring program: *South Deep Station, eight nearshore stations* • Tributary monitoring program • Seneca River monitoring program	Assess compliance with numerical and narrative standards for substances listed in TOGS 1.1.1 Calibrate and verify models

ACJ Statement of Required Program Objective:
Evaluate changes in the water quality and trophic state of Onondaga Lake in response to reductions in external loading achieved by the improvements to Metro and the CSOs.

Ambient Monitoring Program Elements	**Data Used To**
(Annual program) • Lake monitoring: phosphorus, chlorophyll-a, water clarity, DO status of lower waters • Tributary and Metro effluent monitoring: loads (esp. nutrients)	Assess conditions in relation to inputs and trends Calibrate USGS watershed model of land use and nutrient export (using AMP tributary data) Construct conceptual model and mass-balance model Calculate “fish space metrics” to track changes in available habitat for cold water, cool water and warm water fish Develop and calibrate Onondaga Lake model

Table A9-3 Continued
Elements of the AMP In relation to ACJ-Required Monitoring Objectives

ACJ Statement of Required Program Objective
Expand the chemical monitoring program to include other indices of ecological integrity: biological data, contaminant burden, and physical habitat.

Ambient Monitoring Program Elements	**Data Used To**
(Annual program unless noted otherwise): (1) fish: nesting, larvae, juveniles, and adult communities. Presence of tumors and other anomalies (DELT-FM). Fish contaminant burden data collected by NYSDEC (2) phytoplankton and zooplankton communities (numbers, biomass, species composition, average size of zooplankton) (3) macrophytes: annual aerial surveys plus ground-truthing; full surveys in 2000, 2005 and 2010 (4) macroalgae: visual surveys in nearshore areas (5) littoral macroinvertebrates: surveys in 2000, 2005 and 2010	Assess current trophic state, abundance and diversity of species, importance of exotic species, reproduction and recruitment Test for trends or shifts in data Compare Onondaga Lake with Oneida Lake (zooplankton community) and other regional lakes (fish community)

ACJ Statement of Required Program Objective:
Through interaction with NYSDEC and appropriate peer reviewers, coordinate data collection and analysis to provide data at an adequate spatial and temporal scale to use in existing or revised lake models

Ambient Monitoring Program Elements	**Data Used To**
• Annual program and supplemental investigations, NYSDEC review and approvals • Meetings with OLTAC and work groups	Support conceptual and empirical (mass-balance) model; AMP data will be used to calibrate and verify new lake model (begin in 2005)

ACJ Statement of Required Program Objective:
Define ambient water quality conditions in the Seneca River between Cross Lake and the Three Rivers junction.

Ambient Monitoring Program Elements	**Data Used To**
(Annual program) • Surveys during low flow conditions	Assess current conditions, provide data for model verification Assess compliance with ambient water quality standards

ACJ Statement of Required Program Objective:
Evaluate and quantify the assimilative capacity of the Seneca River and quantify effects of zebra mussels.

Ambient Monitoring Program Elements	**Data Used To**
• River modeling work group and peer review • Periodic zebra mussel surveys	Support TRWQM model of assimilative capacity of River, including zebra mussel activity. Domain is Cross Lake to Phoenix Dam.

Table A9-4
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

A. Onondaga Lake phytoplankton, zooplankton, macrophytes, and littoral macroinvertebrates

Parameter	Frequency Sampling Interval	Method	Sites	Depths	Data Analysis and Reporting	Data Interpretation Strategy
Phytoplankton	South Deep: Biweekly (April – November) + Monthly in winter, as conditions allow	¾" Tygon tube sampler (Depth Integrated Tube samples)	South Deep+ North Deep	UML composite	1. Biovolume 2. Abundance 3. Species composition 4. Annual Succession 5. Percent blue green	1. Assess community structure, importance of cyanobacteria 2. Trends in abundance and biomass. 3. Aesthetic quality 4. Correlation with chlorophyll 5. Relationship to light penetration
Chlorophyll-*a* & Phaeophytin-*a*	Biweekly + Duplicate Monthly (May – September) + Weekly South Deep (May – September)	¾" Tygon tube sampler (Depth Integrated Tube samples)	South Deep+ North Deep	UML composite + Photic zone (2 x Secchi Disk Transparency)	1. Concentration 2. Magnitude and frequency of bloom conditions	1. Use attainment. 2. Aesthetic quality 3. Site-specific guidance 4. Assess trophic status and algal productivity. 5. Trends 6. Compare to phytoplankton and zooplankton. 7. Evaluate variability. 8. Lake model calibration and validation
Zooplankton	Biweekly (April – November) + Monthly in winter, as conditions allow	Vertical Haul 0.5 m diameter net, 80 μm mesh	South Deep + North Deep	UML composite + 15 m tow	1. Count 2. Biovolume 3. Identification 4. Abundance 5. Species composition 6. Annual succession 7. Size	1. Trends in abundance and biomass. 2. Assess community structure. 3. Size structure. 4. Correlate data with other regional lakes (Oneida Lake) 5. Test relationship to fish community 6. Infer food web impacts.

Table A9-4 (continued)
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

A. Onondaga Lake phytoplankton, zooplankton, macrophytes, and littoral macroinvertebrates (continued)

Parameter	Frequency Sampling Interval	Method	Sites	Depths	Data Analysis and Reporting	Data Interpretation Strategy
Macrophytes	Annual	Aerial Photograph	Entire Lake	-	Plant distribution	Used to track percent cover during years without survey
	2000, 2005, 2010 (August surveys)	Field surveys	Transects in littoral strata	Shoreline to depth of no growth (6 m contour standard)	1. Species richness 2. Biomass 3. Percent cover (lakewide and by strata)	1. Percent cover compared with optimal levels for warmwater fish community (bass) nursery and cover 2. Biomass to support lake model 3. Richness compared with regional lakes 4. Trends
Littoral macroinvertebrates	2000, 2005, 2010 (June surveys)	Field surveys	18 samples, in 5 strata (90 total)	Shoreline to 1.5 m depth	1. NYSDEC indices 2. Percent oligochaetes and chironomids 3. Species richness (lakewide and by strata)	Change from baseline conditions (lakewide and by strata)

Table A9-4 (continued)
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

B. Fisheries Program

Parameter	Frequency Sampling Interval	Method	Sites	Depths	Data Analysis and Reporting	Data Interpretation Strategy
Pelagic Larvae	Biweekly (April-August)	Miller Trawl	North & South basin	5.5 meter double oblique tow	1. Species Identification 2. Length Frequency	1. Community Structure 2. Growth rate, compared to regional lakes and to historical Onondaga Lake data 3. Condition factor 4. Species Richness 5. Pollution tolerance
Littoral Juvenile	Every three weeks (July-October)	¼" mesh bag seine sweep	15	~ 1m	1. Number and species of juveniles captured 2. Catch per unit effort	1. Community Structure 2. Size/length distribution 3. Species Richness 4. Evidence of recruitment 5. Pollution tolerance
Littoral Adults	May, September, October	Night Electrofishing (Angler diary program)	24 sections	< 1m	1. Number and species captured 2. Catch per unit effort	1. Community Structure 2. Size/length distribution 3. Species Richness 4. Evidence of recruitment 5. Pollution tolerance 6. Index of Biological Integrity
Pelagic Adults	May, October	Littoral - Profundal Gill Nets Experimental: hydroacoustics (Angler diary program)	5 sites (1 per station)	4-5 m water (2 hour set)	1. Number and species captured 2. Catch per unit effort	1. Community Structure 2. Size/length distribution 3. Species Richness 4. Evidence of recruitment 5. Pollution tolerance
Nesting survey	June	Visual Count around entire littoral zone (along depth contour)	Entire Lake divided into 24 sections	1 m	Count Where possible, identify species	Change over time: lakewide and at five strata used for biological programs

Table A9-4 (continued)
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

B. Fisheries Program

Deformities, Erosions, Lesions, Tumors, Fungal and Multiple Anomalies (DELT-FM)	Screening on all captured fish	Visual analysis by trained field teams	Lakewide	All (most are adults captured by electrofishing)	Number and types of anomalies	Change over time (trend)

Table A9-4 (continued)
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

C. Lake Chemical/Water Quality Monitoring Program

Parameter	Frequency Sampling Interval	Method	Sites	Depths	Data Analysis and Reporting	Data Interpretation Strategy
Mercury Total and Methyl Mercury (low-level)	April, August, October	Teflon Dunker Modified USEPA Method 1669	South Deep+ North Deep	3m & 18m	Concentration	1. Compliance. 2. Trends 3. Support models
Metals Cd, Cr, Cu, Ni, Pb, Se, Zn, As, K	Quarterly (April, June, September and November)	Wildco Beta horizontal sampler/ Churn	South Deep+ North Deep	UML* + LWL* Composites	Concentration	1. Compliance 2. Charge balance computations (K)
Metals/Salts Ca, Na, Mg, Mn, Fe, Cl, SO_4, SiO_2	Biweekly (April-November); Monthly in winter, as conditions allow	Wildco Beta horizontal sampler/ Churn	South Deep+ North Deep	UML + LWL Composites	Concentration	1. Charge Balance (data quality) 2. Trends 3. Geochemical Analysis 4. Density stratification 5. Phytoplankton community structure
Conventionals BOD-5, NO_2+NO_3-N Cl, SO_4	Biweekly (April-November); Monthly in winter, as conditions allow	Wildco Beta horizontal sampler/ Churn	South Deep+ North Deep	UML + LWL Composites	Concentration (Turbidity, NTU)	1. Indicator of oxygen-demanding material 2. Nitrogen dynamics 3. Charge balance 4. Model support 5. Trends
Phosphorus TP, SRP, TDP	Biweekly (April-November); Monthly in winter, as conditions allow	Submersible Pump	South Deep+ North Deep	Discrete Depths – (0m, 3m, 6m, 9m, 12m, 15m, 18m) plus 1m, biweekly, June 1 – Sept 30 (NYS guidance value)	Concentration	1. Trophic status 2. Trends 3. Compliance with 20 µg/l summer average, upper waters guidance value (support for site-specific analysis) 4. TMDL analysis 5. Model support 6. Bioavailability

Table A9-4 (continued)
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

C. Lake Chemical/Water Quality Monitoring Program (continued)

Parameter	Frequency Sampling Interval	Method	Sites	Depths	Data Analysis and Reporting	Data Interpretation Strategy
Nitrogen TKN, NH_3-N, Org-N, F-TKN	Biweekly (April-November); Monthly in winter, as conditions allow	Submersible Pump	South Deep+ North Deep	Discrete Depths – (0m, 3m, 6m, 9m, 12m, 15m, 18m)	Concentration	1. Compliance with ammonia standards. 2. Assess nitrification in lake and nitrogen cycling. 3. Compute N:P ratios. 4. Habitat for biota 5. Trend analysis 6. TMDL. analysis 7. Model support
NO_3, NO_2	Biweekly (April-November); Monthly in winter, as conditions allow	Wildco Beta horizontal sampler/ Churn	South Deep+ North Deep	UML + LWL composites	1. Concentration 2. Compliance with NYS standards 0.1 mg/l in upper waters	1. Assess compliance with AWQS. 2. Measure in-lake nitrification and nitrogen cycling 3. Use attainment (warm water fishery).
Carbon TOC, TOC-F, TIC	Biweekly (April-November); Monthly in winter, as conditions allow	Submersible Pump	South Deep+ North Deep	0m, 6m, 12m, 18m	Concentration	1. Trends 2. Trophic Status. 3. Indicator of oxygen demanding material. 4. Support models
Total Alkalinity	Biweekly (April-November); Monthly in winter, as conditions allow	Wildco Beta horizontal sampler/ Churn	South Deep+ North Deep	UML + LWL Composites	Concentration	1. Charge Balance. 2. Trends 3. Compute Hardness
Bacteria Fecal Coliform, E. Coli	Biweekly + Weekly (May-September at South Deep) + Weekly (May September at 8 Lake near shore sites)	Grab sample into sterile bottle	South Deep+ North Deep + near shore sites	0m	1. Abundance of indicator organisms 2. Percent of measurements meeting swimming standards	1. Potential presence of pathogens 2. Compliance with standards 3. Use attainment. 4. Trend analysis 5. Effectiveness of CSO control measures. 6. Model support

Table A9-4 (continued)
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

C. Lake Chemical/Water Quality Monitoring Program (continued)

Parameter	Frequency Sampling Interval	Method	Sites	Depths	Data Analysis and Reporting	Data Interpretation Strategy
Solids TS, TSS, VSS, TVS, TDS	Biweekly (April-November); Monthly in winter, as conditions allow	Submersible Pump	South Deep+ North Deep	0m, 6m, 12m, 18m	Concentration	1. Compliance 2. Trend analysis 3. Chemical stratification 4. Correlation with turbidity (water clarity)
Sulfides	Biweekly (April-November); Monthly in winter, as conditions allow Samples collected if waters are anoxic	Wildo Beta horizontal sampler	South Deep+ North Deep	12m, 15m, 18m	Concentration	1. Anoxia 2. Model support (diagenesis)
Turbidity	Daily at 15 minute intervals (April-November)	YSI Buoy	Lake South	2m	Light scattering (NTU)	1. Trend analysis 2. Correlation with other indices affecting water clarity
	Biweekly (April-November); Monthly in winter, as conditions allow	Wildco Beta horizontal sampler/ Churn	South Deep+ North Deep	UML Composite		

Table A9-4 (continued)
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

D. Physical parameters monitored in Onondaga Lake

Parameter	Frequency Sampling Interval	Method	Sites	Depths	Data Analysis and Reporting	Data Interpretation Strategy
Field data pH, Temperature, Salinity, Conductivity, Dissolved Oxygen, ORP	Biweekly (April-November); Monthly (January, February, March, December)	YSI (In-situ)	Lake South & Lake North	0.5 m intervals through water column	1. Volume-days of Anoxia 2. Rate of depletion from LWL 3. DO during fall mixing 4. Volume-days of hypoxia 5. Fish-space metrics	1. Compliance 2. Stratification (thermal and chemical) 3. Model support 4. Trend analysis 5. Ammonia toxicity. 6. Use attainment.(habitat) 7. Concentration of reduced substances and oxidation status of lake (ORP data) 8. pH indicator of CO_2 production and decomposition.
pH, Temperature, Conductivity, Salinity, Dissolved Oxygen, ORP, Chlorophyll & Turbidity	Daily at 15 minute intervals (April-November)	YSI Buoy (web)	South Deep	2m, 6m, 12m, 15m		1. Compliance with DO and pH standards. 2. Evidence of mixing processes (seiche)
Secchi Disk Transparency & Underwater Illumination Profile	Biweekly South Deep + Weekly South Deep (June – September) + Biweekly Near shore stations (June – September)	Secchi Disk & LiCor Datalogger	Lake South & Lake North	From lake surface to depth at which light is 1% of surface illumination	1. Average Secchi, percent of measurements meeting 4 ft (nearshore), 5 ft (South Deep) 2. Extinction coefficient	1. Secchi disk transparency: Compliance with NYSDOH guidance value for bathing beaches. 2. Trends 3. Trophic Status 4. Indicator of water clarity 5. Aesthetics 6. Use attainment

Table A9-4 (continued)
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

E. Tributary Program Summary

Parameter	Frequency Sampling Interval	Method	Sites	Data Analysis and Reporting	Data Interpretation Strategy
Stream benthic Macroinvertebrates (BMI) & Stream Characteristics	BMI: every other year, 1998 – 2012 Stream mapping: 2000, 2002, 2006, 2012	Various methods, most BMI collected using kick screens	10 sites (OC, LC & HB)	1. NYSDEC water quality Index 2. NRCS Visual Stream Assessment Protocol	Change from baseline conditions
Metals Cd, Cr, Cu, Ni, Pb, Hg, Zn, As, K	Quarterly (April, June, September and November)	Depth Integrated Sampling Techniques	14 sites (OC, NM, HB, LC, Metro effluent (ME), Metro bypass (MB), EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	1. Compliance (if AWQS) 2. Load 3. Data quality (K used in charge balance)
Metals/Salts Ca, Na, Mg, Mn, Fe, Cl, SO_4, SiO_2	Biweekly (January-December)	Depth Integrated Sampling Techniques	14 sites (OC, NM, HB, LC, ME , MB, EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	1. Compliance (if AWQS) 2. Load 3. Data quality (major ions used in charge balance) 4. Geochemical analysis
Cyanide	Quarterly	Depth Integrated Sampling Techniques	14 sites (OC, NM, HB, LC, ME , MB, EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	Compliance
Conventionals $BOD\text{-}_5$	Biweekly (January-December)	Wildco Beta horizontal sampler/churn	14 sites (OC, NM, HB, LC, ME , MB, EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	1. Load 2. Indicator of oxygen-demanding material
Phosphorus TP, SRP, TDP	Biweekly (January-December Biweekly	Depth Integrated Sampling Techniques	14 sites (OC, NM, HB, LC, Metro (outfalls 001 and 002), EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	1. Trends 2. Support TMDL 3. Load 4. Bioavailability

Table A9-4 (continued)
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

E. Tributary Program Summary (continued)

Parameter	Frequency Sampling Interval	Method	Sites	Data Analysis and Reporting	Data Interpretation Strategy
Nitrogen TKN, NH_3-N, Org-N, F-TKN	Biweekly (January-December Biweekly	Depth Integrated Sampling Techniques	14 sites (OC, NM, HB, LC, ME , MB, EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	1. Trends 2. Support TMDL 3. Load
NO_3, NO_2	Biweekly (January-December	Depth Integrated Sampling Techniques	14 sites (OC, NM, HB, LC, ME , MB, EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	1. Compliance with AWQS 2. Load 3. Trends
Carbon TOC, TOC-F, TIC	Biweekly (January-December	Depth Integrated Sampling Techniques	14 sites (OC, NM, HB, LC, ME , MB, EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	1. Trends 2. Trophic status 3. Oxygen demand 4. Load
Total Alkalinity	Biweekly (January-December	Depth Integrated Sampling Techniques	14 sites (OC, NM, HB, LC, ME , MB, EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	1. Calculate bicarbonate (charge balance) 2. Trends
Bacteria Fecal Coliform	Biweekly (January-December	2 sterile Coli Bottles	14 sites (OC, NM, HB, LC, ME , MB, EF, Tributary 5A, Lake Outlet, SM, BB)	Abundance	1. Potential presence of pathogens 2. Trends 3. Effectiveness of CSO control measures
Solids TSS, TDS	Biweekly (January-December	Depth Integrated Sampling Techniques	14 sites (OC, NM, HB, LC, ME , MB, EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	Compliance with AWQS
Turbidity	Biweekly (January-December	Depth Integrated Sampling Techniques	14 sites (OC, NM, HB, LC, ME , MB, EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	Transport dynamics

Table A9-4 (continued)

Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

E. Tributary Program Summary (continued)

Parameter	Frequency Sampling Interval	Method	Sites	Data Analysis and Reporting	Data Interpretation Strategy
Field data: pH, Temperature, Salinity, Conductivity, Dissolved Oxygen, ORP	Biweekly (January-December	YSI (In-Situ)	14 sites (OC, NM, HB, LC, ME , MB, EF, Tributary 5A, Lake Outlet, SM, BB)	Concentration	1. Compliance 2. Trends 3. Ammonia toxicity 4. Redox status

F. Seneca River Program Summary

Parameter	Frequency Sampling Interval	Method	Sites	Depths	Data Analysis and Reporting	Data Interpretation Strategy
Chlorophyll-*a*	Monthly (July – September)	Tube sampler “Depth Integrated Tube samples”	16 sites (Seneca, Oneida & Oswego Rivers)	Through the water column. Tube composite through the photic zone and a grab at 1-meter above the river sediments.	Concentration	1. Trophic status 2. Trends 3. Model support
Salts Cl	Monthly (July – September)	Wildco Beta horizontal sampler	16 sites (Seneca, Oneida & Oswego Rivers)	1 meter below water surface and 1 meter above the river sediments	Concentration	1. Trends 2. Geochemical analysis 3. Model support
Conventionals BOD-5	Monthly (July – September)	Wildco Beta horizontal sampler	16 sites (Seneca, Oneida & Oswego Rivers)	1 meter below water surface and 1 meter above the river sediments	Concentration	1. Indicator of oxygen-demanding material 2. Model support
Phosphorus TP, SRP, TDP	Monthly (July – September)	Wildco Beta horizontal sampler	16 sites (Seneca, Oneida & Oswego Rivers)	1 meter below water surface and 1 meter above the river sediments	Concentration	1. Trophic status and algal productivity 2. Trends 3. Model support

Table A9-4 (continued)
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

F. Seneca River Program Summary (continued)

Parameter	Frequency Sampling Interval	Method	Sites	Depths	Data Analysis and Reporting	Data Interpretation Strategy
Nitrogen TKN, NH_3-N, F-TKN, NO_3, NO_2	Monthly (July – September)	Wildco Beta horizontal sampler	16 sites (Seneca, Oneida & Oswego Rivers)	1 meter below water surface and 1 meter above the river sediments	Concentration	1. Compliance 2. N dynamics 3. N:P ratios 4. Trends 5. Model support
Carbon TOC, TDC	Monthly (July – September)	Wildco Beta horizontal sampler	16 sites (Seneca, Oneida & Oswego Rivers)	1 meter below water surface and 1 meter above the river sediments	Concentration	1. Trends 2. Trophic status 3. Oxygen-demanding material 4. Model support

Table A9-4 (continued)
Detailed Reporting of AMP Program, Data Analysis and Interpretation Strategy

F. Seneca River Program Summary (continued)

Parameter	Frequency Sampling Interval	Method	Sites	Depths	Data Analysis and Reporting	Data Interpretation Strategy
Solids TSS, VSS	Monthly (July – September)	Wildco Beta horizontal sampler	16 sites (Seneca, Oneida & Oswego Rivers)	1 meter below water surface and 1 meter above the river sediments	Concentration	1. Trends 2. Model support 3. Indicator of water clarity
Turbidity	Monthly (July – September)	Wildco Beta horizontal sampler	16 sites (Seneca, Oneida & Oswego Rivers)	1 meter below water surface and 1 meter above the river sediments	Light scattering (NTU)	1. Trends 2. Model support 3. Indicator of water clarity
In-situ field data pH, Temperature, Salinity, Conductivity, Dissolved Oxygen, ORP	Monthly (July – September)	YSI	16 sites (Seneca, Oneida & Oswego Rivers)	0.5 m increments	Concentration	1. Compliance 2. Stratification regime. 3. Trends 4. Ammonia toxicity. 5. Redox status 6. pH indicator of CO_2 production/decomposition. 7. DO indicator of suitability of aquatic biota/zebra mussel activity. 8. Support river model and evaluate assimilative capacity
pH, Temperature, Conductivity, Salinity, DO, ORP, Chlorophyll & Turbidity	Daily at 15 minute intervals (April- Nov)	YSI Buoy	Buoy 316 (Seneca River)	Upper waters: 0.86m Lower waters: 3.80 m	Concentration (turbidity, NTU)	1. Trends 2. Compliance
Secchi Disk Transparency and Underwater Illumination Profile	Monthly (July – September) & with diurnal cycles	Secchi Disk & LiCor Datalogger	16 sites (Seneca, Oneida & Oswego Rivers)	Licor data – 20 cm intervals from lake surface to depth at which light is 1% of surface illumination		1. Trends 2. Model support 3. Indicator of water clarity

List of Acronyms:
AWQS: Ambient Water Quality Standards
CPUE: Catch Per Unit Effort
CSO: Combined Sewer Overflow
NYSDOH: New York State Department of Health
PSD: Proportional Stock Density
TMDL: Total Maximum Daily Load

A9-4.3 Design of the AMP: Underlying Assumptions

Design of the AMP builds on decades of monitoring within the lake and its watershed. Several important assumptions underlie the monitoring program; these assumptions are based on analysis of the historical data and mass-balance calculations. Among the assumptions are the following:

- South Deep is representative of lake-wide conditions.

This assumption has been evaluated by comparing data collected at North Deep on a quarterly frequency with the South Deep data. No systematic differences in concentration of monitored parameters have been detected. This analysis will be updated in 2005 as part of Dr. William Walker's statistical framework.

- External loading to the lake is assessed by monitoring discharge and concentration of six tributaries plus Metro effluent. In total, approximately 95% of the water flow into the lake is gauged and sampled. It is assumed that this monitoring is sufficient to provide a robust estimate of external loading.

This assumption was tested in 2003, when storm event samples were obtained from two small streams draining the nearshore (ungauged) portion of the watershed. The concentrations of monitored parameters in the two streams, Bloody Brook and Sawmill Creek, were less than or comparable to concentrations measured in the gauged streams. With the very low flow contribution, it was determined that the loading from the nearshore (ungauged) portion of the lake watershed was minimal. That is, the ungauged areas do not contribute a disproportionate load given their drainage area.

- Deposition onto the lake surface (including precipitation and dry fall) accounts for a small fraction of the total external nutrient load and can be adequately characterized from regional data.

The mass balance framework developed by Dr. William Walker provides a basis for evaluating the magnitude and importance of precipitation within the lake's phosphorus budget. The lake surface area comprises a very small fraction of the overall drainage basin, and precipitation onto the lake surface represents about 2% of the total water inflow. The concentration of phosphorus in rainwater is variable, but typically well below the concentrations measured in the tributary streams, and an order of magnitude less than the concentration in the Metro effluent. Again looking to Dr. Walker's mass balance framework, precipitation represents less than one-half of 1% of the total P loading to the lake assuming TP concentration =30 µg/l. This is a regional average concentration of phosphorus in precipitation. Doubling this concentration still represents less than 1% of the total annual loading; for this reason site-specific sampling has not been recommended. The magnitude and importance of atmospheric loading of mercury has not been quantified as part of the AMP.

- Groundwater does not represent a significant component of the lake's hydrologic budget.

This assumption can be examined by evaluating the extent to which water and chloride models show reasonable agreement between inputs, outputs, and retention in the lake.
Onondaga Creek is influenced by groundwater seepage into the downstream reaches just above the Inner Harbor. Likewise, groundwater flux into Ninemile Creek has been documented. A chloride

model of the lake, assuming no groundwater contribution, was constructed (Doerr et al. 1994) and predicted measured concentrations within about 5%. This implies that groundwater input to the lake is likely a minor component (<5%) of the hydrologic budget.

- Water quality of the lake may be adequately characterized by examining the lake as a two-layer system during the period of thermal stratification, which typically extends from late May through late October. Furthermore, the photic zone does not extend into the lower water layer.

This assumption will be examined through the Onondaga Lake modeling project, scheduled to begin in 2005.

A9-4.4 Design of the AMP: Hypothesis Testing and Statistical Power

The elements of the monitoring program were distilled into a series of testable hypotheses. This work product was used as a basis for evaluating the AMP design, allowing the project team and the advisors to determine whether the correct parameters were being measured. A summary of the hypotheses for elements of the monitoring program is presented in Table A9-5. Note that there are three types of hypotheses to be tested using data generated by the AMP. The first relates to whether Onondaga County is in compliance with the effluent limits required by the State Pollution Discharge Elimination System (SPDES) permit. The second type examines whether ambient water quality standards in the receiving water have been met. The third type of hypothesis, which is used for assessing the biological programs as well as the water quality programs, is whether there is a trend in the monitoring data.

It is evident from the list of hypotheses that a major focus of the AMP is to detect change. A challenge in environmental monitoring programs is to differentiate between natural variability and true change. OLTAC member Dr. William W. Walker Jr. examined the historical monitoring data to characterize the variability of the parameters used to assess progress (for example, concentrations of ammonia-N, bacteria, chlorophyll-*a* at the lake's South Deep station). The AMP design was then evaluated to determine what magnitude of "true" change in concentration could be detected at a given level of statistical certainty. The AMP was modified to increase the monitoring frequency for certain parameters that are highly variable (e.g. chlorophyll-*a*). For the majority of lake water quality parameters the biweekly sampling program was found to be adequate. Dr. Walker summarized his analysis of the power of the water quality monitoring program in the Phase 1 Statistical Framework (January 1999) and an updated Phase 1 Statistical Framework (January 2002). His report evaluating the design of the biological programs and their power to detect change was issued as the Phase 2 Statistical Framework (February 2000) and an update to the Phase 2 Statistical Framework (August 2002).

Dr. Walker will update the statistical framework during 2005 with the most recent water quality and biological data. The 2005 update will be structured to reference these specific hypotheses.

TABLE A9-5
Summary of Hypotheses Underlying the AMP

Monitoring Parameter	Hypothesis	Type of Hypothesis			Data Used for Assessment
		Compliance with SPDES permit	Compliance with ambient water quality standards or guidance value	Significant Trend or Shift in Monitoring Data	
Ammonia-N	Improvements at Metro enable the County to meet Stage III effluent limits (or as modified by TMDL) for ammonia N	*			Outfall 001 effluent concentrations, calculated for summer and winter (seasonal limits apply)
	Reduced ammonia load results in compliance with ambient water quality standards and federal criteria for ammonia in Onondaga Lake		*	*	South Deep station Biweekly monitoring, discrete samples collected at 3-m intervals, plus temperature and pH
Nitrite-N	Achievement of Stage III effluent limits for ammonia results in compliance with the NYS ambient water quality standard for nitrite (warm water fish community)		*	*	UML, LWL composite samples, biweekly at South Deep
Phosphorus	Improvements at Metro will enable the County to meet final effluent limits (as modified by TMDL)	*			Outfall 001 effluent concentrations
	Reduced phosphorus load from Metro reduces concentration of phosphorus in Onondaga Lake		*	*	South Deep station Biweekly monitoring TP, SRP and TDP, discrete samples collected at 3-m intervals
	Reduced phosphorus load from Metro brings the lake into compliance with guidance value (or site-specific guidance value)		*	*	TP at South Deep, 1-m depth (weekly measurements, June – Sept)

TABLE A9-5 (continued)
Summary of Hypotheses Underlying the AMP

Monitoring Parameter	Hypothesis	Type of Hypothesis			Data Used for Assessment
		Compliance with SPDES permit	Compliance with ambient water quality standards or guidance value	Significant Trend or Shift in Monitoring Data	
Dissolved Oxygen	Improvements at Metro enable the County to meet Stage III effluent limits (or as modified by TMDL) for BOD	*			Outfall 001 effluent concentrations
	Improvements at Metro and related load reductions bring the lake into compliance with AWQS for DO during fall mixing.		*	*	Weekly or biweekly measurements through water column and high-frequency measurements at buoy
	Improvements at Metro reduce the volume-days of anoxia.			*	Weekly or biweekly measurements through water column and high-frequency measurements at buoy
	Improvements at Metro reduce the areal hypolimnetic oxygen depletion rate.			*	Weekly or biweekly measurements through water column and high-frequency measurements at buoy
Indicator bacteria	CSO remedial measures reduce the loading of fecal coliform bacteria entering the lake through Onondaga Creek, Ley Creek, and Harbor Brook during high flow conditions.	*		*	Storm event data: baseline and post-improvement rating curves for fecal coliform bacteria (load as a function of total precipitation, and total storm flow)
	Implementation of Stage 1 and II improvements to the wastewater collection and treatment system (including CSO projects) will reduce concentration of indicator organisms in Onondaga Lake	*	*	*	Indicator bacteria abundance at nearshore stations during summer and following storms. Annual average concentration at South Deep, 0m depth
Chlorophyll-*a*	Metro improvements and related nutrient load reductions result in lower chlorophyll concentrations in the lake.			*	Weekly or Biweekly measurements at South Deep, photic zone and UML

TABLE A9-5 (continued)
Summary of Hypotheses Underlying the AMP

Monitoring Parameter	Hypothesis	Type of Hypothesis			Data Used for Assessment
		Compliance with SPDES permit	Compliance with ambient water quality standards or guidance value	Significant Trend or Shift in Monitoring Data	
Secchi disk transparency	Metro improvements and related nutrient load reductions result in improved water clarity (as measured by Secchi disk transparency) in Onondaga Lake			*	Weekly or Biweekly measurements at South Deep and nearshore stations.
Phytoplankton community	Metro improvements and related nutrient load reductions result in lower biomass of phytoplankton in Onondaga Lake			*	Biweekly samples of UML phytoplankton community, numbers, size and identifications (PhycoTech)
	Metro improvements and related nutrient load reductions result in reduced importance of cyanobacteria to the lake's phytoplankton biomass			*	Biweekly composite samples of UML phytoplankton abundance, biomass, and ID (PhycoTech)
Zooplankton community	Metro improvements and related nutrient load reductions reduce the biomass of zooplankton in Onondaga Lake			*	Biweekly composite samples of UML and tow (0-15 m), zooplankton abundance, size, biomass, ID (Cornell)
	Metro improvements and related nutrient load reductions (and DO improvements) increase the abundance of zooplankton deeper in the water column			*	Biweekly composite samples of UML and tow (0-12 m), zooplankton abundance, size, biomass, ID (Cornell)
Macroalgae	Metro improvements and related nutrient load reductions result in reduced areal coverage of macroalgae in nearshore areas of Onondaga Lake			*	Weekly surveys during recreational period (June –Sept) at eight nearshore stations.
Macrophytes	Metro improvements and related nutrient load reductions result in increased areal coverage of macrophytes in littoral zone of Onondaga Lake			*	Percent cover, biomass, and maximum depth of growth. Surveys: 2000, 2005, 2010 plus annual aerial photos (% cover)

TABLE A9-5 (continued)
Summary of Hypotheses Underlying the AMP

Monitoring Parameter	Hypothesis	Type of Hypothesis			Data Used for Assessment
		Compliance with SPDES permit	Compliance with ambient water quality standards or guidance value	Significant Trend or Shift in Monitoring Data	
Macrophytes	Metro improvements and related load reductions result in increased number of macrophyte species in Onondaga Lake			*	Macrophyte species richness Detailed surveys: 2000, 2005, 2010
Littoral macroinvertebrates Note: effects may be in strata 2, 3, and 4	Implementation of load reductions at Metro and CSO remediation will increase species richness of littoral benthic macroinvertebrates			*	Littoral macroinvertebrate species richness. Detailed surveys: 2000, 2005, 2010
	Implementation of load reductions at Metro and CSO remediation will increase the relative abundance of benthic macroinvertebrates that are not chironomids or oligochaetes			*	Littoral macroinvertebrate dominance, percent oligochaetes. Detailed surveys: 2000, 2005, 2010
	Implementation of load reductions at Metro and CSO remediation will improve the NYSDEC Biological Assessment Profile as compared to baseline conditions.			*	NYSDEC calculated index Detailed surveys: 2000, 2005, 2010
	Implementation of load reductions at Metro and CSO remediation will improve the littoral macroinvertebrate HBI as compared to baseline conditions (indicating increased importance of pollution sensitive organisms in the community)			*	Hilsenhoff Biotic Index (HBI) Detailed surveys: 2000, 2005, 2010
Fish community	Implementation of load reductions at Metro and CSO remediation will increase the number of fish species present in Onondaga Lake			*	Annual program Species richness, electrofishing, gill nets,
	Implementation of load reductions at Metro and CSO remediation will increase the number of fish species that are sensitive to pollution present in Onondaga Lake			*	Annual program: (Electrofishing) Pollution tolerance index (Whittier and Hughes 1998)

TABLE A9-5 (continued)
Summary of Hypotheses Underlying the AMP

Monitoring Parameter	Hypothesis	Type of Hypothesis			Data Used for Assessment
		Compliance with SPDES permit	Compliance with ambient water quality standards or guidance value	Significant Trend or Shift in Monitoring Data	
Fish community	Implementation of load reductions at Metro and CSO remediation will increase the number of fish species reproducing in Onondaga Lake			*	Annual program Nesting survey Larval tows Larval light traps Littoral seines
	Implementation of load reductions at Metro and CSO remediation will improve the lake's IBI . Effects may be in strata 2,3, and 4			*	Annual program Electrofishing
	Implementation of load reductions at Metro and CSO remediation will increase the habitat available for the coolwater fish community			*	Fish space metrics: dissolved oxygen and temperature profiles at South Deep station

A9-4.5 Design of the AMP: Data Management

The AMP produces an extensive dataset; more than 20,000 water quality measurements are obtained each year in Onondaga Lake, its tributary streams, and the Seneca River. Dr. Walker has developed an integrated database to manage the data. This effort has resulted in a powerful tool for the County and other stakeholders to evaluate specific results by parameter, depth, and date. The database is also used to screen for outliers and test for trends; it generates plots for data exploration and reporting.

A9-4.6 Design of the AMP: Metrics to Measure and Report Progress

Raw data are submitted on a quarterly basis to the NYSDEC. Screened and validated data are provided annually and are included in the OCDWEP Annual AMP Report. The process of turning data into information occurs continually through the year and is formalized in the Annual AMP report. Results and findings of the complete monitoring effort are documented in this report which undergoes review by OLTAC members and NYSDEC simultaneously for their formal approval.

A series of metrics have been developed to organize and report the extensive AMP dataset. As defined by EPA, metrics are attributes of the physical, chemical and/or biological ecosystem that respond to human disturbance. For the Onondaga Lake watershed, metrics are designed to indicate progress towards compliance with applicable standards and guidelines, and progress towards attaining a desired use.

Selected metrics may relate directly to an impairment of the lake or watershed; relate to a resource of interest; or correspond to a published standard that, in turn, reflects the requirements of public health or the aquatic biota. Candidate metrics can be measured and interpreted with relative ease to answer basic questions such as: “is the lake getting better?” and “is it safe for my family to swim here?”

Metrics selected to interpret and report on the AMP data are listed in Table A9-6. Note that the metrics are grouped into categories that address human uses and ecosystem function.

(1) water contact recreation;
(2) aesthetics;
(3) aquatic life protection; and
(4) sustainable recreational fishery

Metrics for water contact recreation are straightforward: New York State Department of Health and EPA have standards and guidance values for indicator bacteria and water clarity that are designed to be protective of human health and safety. Selecting metrics for aesthetics is slightly more judgmental, as they relate to perceived attributes such as water color and clarity, odors, and the visible extent of weed and algal growth. Water quality conditions needed to support aquatic life are fairly well defined in federal criteria and state standards. Onondaga County AMP metrics are designed to track water quality and habitat conditions during critical periods for reproduction and survival of young animals.

TABLE A9-6
Summary of Metrics

Desired Use	Metrics	Measured By
Water contact recreation	Indicator Bacteria	Fecal coliform bacteria at nearshore and South Deep station.
	Water Clarity	Secchi disk transparency at nearshore stations.
Aesthetics	Water Clarity	Secchi disk transparency at South Deep.
	Bloom frequency and magnitude	Percent of chlorophyll-*a* measurements greater than 15 µg/l (moderate bloom).
		Percent of chlorophyll-*a* measurements greater than 30 µg/l (intense/nuisance bloom).
	Algal community structure	Percent non-blue green taxa.
Aquatic Life Protection	Ammonia N	Percent of measurements in compliance with standards.
	Nitrite N	Percent of measurements in compliance with standards.
	Dissolved Oxygen	DO at fall mixing.
Fish Reproduction and Recruitment	Indicator species with documented successful reproduction (ACJ cites walleye, bass, and sunfish)	Compare with list developed by Onondaga Lake Technical Advisory Committee and other experts based on habitat and nature of open system.
	Species found in the lake	Percent intolerant or moderately intolerant.
	Habitat quality	Percent cover of macrophytes: scaled to optimal level for largemouth bass (40 - 60% cover is target).

A9-5 Data interpretation for the biological programs

Analysis and interpretation of the biological components of the AMP is challenging. There are no equivalent promulgated standards as cited for the water quality parameters. The plan for analysis and interpretation of the biological data is primarily focused on changes over time. There are also limited comparisons with reference systems such as Oneida Lake, and comparisons to benchmark conditions considered desirable for various functions and values of the aquatic ecosystem.

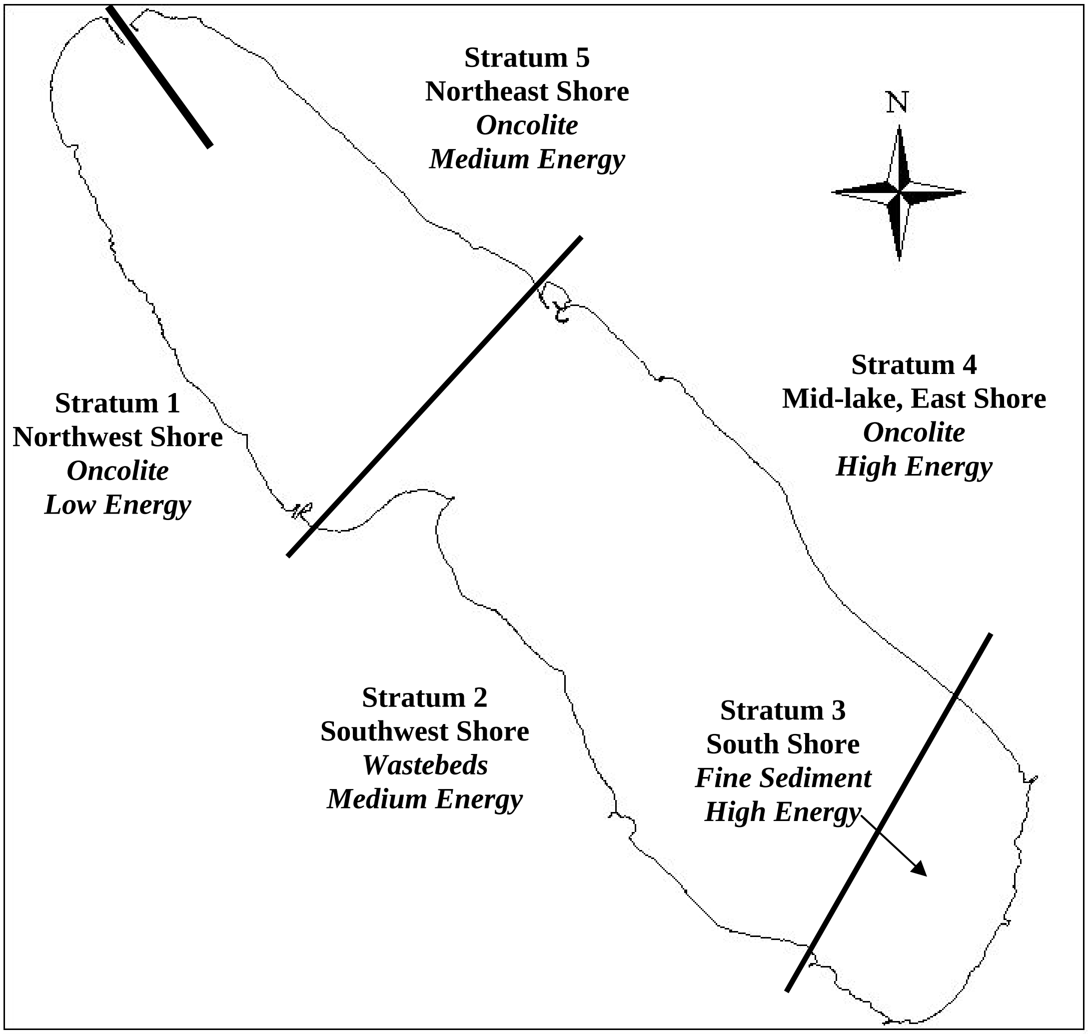
One way to interpret the fish data is to compare the current community to the fish community present in Onondaga Lake at two critical periods: (1) during the early years of European settlement, and (2) during the early 1960s. The nature of the early fish community can provide insight into the natural condition, while the community during the 1960s likely represents the worst conditions of water quality and habitat degradation.

However, the biological data, including fish, must be evaluated with respect to the rest of the ecosystem. For example, the reproductive success of some fish species is influenced by macrophyte coverage, planktivorous fish can alter zooplankton community assemblages, and zebra mussels can alter trophic interactions. In order to fully understand and interpret changes to one aspect of the biological community it is necessary to describe the biological components that interact and influence the community in question.

A9-5.1 Sampling design

Biological sampling in Onondaga Lake occurs both nearshore (fish, macroinvertebrates, macrophytes) and offshore (larval fish, zooplankton, phytoplankton). Because of the variability of the lake's nearshore habitat conditions, the littoral habitat was divided into five strata based on a combination of substrate type and wave energy, both of which influence aquatic macrophytes and macroinvertebrates and, in turn, fish distribution. These five strata are displayed in Figure A9-2:

Stratum 1. Oncolite substrate with low wave energy (NW portion of the lake).
Stratum 2. Wastebed substrate with moderate wave energy (SW shore)
Stratum 3. Soft substrate with high wave energy (South end)
Stratum 4. Oncolite substrate with high wave energy (SE shore)
Stratum 5. Oncolite substrate with medium wave energy (NE shore)



╱ Strata Boundaries	Figure A9-2. Map of Onondaga Lake showing boundaries of five sampling strata based on a combination of sediment texture and wave energy

The current schedule for biological monitoring through the 15-year AMP program is summarized in Table A9-7. This schedule may change as completion dates for CSO projects become firm or new issues arise. This table will be updated with subsequent revisions of the DAIP.

TABLE A9-7
Summary of Schedule and Methodologies Used for the Biological Monitoring Program

(Subject to annual NYSDEC review and approval; last updated March 2005)

Program	Component	Methods	Schedule	Comments
Fish	Adult	Littoral Electrofishing	Annual	Entire lake shoreline, transects alternate between collecting all fish encountered and gamefish only, 2 surveys; May, Sept.
		Littoral-profundal Gill Nets	Annual	One net each stratum, set on bottom at 5m depth, 2 events; May, Sept.
		Angler Diaries	Annual	Dependant on number of diaries returned
	Young-of-the-Year	Littoral Seines	Annual	15 sites, three sites per stratum, every 3 weeks, May-Oct, 8 events total
	Larvae	Pelagic Miller High Speed Trawls	Annual	Daytime samples, 4 transects N/S, oblique tows, ~surface to 5m depth, bi-weekly, May-Aug., 8 events total
	Nests	Visual Observation	Annual	Entire Shoreline, June
Macroinvertebrates	Lake Littoral Zone	Petite Ponar	2000 2005 2010	Five sites, one in each stratum, June, 18 replicates, identified to species level
	Tributary	Kick Net and Jab Net	Bi-annual	Four sites in Onondaga Creek, three sites in Ley Creek and Harbor Brook, July samples, 4 replicates, identified to species level
	As part of Tributary Mapping	Kick Net	2000 2002 2006 2012	One site per mile of stream, 26 sites in Onondaga Creek, 9 in Ley Creek, 7 in Harbor Brook, one sample per site, identified to Family level in the field
Macrophytes	Field Survey	Quadrats along Line Transects	2000 2005 2010	20 line transects, four per stratum, 1/2m^2, quadrats spaced every other m along the transect, from shore to 6m depth, species presence, percent coverage and biomass, August
	Lakewide Survey of Cover	Aerial Survey	Annual (if water clarity permits)	Low altitude air photographs of entire lake, color film, digital images. Every 5 years images are imported to GIS and areas of macrophyte growth delineated.
Zooplankton	Lake	Vertical Net Haul	Annual	Bi-weekly at South Deep, April to Nov., Quarterly at North Deep, UML sample plus 15m vertical net haul. Winter sampling if possible.
Phytoplankton	Lake	Vertical Net Haul	Annual	Bi-weekly at South Deep, April to Nov., Quarterly at North Deep, UML sample. Winter sampling if possible.

A9-5.2 Species Data

A9-5.2.1 Pollution tolerance

Organisms have varying degrees of sensitivity to disturbances in their environment. Those most sensitive to disturbance are the first to be extirpated and the last to re-colonize. Dominance and distribution of pollution-tolerant or pollution-sensitive organisms can indicate relative degree of impact between locations. Changes in the distribution of these communities can be tracked over time. The AMP utilizes several ways of examining pollution tolerance, including metrics specifically derived to quantify pollution tolerance (Table A9-8).

A9-5.2.2 Exotic/invasive species

Because Onondaga Lake is directly connected to the Barge Canal system, it is highly susceptible to invasion by exotic species. Invasive species often take advantage of disturbance to establish populations. Once established they can dramatically alter habitat, water quality, and trophic structure. The AMP has detected the early stages of invasion of several important species. For example, the exotic zooplankton *Cercopagis pengoi* was first detected in Onondaga Lake during routine sampling in 2000. Once exotic species are detected, the program can be tailored to track their progress and effects on the ecosystem.

A9-5.2.3 Associated with nuisance conditions

Some species can be considered to be a nuisance to humans. Some of these are directly perceptible, such as blue-green algal blooms, others become apparent to lake users through indirect effects in the food web. For example, the recent dramatic increase in the fish species alewife (*Alosa pseudoharengus*) has reduced the population of large-sized zooplankton (their preferred food source) in the lake; this reduction in large-sized zooplankton decreased the effective grazing pressure on algae. As a result, water clarity has declined.

A9-5.2.4 Included in management/rehabilitation plan

Some species have special meaning within the context of the ACJ and/or future management plans. This is most common with the fish program. For example, the ACJ states the County should “evaluate the success of walleye, bass and sunfish propagation (quantitative lakewide nest surveys, survival and recruitment estimates, and juvenile community structure) in the lake” (ACJ Appendix D, IV.5). These species are given special consideration within the biological monitoring program.

TABLE A9-8
Summary of Pollution Tolerance Metrics Used for the Biological Monitoring Program

Program	Component	Pollution Tolerance Metric	Comments
Fish	Adult	Pollution Tolerance Index	Based on the Index published by Whittier and Hughes (1998). These investigators compiled data from 169 lakes to develop an overall rating based on tolerance to eutrophication, turbidity, human activity in the watershed and species introductions. Their tolerance categories include: intolerant, moderately intolerant, moderate, moderately tolerant, and tolerant.
		Indicator Species	Indicators species are those that can be used to assess environmental condition. Presence of organisms known to be tolerant or sensitive to environmental degradation offer important information. Adult fish as indicator species are most useful if populations exist and are less useful if only a few individuals are encountered.
	Young-of-the-Year	Indicator Species	Young-of-the-year are excellent indicators of environmental change as the early life history stages are usually most susceptible to disturbance and pollution.
Macroinvertebrates	Lake Littoral Zone & Tributary	NYSDEC Biological Assessment Profiles	NYSDEC Biological Assessment Profiles are an Index of Biotic Integrity developed specifically for macroinvertebrates in New York State. An overall assessment of water quality for each site is calculated by averaging results of four individual metrics obtained through a scaled ranking of the index values. After all index values for a site are converted to a common scale value, they are averaged to obtain a score denoting overall assessment of water quality. The score results in a designation of one of four categories: non-impacted, slightly impacted, moderately impacted, or severely impacted.
		HBI	The Hilsenhoff Biotic Index (HBI) is considered by many investigators to be the most reliable index of composition of the macroinvertebrate community and water quality status (Novak and Bode 1992). HBI indicates the effects of organic pollution and is based on species-specific tolerance levels.
		Percent Oligochaetes	As oligochaetes are often found in high relative proportions in areas impaired by organic enrichment, their percent contribution to the community can be a good measure of the relative amount of organic enrichment at different locations. More importantly, the change in the percent contribution of oligochaetes over time, will be a good measure of the change in organic enrichment at the study sites.
	As part of Tributary Mapping	FBI	The Family Level Index (FBI) is based upon the tolerance values and theories the HBI but is conducted in the field with family level identifications.
Macrophytes	Field Survey	Indicator Species	Determination of environmental impact based on macrophytes is difficult. However some species have known tolerances to water quality variables. For example *Potamogeton pectinatus* (a species that has been common in Onondaga Lake since at least the early 1990's) is more tolerant of salinity than many other macrophytes. Knowledge of these types of tolerances can help in understanding the current lake community as well as the changes that occur.

A9-5.3 Population Data

A9-5.3.1 Average size of individuals

Size of individuals is monitored for fish and zooplankton in the AMP. The size that animals attain is a function of both the genetics of the organism as well as the environmental conditions the organism has been subjected to throughout its life. Changes in the ecosystem are often reflected by changes in growth, thus making analysis of size of certain organisms a potential valuable monitoring tool. For example, growth may be density dependant, so populations with poor recruitment may be characterized by fast-growing individuals. In addition, the size structure of some organisms can have dramatic cascading effects throughout the trophic structure of the lake. Average size of some organisms can also be compared to other regional lakes.

A9-5.3.2 Abundance

Abundance measures are difficult to quantify in biological populations due to their inherent spatial and temporal variability. However, changes in abundance can provide useful information in the AMP because change in population size is the mechanism underlying changes in many community metrics. Expected changes in abundance due to improving water quality or habitat may not always be positive. Some species exploit disturbed conditions and their abundance can be expected to decrease with improving conditions. As the dynamics of the lake community change, the lake will become more hospitable to some species and less to others, gradually abundance of species will change to reflect the new lake condition.

A9-5.3.3 Reproductive success (reproduction and recruitment)

Monitoring reproduction and recruitment of the fish community is particularly useful because the early life history stages are often very sensitive to disturbance. Reproductive success is affected by both biotic and abiotic factors. For example, reduction in ammonia concentration in the water column during the spring is likely to increase survival of sensitive early life stages (abiotic factor). Any effects of improved water quality on the fish community will likely first be reflected in the early life history stages. However, the food web effects must also be considered. Predation by fish such as alewife will reduce survival of larval fishes (biotic factor). The AMP monitors nesting of fish, larval fish, and juveniles.

A9-5.4 Community Data

A9-5.4.1 Richness

Richness, the number of different taxa (usually species) found in a community, is calculated for all components of the biological monitoring program. Richness may not be correlated with water or habitat quality. In fact, richness can increase with disturbance; for example, invasive species may become established without eliminating native species. Richness measurements can be used to detect substantial changes in community structure, if the sampling effort is held relatively constant. If changes in richness are detected, the underlying mechanism will be investigated to analyze the potential significance.

A9-5.4.2 Diversity

The distribution and abundance of different organisms, and how these attributes vary both spatially and temporally, play a major role in determining how an ecosystem functions to process energy and materials (Hooper et al. 2005). The numbers and types of organisms present (sometimes referred to as biodiversity) act together with the effects of climate, resource availability, and disturbance regimes to influence ecosystem properties (Hooper et al. 2005). Species composition, richness, evenness, and interactions respond to and influence ecosystem properties (Hooper et al. 2005). A high biodiversity can be interpreted as indicating functional stability (Karr 1968, Margalef 1968, Odum 1969). Biodiversity can be expressed in terms of numbers of entities (how many genotypes, species, or ecosystems), the evenness of their distribution, the differences in their functional traits, and their interactions (Hooper et al. 2005).

The Onondaga Lake biological monitoring program utilizes the Shannon-Weiner diversity index as a measure of biodiversity. Shannon-Weiner diversity is a function of both the number of species present (richness) and the equitability of distribution of individuals within these species (evenness) (Washington 1984). Shannon-Weiner diversity is greatest when large numbers of taxa are represented in equal proportions. Shannon-Weiner diversity can help determine if disparity occurs between different sites within the same waterbody or over time. However, care should be taken to not compare Shannon-Weiner diversity values between waterbodies as this metric is expected to differ depending on size and connectedness of the waterbody. Shannon-Weiner diversity is usually utilized with other more descriptive indices that, taken together, can yield a more complete view of the community. This group of metrics is used to document change at the community level. If changes are observed, species-level information is examined to determine the source of those changes and whether they might be attributed to changes in habitat or water quality.

A9-5.4.3 Presence and relative abundance of indicator organisms

One important characteristic of macroinvertebrates is their differential tolerance to various types of pollution; these different tolerances can influence the species composition and relative abundance of organisms in stream segments affected by various types of pollution. Several indices have been developed to examine the macroinvertebrate community and infer water quality and habitat conditions. Benthic macroinvertebrates are good indicators of localized conditions due to their limited migration patterns and sessile mode of life.

The tolerance of benthic macroinvertebrates to various types of pollution has been investigated, including organic (oxygen-demanding) waste, nutrients, sediment, salts, metals, and temperature. Both point sources and nonpoint sources (runoff) can cause these types of pollution to reach streams and rivers.

The AMP includes two macroinvertebrate sampling efforts to evaluate if the stream biota changes as CSO improvements are brought on line. The first is the biennial tributary macroinvertebrate program; macroinvertebrates are collected and identified to the lowest possible taxon (ideally, the species level) at three or four sites on the CSO-affected streams (Onondaga Creek, Ley Creek, and Harbor Brook). The second effort is associated with the periodic stream mapping program; macroinvertebrates are collected and identified to family at one site per stream mile on the three CSO-affected streams. Results are used to calculate standard indices that assess whether a stream segment is impaired, and what type of pollution is most likely responsible.

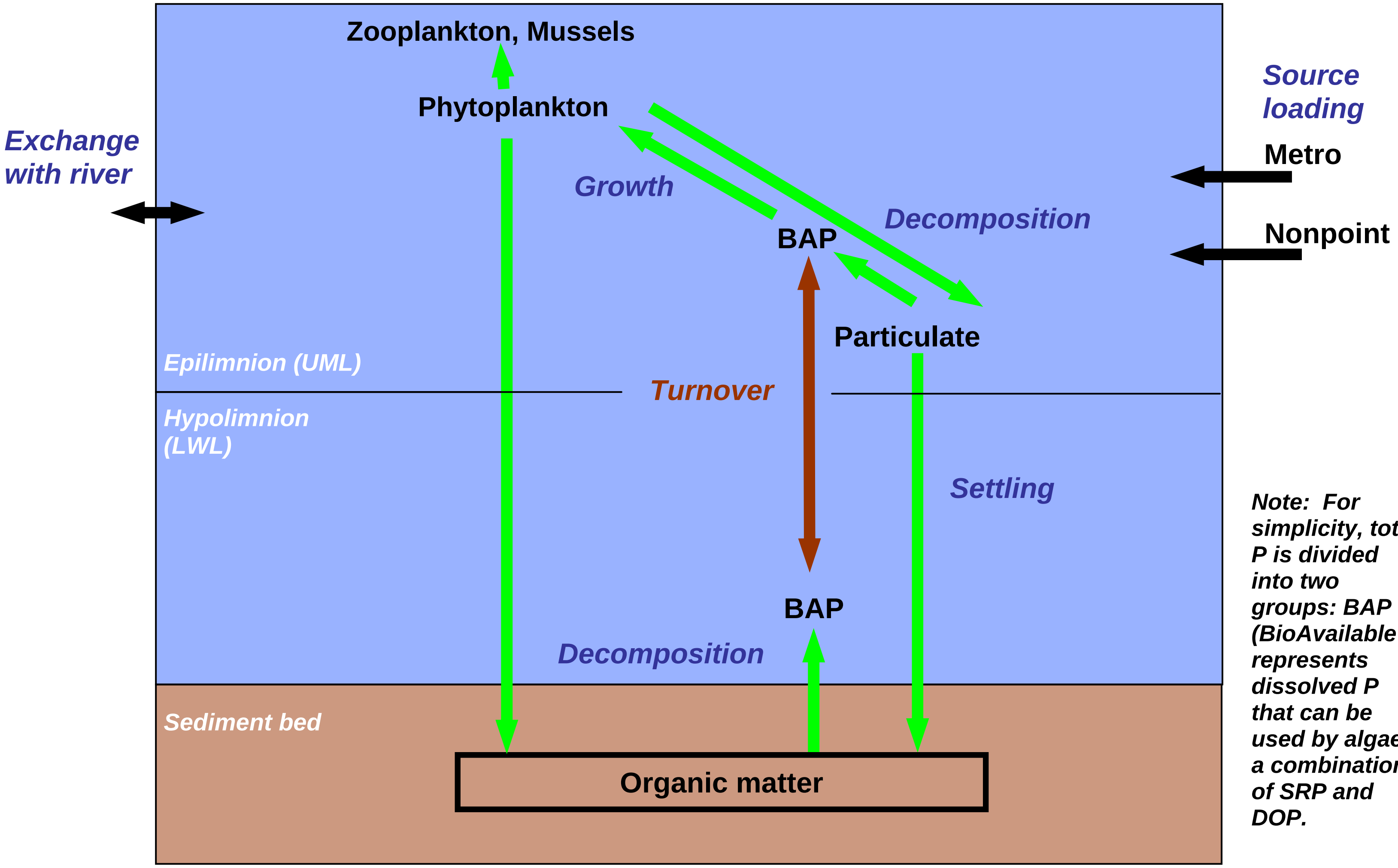
A9-6 Modeling

As described in Section 4, an integrated program of monitoring and modeling will provide the information needed to determine whether the improvements to Metro and the CSOs are sufficient to bring the surface waters (Onondaga Lake., the tributary streams, and a segment of the Seneca River) into compliance with state and federal requirements. Data from the AMP are used to construct and verify models. There are conceptual models of the lake and its watershed that describe how energy and materials cycle. Mathematical models, which are quantitative formulations of mechanisms and interactions that affect water quality, are under development.

A9-6.1 Conceptual Model

A conceptual model describes the interrelationships between physical, chemical, and biological characteristics of the lake and watershed; it provides a tool for interpreting data and understanding underlying mechanisms. The conceptual model also provides a valuable tool to evaluate the adequacy of the monitoring program itself and determine whether the appropriate questions are being asked of the ecosystem and the data set. Finally, the conceptual model provides the foundation for development of a predictive mathematical model.

A conceptual model of the phosphorus, nitrogen, and dissolved oxygen dynamics in Onondaga Lake was drafted by QEA, LLC and presented in the Onondaga County 2001 Annual AMP report. Figures from the 2001 AMP Annual Report are included in the DAIP; Figure A9-3 is the phosphorus cycle, Figure A9-4 is the Nitrogen cycle, and Figure A9-5 is the Dissolved Oxygen (DO) cycle.



Note: For simplicity, total P is divided into two groups: BAP (BioAvailable P) represents dissolved P that can be used by algae, a combination of SRP and DOP.

Figure A9-3. Conceptual model of phosphorus dynamics in Onondaga Lake under present conditions. Seasonal importance of primary pathways indicated by colors: Summer, Fall.

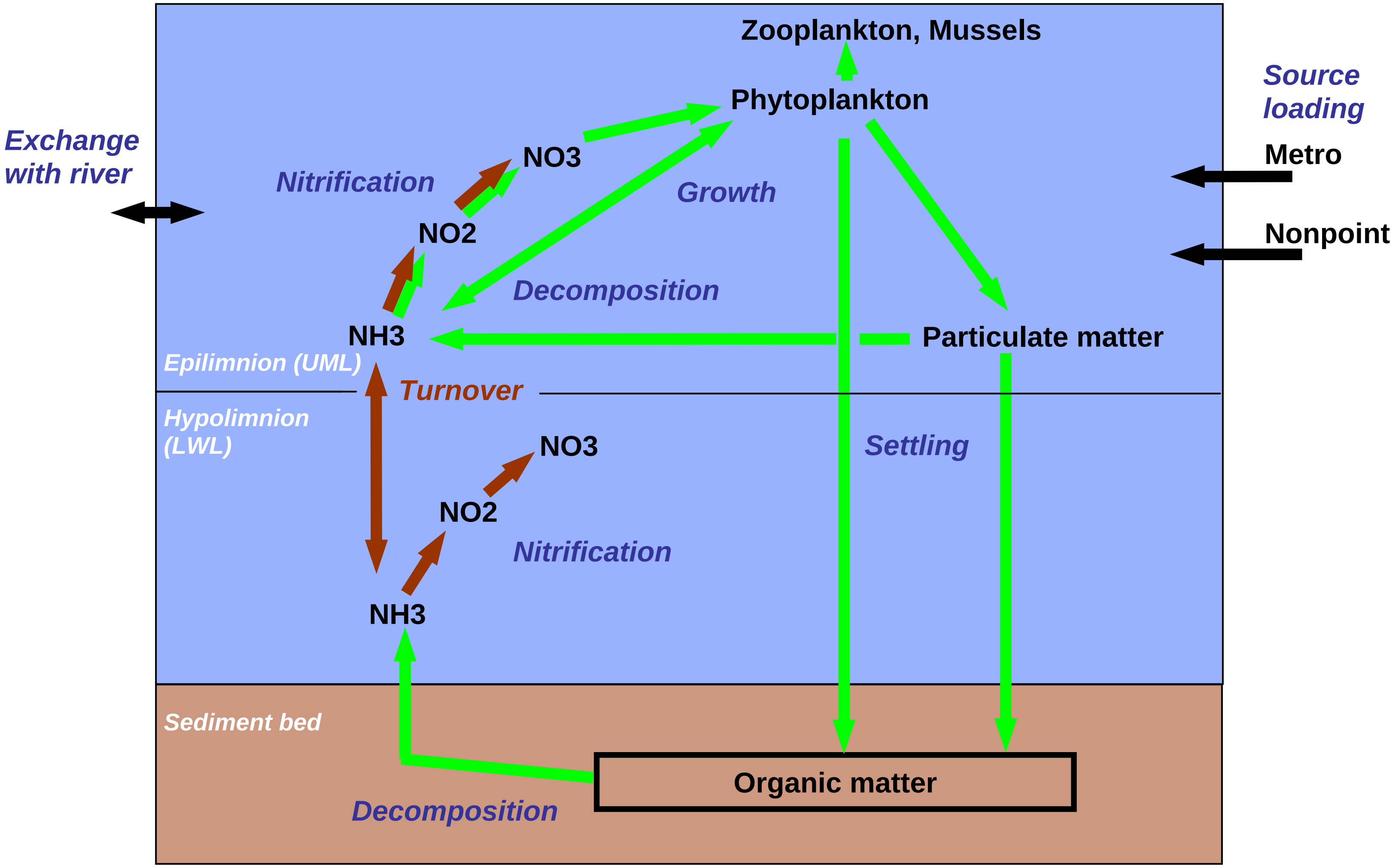
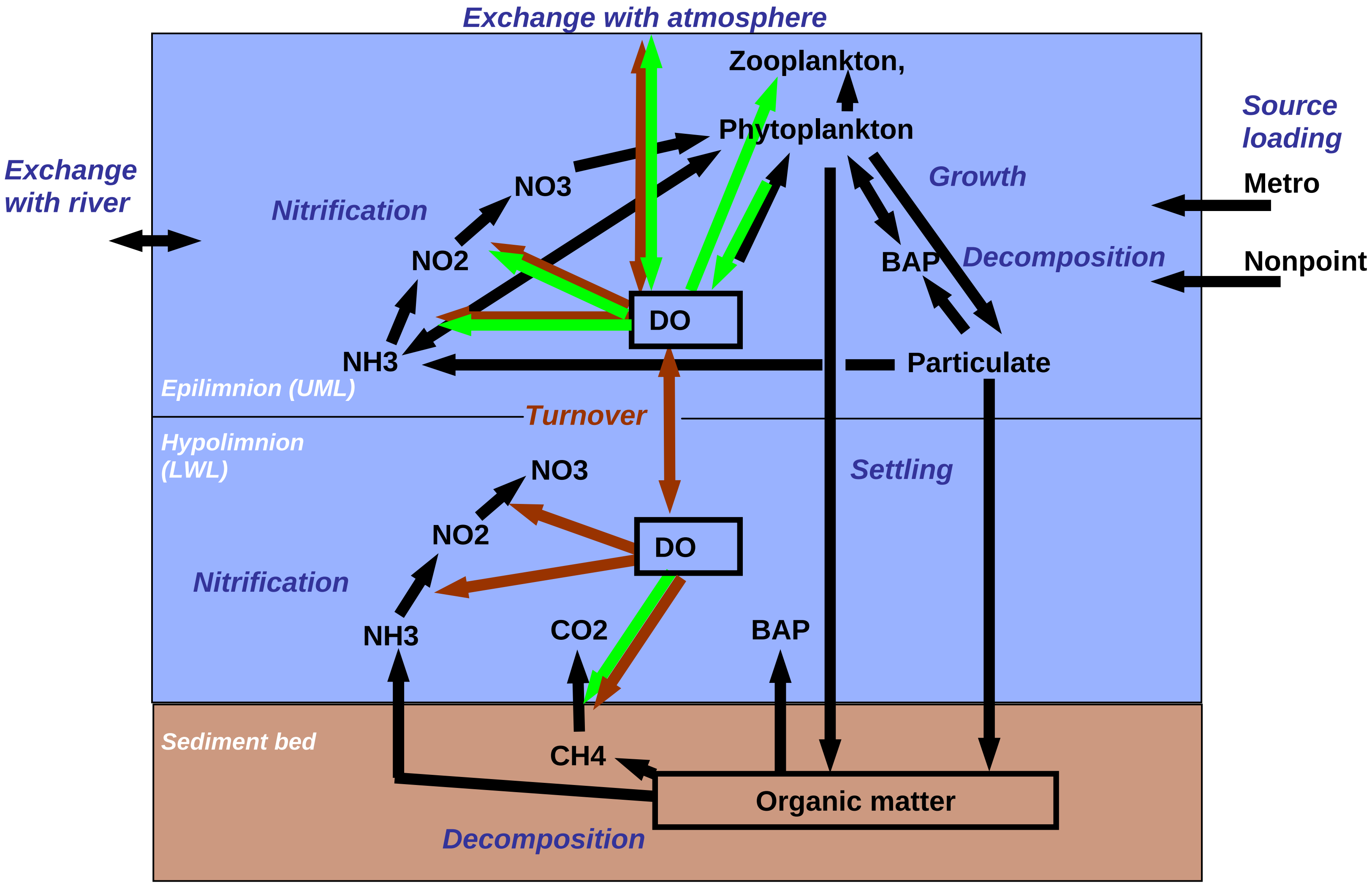


Figure A9-4. Conceptual model of nitrogen dynamics in Onondaga Lake under present conditions. Seasonal importance of primary pathways indicated by colors: Summer, Fall

Figure A9-5. Conceptual model of dissolved oxygen dynamics in Onondaga Lake under present conditions. Seasonal importance of primary pathways indicated by colors: Summer, Fall.



A9-6.2 Mass-balance Model

The development and structure of a mass-balance modeling framework for Onondaga Lake is described in the Onondaga County AMP Annual Reports. The framework facilitates computation and analysis of mass balances for nutrients and other water quality components using hydrologic and water quality data collected in the Lake and its tributaries since 1986. Lake water and mass balances are formulated on yearly and seasonal (May-September) time scales. Results provide a basis for:

(1) Estimating the magnitude and precision of loads from each source;
(2) Assessing long-term trends in load and inflow concentration from each source and source category (point, nonpoint, total);
(3) Evaluating the adequacy of the monitoring program, based on the precision of loads computed from concentration and flow data;
(4) Developing and updating an empirical nutrient loading model that predicts eutrophication-related water quality conditions (as measured by nutrient concentrations, chlorophyll-*a*, algal bloom frequency, transparency, and hypolimnetic oxygen depletion) as a function of yearly nutrient loads, inflows, and lake morphometry;
(5) Developing simple input/output models for other constituents; and
(6) Developing data summaries to support integration and interpretation of monitoring results in the County's annual AMP reports.

A9-6.3 NYSDEC Total Maximum Daily Load (TMDL) Allocation

The ACJ requires that NYSDEC issue a revised Total Maximum Daily Load (TMDL) allocation for ammonia and phosphorus inputs to Onondaga Lake on or about January 1, 2009. The TMDL will define the total loading of ammonia and phosphorus that can be assimilated by the lake while maintaining compliance with water quality standards. The total required reductions in point and nonpoint source loading will be defined. To complete this task, NYSDEC requires a reliable model of how the lake responds to loading, plus an accurate allocation of the sources of ammonia and phosphorus.

A9-6.4 USGS Onondaga Lake Watershed Model

One of the projects funded by the Onondaga Lake Partnership is a watershed model of the lake. USGS is developing this model which will be used to estimate nonpoint source loads of materials to Onondaga Lake under various hydrologic conditions and land use practices. The tributary loading estimates developed through the AMP are being used as the basis for model calibration.

A9-6.5 Three Rivers Water Quality Model (TRWQM)

A water quality model of the Three Rivers system was developed by QEA, LLC to assess the waste load assimilative capacity of the Seneca River. The model quantifies the River’s assimilative capacity and accommodates respiration of zebra mussels, as set forth in the AMP Requirements (ACJ Appendix D, item IV.2, refer to pages 8- 9 of this document). The model will serve as the basis for a TMDL allocation for oxygen-demanding materials and will be used to determine if diversion of Metro effluent to the Seneca River is a viable alternative.

Onondaga County funded development of the TRWQM. The model domain extends from Cross Lake to the Phoenix Dam. A peer review of the TRWQM has been completed.

The model simulates water quality conditions in the river in response to various environmental conditions, including upstream water quality conditions, point source discharges, water temperature, and zebra mussel growth.

A9-6.6 Onondaga Lake Model

Onondaga County has completed a Request for Proposals and selection process for development of a water quality/eutrophication model of Onondaga Lake. QEA, LLC will complete the lake model that will be used for the NYSDEC TMDL allocation and final effluent limits. This water quality model will link the watershed model and the TRWQM. The model will be developed using data from the AMP and will be the primary means of determining the level of treatment and location of the Metro discharge; to address the issues outlined in Section 4 of this DAIP. Model development will be a collaborative effort that includes Onondaga Lake Partnership as well as expert peer reviewers. While the primary focus is on water quality, the model will incorporate biological influences on the lake ecosystem. The overall goal will be to develop a tool that can help assess water quality improvements from both the bottom-up effects (i.e. reduced loading of nutrients and organic material) and the top-down effects (i.e. food web interactions).

A9-7 Literature Cited

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APPENDIX 10: SPECIAL STUDIES

A. SPENCE-PATRICK WELL-POINT (ONONDAGA CREEK GROUNDWATER) 2004

B. ONONDAGA CREEK INNER-HARBOR BACTERIA DATA

C. TRIBUTARY DATA UPSTREAM/DOWNSTREAM OF CSOs

A. SPENCE-PATRICK WELL-POINT (ONONDAGA CREEK GROUNDWATER) 2004

DATE	ALK-T	BOD5	Ca	Chloride	COND	DO-field	Fe	K	Mg	Mn	Na	pH-field
23-Mar-04	105	4	1640	57800	137600	4.8	82.8	98.4	227	0.458	33900	6.84
16-Jun-04	108		1570	61500	121000	4.6	50.7	97.5	260	0.490	35900	6.65
08-Sep-04	118		2110	63000	146600	4.3	11.4	128	299	0.314	50500	6.65
05-Nov-04	158		2070	62700	149800	4.2	18.2	125	295	0.452	47200	6.63
Mean	**122**	**4**	**1848**	**61250**	**138750**	**4.5**	**41**	**112**	**270**	**0.43**	**41875**	**6.69**
Min	**105**	**4**	**1570**	**57800**	**121000**	**4.2**	**11**	**98**	**227**	**0.31**	**33900**	**6.63**
Max	**158**	**4**	**2110**	**63000**	**149800**	**4.8**	**83**	**128**	**299**	**0.49**	**50500**	**6.84**

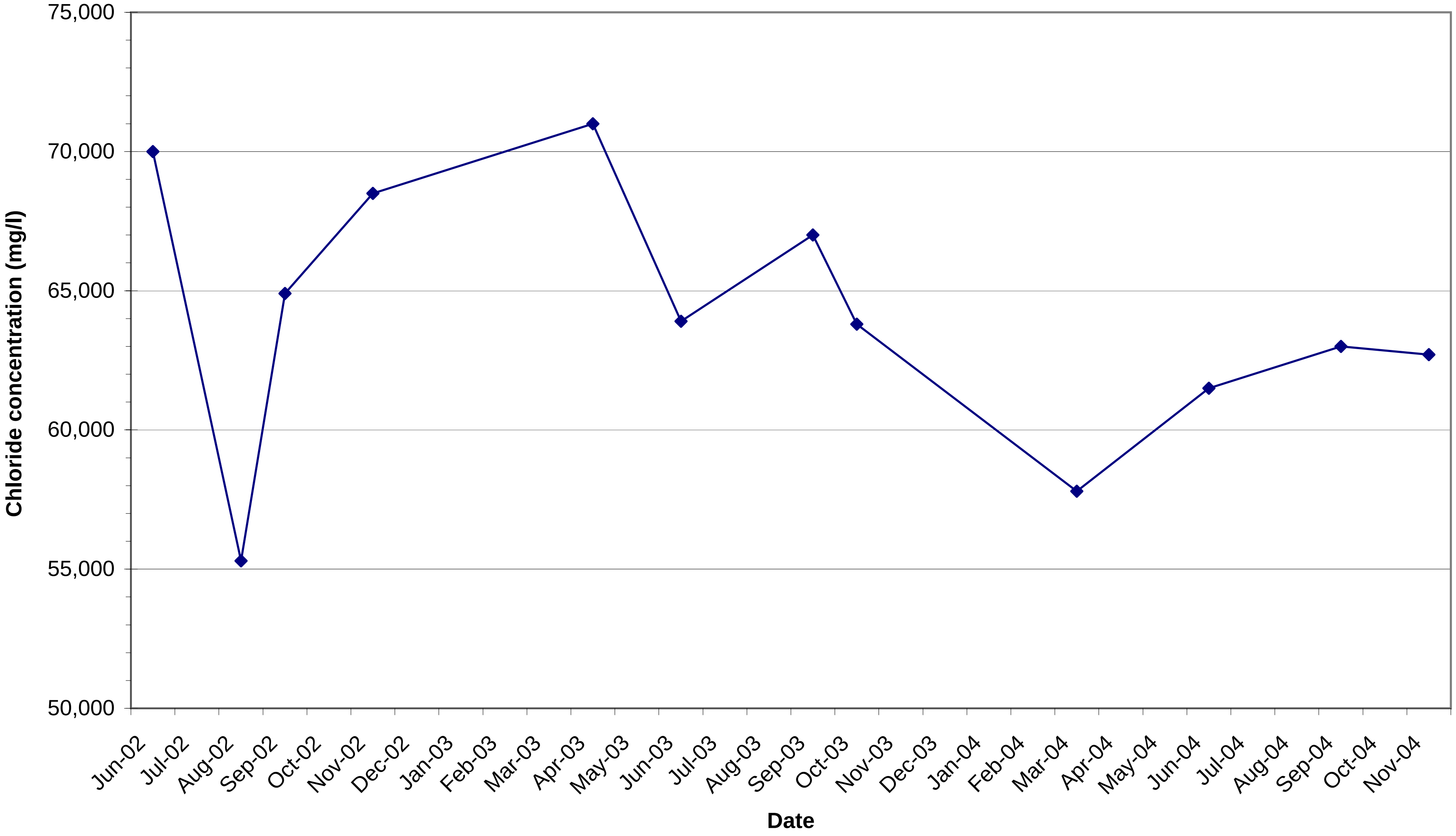
DATE	Redox	Salinity-field	SO4	TDS	Temp-field	TSS
23-Mar-04		105.98	3170	94500	12.35	167
16-Jun-04	64	91.14	2860		16.95	
08-Sep-04	22	115.32	3900		14.76	
05-Nov-04		116.97	3020		9.77	
Mean	**43**	**107**	**3238**	**94500**	**13.5**	**167**
Min	**22**	**91**	**2860**	**94500**	**9.8**	**167**
Max	**64**	**117**	**3900**	**94500**	**17.0**	**167**

Table A10-A1. Spence-Patrick Well-Point (Onondaga Creek Groundwater) at quarterly samples in 2004.

	Onondaga Creek		Onondaga Creek			Harbor Brook			
	Dorwin Ave.		Kirkpatrick St.			Velasko Rd.		Harbor Brook Hiawatha Blvd.	
WQ Variable	**Load**	**Concentration**	**Load**	**Concentration**		**Load**	**Concentration**	**Load**	**Concentration**
Chloride	15,339	118	71,031	425		2,151	228	2,712	270
TP	7,942	61	10,945	65		398	42	811	81
SRP	554	4	1,253	7		76	8	255	25
TN	200,556	1,541	266,582	1,595		20,254	2,147	21,434	2,131
NH3	8,440	65	18,206	109		8,440	65	18,206	109

Table A10-A2. Upstream-downstream comparison of mean loading and concentration in Onondaga Creek and Harbor Brook from 2000-2004. Data are from Appendix 7, Tables 2 through 6. Chloride load is in million tons, concentration is ppm. Other loads are in kg, concentrations in ppb.

Figure A10-A1. Spence-Patrick Well-Point (Onondaga Creek-Groundwater) Chloride (mg/l)



B. ONONDAGA CREEK INNER-HARBOR BACTERIA DATA

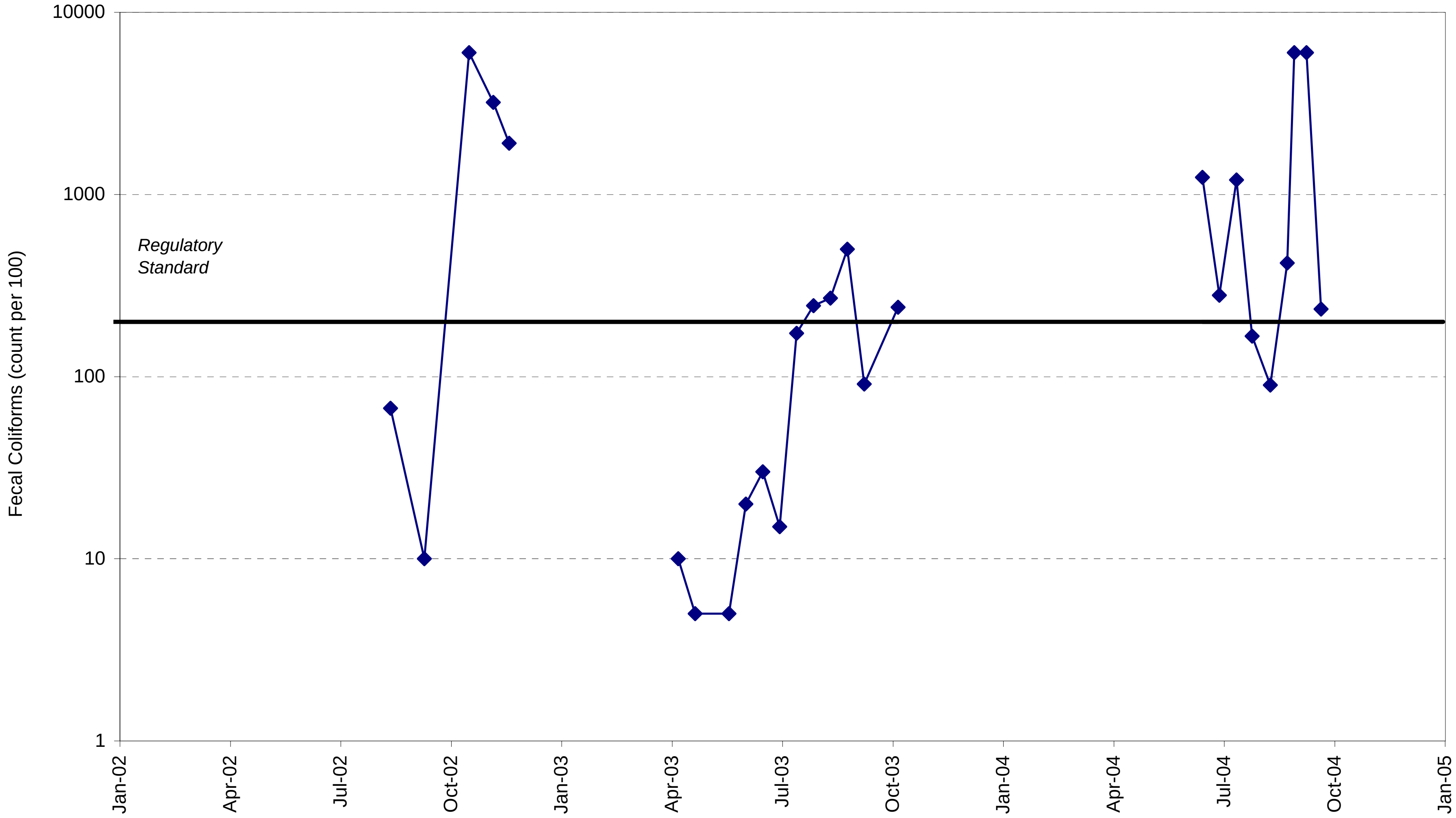


Figure A10-B1. Fecal Coliforms measured in the Inner Harbor over time, 2002 through 2004. Regulatory standard is 200 count per 100.

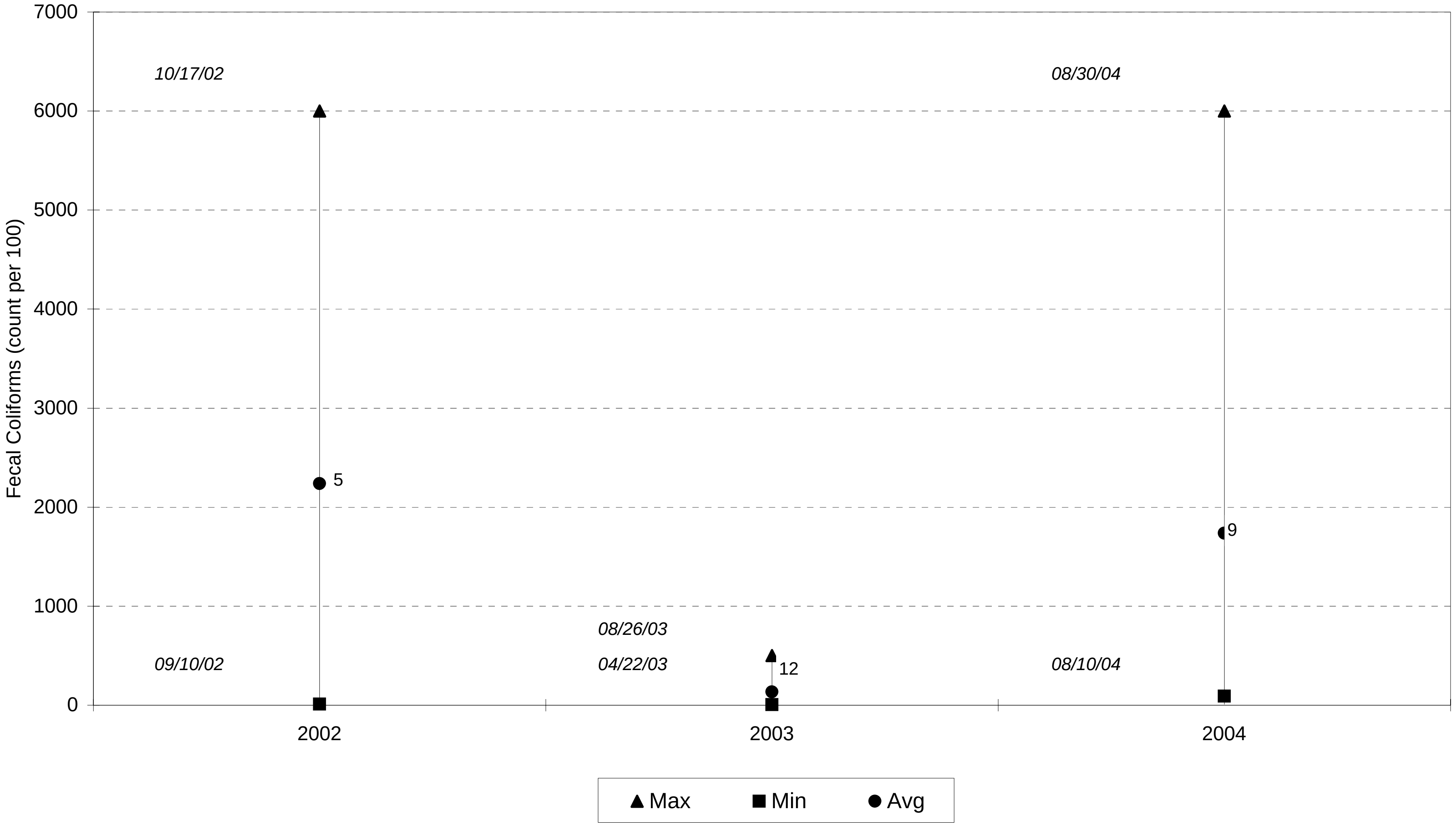


Figure A10-B2. Statistical summary by year of fecal coliforms measured in the Inner Harbor. Sample count appears beside Average marker. Maximum and Minimum sample dates appear beside the appropriate markers. Regulatory limit is 200 count per 100.

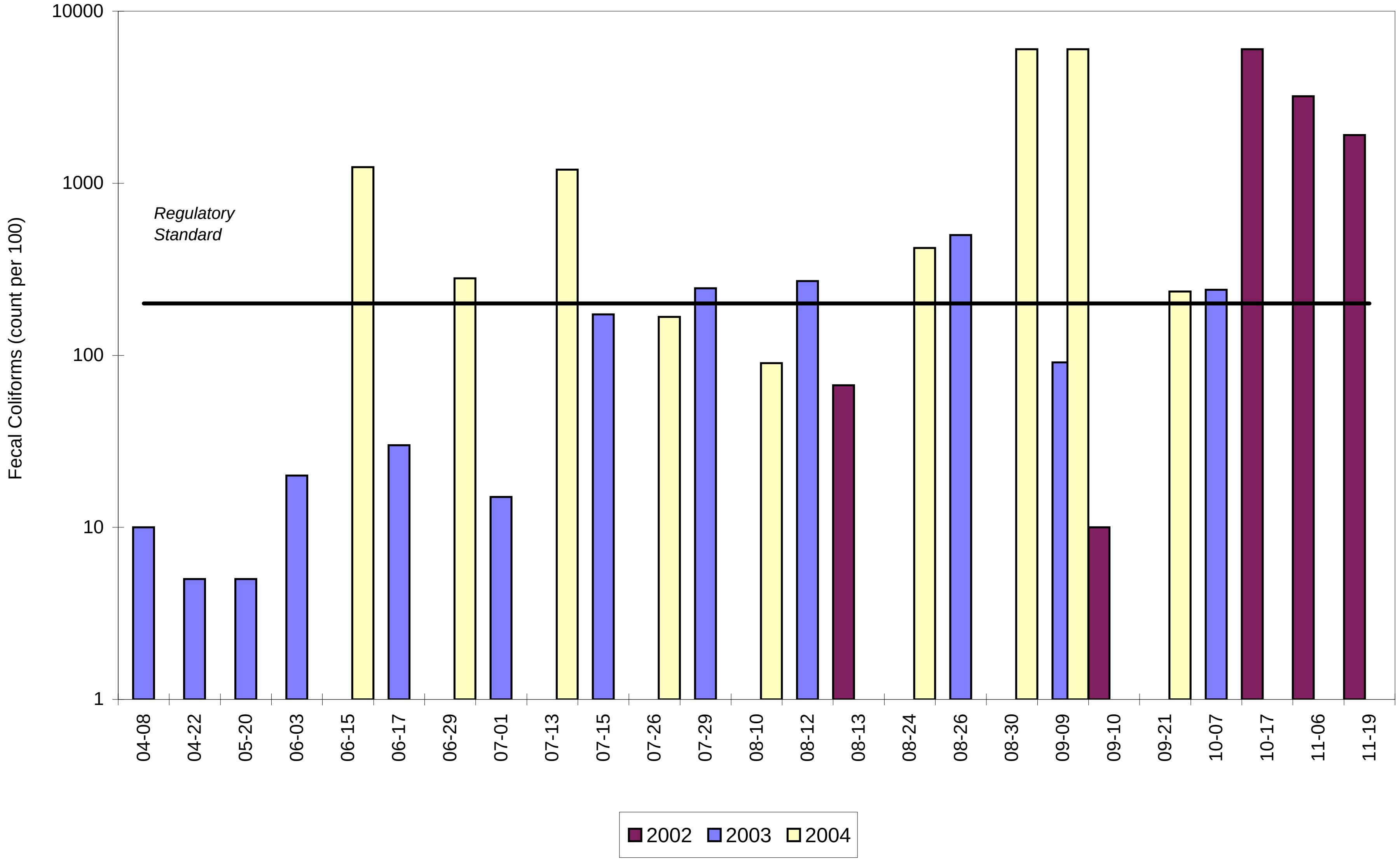


Figure A10-B3. Fecal Coliforms measured in the Inner Harbor, 2002 to 2004, comparison of yearly data by time of year. Regulatory limit is 200 count per 100.

C. TRIBUTARY DATA UPSTREAM/DOWNSTREAM OF CSOs

	Onondaga Creek		Onondaga Creek			Harbor Brook		Harbor Brook	
WQ	**Dorwin Ave.**		**Kirkpatrick St.**			**Velasko Rd.**		**Hiawatha Blvd.**	
Variable	**Load**	**Concentration**	**Load**	**Concentration**		**Load**	**Concentration**	**Load**	**Concentration**
Chloride	15,339	118	71,031	425		2,151	228	2,712	270
TP	7,942	61	10,945	65		398	42	811	81
SRP	554	4	1,253	7		76	8	255	25
TN	200,556	1,541	266,582	1,595		20,254	2,147	21,434	2,131
NH3	8,440	65	18,206	109		8,440	65	18,206	109

Table A10-C1. Upstream-downstream comparison of mean loading and concentration in Onondaga Creek and Harbor Brook from 2000-2004. Data from Appendix 7, Tables 2 through 6. Chloride load is in million tons, concentration is ppm. Other loads are in kg, concentrations in ppb

APPENDIX 11: BIBLIOGRAPHY OF MATERIAL PERTAINING TO ONONDAGA LAKE, NEW YORK

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APPENDIX 12: 2004 RAW ANALYTICAL DATA

2004 Onondaga Lake Analytical Data
2004 Onondaga Lake Deep Stations Data
2004 Onondaga Lake South Deep LiCor Data
2004 Onondaga Lake Tributaries Analytical Data
2004 Onondaga Lake Tributaries In-Situ Data
2004 Seneca River Survey Data (ALL)

2004 Syracuse Metropolitan WWTP & USGS Flow Data