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Monitoring and Evaluation of Cyanobacteria in Lake Champlain

Summer 2004

Prepared by
Mary C. Watzin, Emily Brines Miller, Meghan Kreider, Sam Couture, Todd Clason, and Michael Levine, Rubenstein Ecosystem Science Laboratory, Rubenstein School of Environment and Natural Resources University of Vermont with support from: Gregory L. Boyer, Department of Chemistry, State University of New York, College of Environmental Science and Forestry

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MONITORING AND EVALUATION OF CYANOBACTERIA IN LAKE CHAMPLAIN

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Report to

Lake Champlain Basin Program

Mary C. Watzin, Emily Brines Miller, Meghan Kreider, Sam Couture, Todd Clason and Michael Levine
Rubenstein Ecosystem Science Laboratory
Rubenstein School of Environment and Natural Resources
University of Vermont
Burlington, VT 05401

with support from:

Gregory L. Boyer
Department of Chemistry
State University of New York
College of Environmental Science and Forestry
Syracuse, NY 13210

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EXECUTIVE SUMMARY

In 2004, monitoring for potential toxin-producing cyanobacteria continued on Lake Champlain with the following specific objectives:

- Continue monitoring of BGA at selected stations in the greater Burlington area, the Long-term Water Quality and Biological Monitoring Project sites, and Missisquoi Bay by UVM and the Vermont DEC. The Burlington Bay sampling will focus on the lake area above the Burlington and Champlain Water district intakes, and off of Red Rocks and North Beaches.
- Continue to work with volunteer lay monitors in Missisquoi Bay and through the Vermont Lay Monitoring program administered by the Vermont DEC.
- Continue screening for the presence of toxins when potential toxin-producing BGA are observed.
- Continue to use and refine a tiered BGA alert system framework, incorporating data and knowledge gained during 2003.
- Enhance the communication network among state and provincial agencies in Vermont, New York and Quebec to facilitate exchange of information about current BGA conditions and the potential for human exposure to toxins. Continue to work towards a lake-wide standard for reporting this information.

Collections of net and whole water plankton began in June in most locations, and continued through October. Sample sites encompassed all of Lake Champlain, but a special effort was made in Missisquoi Bay and St. Albans Bay, areas known to have problems with toxic blooms in the past. Lay monitors living around Missisquoi Bay were recruited to collect samples from shoreline locations where algae accumulated.

In 2004, potential toxin-producing cyanobacteria species remained a common part of Lake Champlain's plankton. As in the past two years, highest abundances were found in Missisquoi Bay and St. Albans Bay, where total phosphorus and total nitrogen concentrations were also high. Using the 2004 data, we also found that N:P ratios were low in Missisquoi Bay and St. Albans Bay, a condition that may favor cyanobacteria. Microcystins were common in samples collected from both Missisaquoi Bay and St. Albans Bay from July through October 2004. The seasonal average for microcystin in Missisquoi Bay was 49 µg/L; for St. Albans Bay it was 2.2 µg/L. Highest concentrations were found in shoreline algal accumulations sampled in August and September. In 2004, anatoxin-a was not detected at any site.

As in past years, there was a high degree of spatial variability in toxin concentrations, and all high toxin concentrations were found in dense surface accumulations of algae or in scums. The lay monitors were again particularly valuable in extending our sampling effort to include the shoreline problem areas. The e-mail notification system worked well to keep public health officials informed about algal and toxin conditions, but additional public education efforts are still needed when a bloom develops.

INTRODUCTION

In 1999, cyanobacteria, also known as blue-green algae (BGA), bloomed in parts of Lake Champlain and may have produced toxins potentially harmful to human health. During the summer of 2000, a collaborative effort involving the University of Vermont (UVM), the NRCS Watershed Science Institute, the Vermont Department of Health (VT DOH), the Vermont Department of Environmental Conservation (VT DEC), SUNY-ESF in Syracuse (SUNY), Wright State University, the Florida Department of Health and the Maine Department of Marine Resources documented the regular presence of toxin-producing blue-green algae in lake, as well as trace amounts of cyanotoxin on several occasions.

In the summer of 2001, UVM, VT DOH and SUNY continued the collaborative effort, concentrating on the larger Burlington Bay area. Plankton communities in the vicinity of two drinking water facilities (the Champlain Water District and the Burlington Municipal Water Treatment Plant) and two public beaches (North Beach in Burlington and Red Rocks Beach in South Burlington) were monitored over the growing season. While BGA were noted in the study area during 2001, and toxins were detected in concentrated plankton samples; environmental conditions in Burlington Bay did not support extensive blooms. Such blooms occurred in other areas of Lake Champlain, including Missisquoi Bay, St. Albans Bay, the Northeast Arm and the Inland Sea. Although the potential for human exposure to toxins may be greater in the Burlington Bay area because of the large municipal water systems and the beaches, the environmental conditions were not conducive to massive blooms that could release large amounts of toxins into the water.

In 2002, monitoring continued in the Burlington area, and was expanded to include the 12 stations routinely sampled as part of the Vermont and New York Long-Term Water Quality and Biological Monitoring program, as well as several locations in St. Albans Bay and selected samples from Missisquoi Bay. A tiered alert system prototype was tested during the summer. Burlington Bay again had low densities of BGA in 2002, whereas St. Albans Bay and especially Missisquoi Bay had high densities of BGA by mid-July.

In 2003, the monitoring effort continued in Burlington Bay, St. Albans Bay and at the Long-Term Monitoring sites. Monitoring was expanded to include several additional sites in Missisquoi Bay, a site near the Crown Point Bridge in the southern portion of the lake, and a number of locations sampled by volunteers in the South Lake and in the Missisquoi Bay area. These additional locations were monitored with the prototype tiered alert system, and provided more data for refinement and improvement of this monitoring framework.

In 2004, monitoring efforts continued in Burlington Bay, at the Long-Term Monitoring sites, in Missisquoi Bay and St. Albans Bay, and at selected other sites. Missisquoi Bay continued to be the focus of much of our effort since massive blooms have developed in this area during the last three years, and microcystin levels have routinely exceeded the WHO (1998) guideline of 1 µg/L for drinking water in this area.

The Specific Objectives of the Monitoring Program in 2004 were to:

- Continue monitoring of BGA at selected stations in the greater Burlington area, the Long-Term Water Quality and Biological Monitoring Project sites, and Missisquoi Bay by UVM and the Vermont DEC. The Burlington Bay sampling will focus on the lake area above the Burlington and Champlain Water district intakes, and off of Red Rocks and North Beaches.
- Continue to work with volunteer lay monitors in Missisquoi Bay and through the Vermont Lay Monitoring program administered by the Vermont DEC.
- Continue screening for the presence of toxins when potential toxin-producing BGA are observed.
- Continue to use and refine a tiered BGA alert system framework, incorporating data and knowledge gained during 2003.
- Enhance the communication network among state and provincial agencies in Vermont, New York and Quebec to facilitate exchange of information about current BGA conditions and the potential for human exposure to toxins. Continue to work towards a lake-wide standard for reporting this information.

METHODS

Field Collection

To survey plankton populations lakewide, we established partnerships with the VT DEC staff and the VT Lay Monitoring Program. VT DEC staff collected plankton samples from the 14 Long-Term Monitoring Program sites during their routine collections (Figure 1). Lay monitors collected plankton samples during routine collections at additional sites, primarily in the southern sections of Lake Champlain. Working with the Lake Champlain Committee, we also recruited volunteers to sample shoreline locations in Missisquoi and Maquam Bays (Figure 2). We also sampled sites in Burlington Bay (Figure 3), where the highest population density of basin residents live and two large water supply systems draw their water.

Frequency. Monitoring for the presence of BGA began in May at the VT DEC sites, in early June 2004 on Burlington Bay and at the McCuen Slang Boat Launch in the South Lake, St. Albans Bay, and Missisquoi Bay sites. Sampling continued through October at all these locations. Lay. The VT DEC sites were sampled approximately biweekly regardless of bloom conditions, as dictated by the state's regular program activities. The Vermont Lay Monitors in the south lake only took samples if blue green algae were noted at their sampling location. Frequency of sample collection in Burlington Bay, Missisquoi Bay, St. Albans Bay, and at the McCuen Slang Boat Launch was bi-weekly or weekly, as determined following the tiered alert system framework (Table 1). This framework, based on recommendations in Chorus and Bartram (1999) calls for less frequent sampling initially, then weekly sampling once bloom conditions appear. The lay monitors in Missisquoi Bay and Maquam Bay sampled weekly from July through August. In Burlington Bay, cyanobacteria levels remained low throughout the season, and we remained at a bi-weekly sampling interval for the entire period. In Missisquoi and St. Albans Bay, algal densities were much higher, and weekly sampling was initiated in early July and continued until September, when cell densities indicated the decline of the bloom.

Figure 1. Location of the Lake Champlain Long-Term Biomonitoring Project Stations.

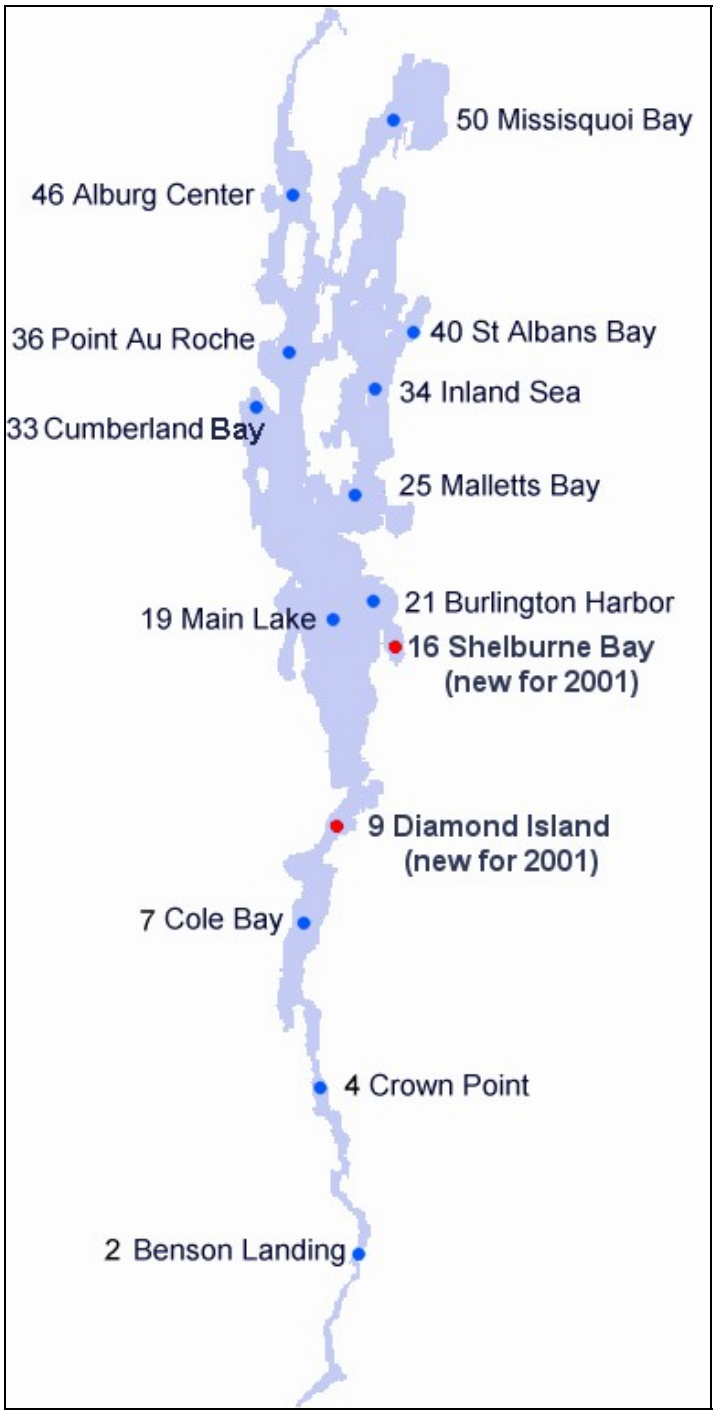


Figure 2. Sampling locations in Missisquoi Bay, 2004.

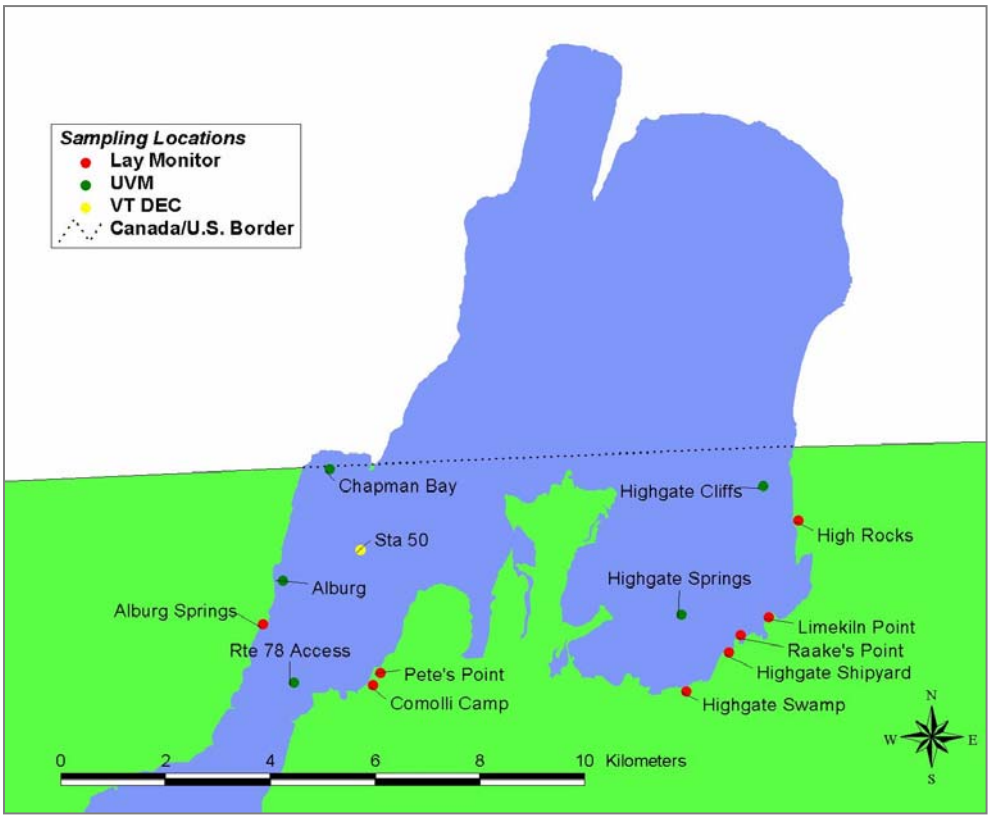


Figure 3. Sampling locations in Burlington Bay, 2004.

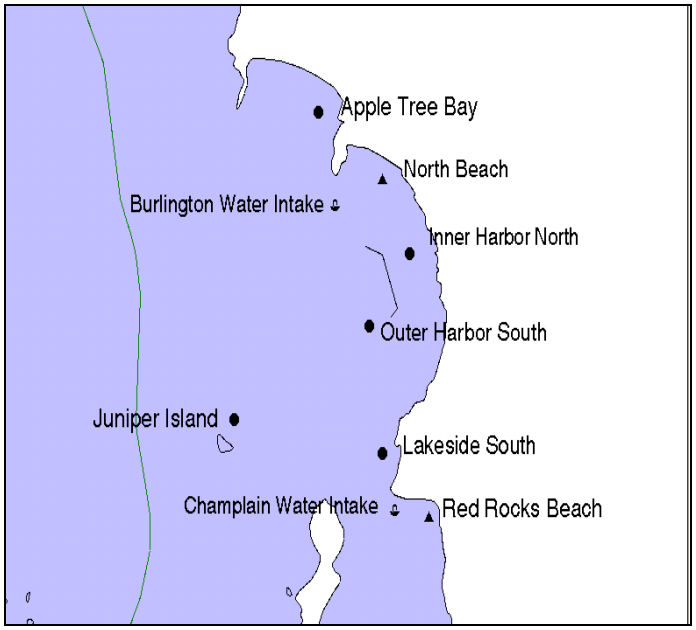


Table 1. Outline of our prototype tiered sampling and alert framework.

Qualitative sampling	
Frequency:	2/month
Collect:	Vertical plankton tows (63 µm net, upper 3 m) Screened within 48 hours
Conclusions:	If potential toxin-producing taxa observed, proceed to *Quantitative sampling*
Quantitative sampling	
Frequency:	2/month
Collect:	Vertical plankton tow (63 µm net, upper 3m) Full enumeration within 48 hours
Conclusions:	If BGA reaches densities reach 2000 cells/mL, proceed to V*igilance level*
Vigilance level	
Frequency:	1/wk at mid-day
Collect:	Vertical plankton tow (63 µm net, upper 3m) Full enumeration within 48 hours
Conclusions:	If BGA exceed 4,000 cells/mL with greater than 80% of natural units BGA, proceed to *Alert Level 1* Return to *Quantitative sampling* if densities fall below 2,000 BGA cells/mL Notify public health officials that BGA are abundant and blooms could form
Alert Level 1	
Frequency:	1/wk at mid-day (or more frequently as needed)
Collect:	Whole water phytoplankton samples Whole water chlorophyll *a* Whole water toxin samples
Conclusions:	If microcystin concentration exceeds 1µg/L, proceed to *Alert Level 2* Notify public health officials of potential risks to humans and animals
Alert Level 2	
Frequency:	1/wk at mid-day (or more frequently as weather conditions dictate)
Collect:	As for alert level 1
Conclusions:	Return to *Alert Level 1* if microcystin concentration drops below 1 µg/L Notify public health officials that significant risk to humans and animals exists. Public Health Advisories should be issued by appropriate agencies.

Analytical Parameters. The following types of samples were collected in Burlington Bay, St. Albans Bay and Missisquoi Bay during 2004:

- whole water and net plankton
- whole water for total nitrogen
- whole water for total phosphorus
- whole water for chlorophyll *a*
- whole water and plankton for toxins (the analysis of this parameter began when microscopic analysis indicated potential toxin-producing taxa were present)

At the VT DEC sites, only net plankton samples were collected for this project; however, total nitrogen, total phosphorus, and chlorophyll samples were collected as part of the Long-Term Biomonitoring Project.

In Burlington Bay, temperature, conductivity and oxygen were measured using a Seabird profiler from 0.5 m below the surface to 0.5 m above the bottom on some dates. Secchi depths were measured at all locations in Burlington Bay, Missisquoi Bay, St. Albans Bay, and at the Long-Term Biomonitoring Project sites.

Sample Collection. Net plankton, net chlorophyll and net toxin samples were obtained using a 63μm Wisconsin net. A single 3m tow was collected, placed in a cooler, and transported back to the laboratory where it was subdivided for the analyses. The total volume collected for each composite was recorded.

Total nitrogen, total phosphorus, whole water chlorophyll, and whole water plankton samples were collected by surface grab sampling. Two replicates were collected for each parameter.

Preservation and storage. Nalgene bottles were used for all samples. Nutrient and toxin containers were cleaned with 20% hydrochloric acid solution prior to use. Nitrogen samples were preserved with sulfuric acid to a pH less than 2. Total phosphorus samples were frozen until analysis. Plankton samples were preserved with 1% Lugols iodine solution and stored in the dark until analysis. Chlorophyll samples were filtered and frozen for analysis within 24 hours. Lake water samples for toxin analysis were preserved in one of three ways: filtered and frozen upon return to the lab, filtered and shipped for analysis at SUNY within 24 hours, or shipped as whole water samples for analysis at SUNY within 24 hours. Water treatment facility raw and finish water samples were extracted within 48 hours and shipped for analysis.

Sample Analysis

Chlorophyll. All samples were thoroughly mixed and then filtered onto 1.2 μm glass fiber filters (Whatman 934-AH) under low pressure. After sufficient material was filtered to leave a visible green layer, filters were placed in clean 15mL plastic centrifuge tubes and frozen. For chlorophyll extraction, 8mL of 95% ethanol was added to each tube, all tubes were placed in an 80°C water bath for 8 minutes, covered in foil, and placed in a refrigerator overnight. After extraction, the samples were brought to room temperature, shaken to homogenize the extract, and

centrifuged at 3000 rpm for 10 minutes. Non-acidified and acidified extract absorbance was measured at 665 and 750 nm. Chlorophyll concentrations in the net plankton samples were extrapolated to reflect actual chlorophyll concentrations in the original lake water. About 10% of the samples were run in duplicate.

Net plankton. Net plankton were analyzed either as qualitative or quantitative samples. Initial samples were evaluated qualitatively, noting and recording the taxa present. Once potentially toxic cyanobacteria were identified in the samples, evaluation became quantitative; individual algal units in the samples were identified and enumerated, and densities were calculated for each taxon.

An aliquot of well-mixed sample was placed in a Sedgewick Rafter cell and allowed to settle for 5 minutes. Cells were examined at 100X with phase contrast using an inverted Olympus IX70 microscope. For qualitative samples, the entire chamber was scanned and algal taxa present were recorded. For quantitative samples, algal units were identified and enumerated. Counting continued until 100 cells of the most abundant unit had been observed or at least 10 fields had been examined. Algal units were categorized by size (single cells, fragments of colonies or filaments, small, medium, or large colonies or filaments). The enumerated natural units were multiplied by a cell factor to estimate cell densities (Table 2). Cell densities were extrapolated to reflect plankton populations in the original lake water.

Table 2. Cell factors used to estimate field densities of colonial algae.

Taxon	Unit Category	Estimated Cells/Unit	Cell Factor
Anabaena spp., Aulocoseira, Fragilaria	fragment	1 – 20	10
	small	20 – 100	60
	medium	100 – 1000	500
	large	>1000	1000
Microcystis, Coelosphaerium	small	<100	50
	medium	100 - 1000	500
	large	>1000	1000
Gloetrichia spp.	fragment	single trichome	20
	small	quarter of a colony	2500
	medium	half of a colony	5000
	large	entire colony	10,000
Aphanizomenon spp.	fragment	single trichome	measured
	small	small flake	200
	medium	medium flake	500
	large	large flake	1000

Whole water plankton. Whole water plankton were examined using Ütermohl settling chambers. Aliquots of well-mixed samples were allowed to settle for a minimum of 4 days, then counted using an Olympus IX70 inverted microscope with phase contrast at 400x. Counting continued until 100 individuals of the most abundant taxa had been observed or 100 fields had been evaluated. Natural units and cell densities were determined as described above.

Phosphorus. Total phosphorus samples were thawed and mixed thoroughly. A 50mL aliquot was digested using ammonium persulfate (APHA 1995) and analyzed following Quikchem™ Method 10-115-01-1-F using a Lachet Quikchem™ 8000 Series Flow Injection Analyzer.

Total Nitrogen. Total nitrogen samples were analyzed using persulfate digestion (APHA 1995) following Quikchem™ Method 10-107-06-2-H using a Lachet Quikchem™ 8000 Series Flow Injection Analyzer.

Toxin Sample Preparation. To prepare net plankton for analysis, a well-mixed aliquot of plankton concentrate was filtered onto Whatman 934-AH glass fiber filters. Filters for analysis of toxins by high performance liquid chromatography (HPLC) and protein phosphatase inhibition assay (PPIA) at SUNY were placed on ice and shipped by overnight carrier. Filters for enyzme-linked immunosorbant assay (ELISA) analysis by the VT DOH were placed on ice and delivered to their laboratory in Burlington within 24 hours. Filters for ELISA assay by UVM were placed in 15mL glass centrifuge tubes with Teflon-lined caps with 8 mL of 50% methanol, shaken well and stored at –80°C until analysis.

Whole water samples for analysis by HPLC and PPIA at SUNY were kept cold and sent off by overnight carrier within 24 hours.

Microcystin (s) by ELISA. Toxin samples in 50% methanol were thawed, shaken and re-frozen two times before beginning analysis. Extracted samples were diluted with deionized water until methanol represented less than 5% of the total volume, following recommendations to improve the accuracy of the method (Metcalf et al. 2000). Microcystin plate kits were purchased from Envirologix Inc. (Portland ME). UVM and VT DOH used kits from the same production lot. Analyses at VT DOH were used as a QA/QC check.

Samples were run in duplicate following manufacturer's instructions on a KC Jr. plate reader (Biotek Instruments), utilizing standards provided in the kit. Mean values were used to determine the toxin concentration of each pair of samples. Samples exceeding the range recommended by the kit were diluted and re-analyzed. Samples below the range were also re-analyzed using manufacturer recommended dilution procedures for the standards. Laboratory blanks were run with each sample batch using deionized water.

Microcystin (s) by PPIA. PPIA analysis followed a modification of Carmichael and An (1999). Microcystin LR standards (0.06 – 1000 µg/L) were prepared fresh from a 40 µg/L stock in 50% acidified methanol. The protein phosphatase 1, catalytic subunit Roche, was used at a working concentration of 0.1mU/200 µL. All assays were done in 96 well plates in a 37°C incubator. Readings at 405nm were taken every 5 minutes for 60 minutes using an E-max plate reader.

Anatoxin-a by HPLC. At SUNY, algal material was freeze-dried and then extracted with acidified methanol. Solid phase extraction cartridges were eluted with 100% methanol. Samples were analyzed in a Zorbax ACE C18 column with C-18 Phenomenex guard disk following James et al. (1997). Several duplicate samples were analyzed at Wright State University by Dr. Wayne Carmichael, using the same procedures, as a QA/QC check.

RESULTS

Cyanobacteria and Toxins at the Monitoring Sites

While many of the samples collected at the Long Term Monitoring Sites were analyzed qualitatively until mid to late summer, almost all of the samples collected by UVM and the lay monitors were analyzed quantitatively. The total number of samples collected for quantitative plankton, toxin and chlorophyll analyses exceeded 600 in 2004 (Table 3).

Table 3. Number of samples collected and analyzed in the Cyanobacteria Monitoring Program in 2004.

	Phytoplankton		Microcystin		Chlorophyll *a*	
	net	water[1]	net plankton	whole water plankton	net plankton	whole water plankton
Number of Samples Collected	341	83	256	260	248	310
Number of Samples Analyzed	316	83	34*	195*	227	310
water[1] - whole water samples to be counted by net protocol						
* - meeting QA						

The alert status reached and the maximum density of potentially toxic cyanobacteria cells at each site monitored are listed in Table 4. *Aphanizomenon* spp., *Microcystis* spp. and *Anabaena flos-aquae* were all widely distributed at sites across Lake Champlain.

At the Long-term Biomonitoring sites, cyanobacteria densities did not reach the Alert Level at any site except Station 50, in Missisquoi Bay. At the UVM Sites, Alert Level was reached in mid-July in Missisquoi Bay and in early August in St. Albans Bay. At the lay monitoring sites, all of which were located along the shoreline, Alert Level was reached in early to mid-July in most locations in Missisquoi Bay. The Burlington Bay sites did not reach Alert Level at all this year. Two South Lake sites reached Alert Level 1 briefly in July.

Table 4. Summary of plankton sample status at cyanobacteria monitoring stations in 2004. All microcystin concentrations are based on ELISA tests conducted at UVM.

Long-term Monitoring Sites (VT DEC)

Station (south to north)	Monitoring Status	Date Achieved	Cyanobacteria Present	Maximum Density of Potentially Toxic Cells/mL
2. Benson Landing	Quantitative	July 13	*Aphanizomenon*	15
4. Crown Point	Quantitative	July 28	*Anabaena, Aphanizomenon, Microcystis*	297
7. Cole Bay	Quantitative	Aug 11	*Aphanizomenon*	89
9. Diamond Island	Quantitative	Aug 11	*Aphanizomenon*	49
16. Shelburne Bay	Quantitative	July 29	*Aphanizomenon*	30
19. Main Lake	Quantitative	July 28	*Aphanizomenon*	23
21. Burlington Harbor	Quantitative	July 14	*Anabaena, Aphanizomenon*	54
25. Malletts Bay	Quantitative	Sept 1	*Aphanizomenon, Microcystis*	84
33. Cumberland Bay	Quantitative	Sept 2	*Aphanizomenon, Microcystis*	27
34. Inland Sea	Quantitative	Aug 10	*Anabaena, Aphanizomenon, Microcystis*	298
36. Point au Roche	Quantitative	Sept 2	*Anabaena, Aphanizomenon, Microcystis*	121
40. St. Albans Bay	Quantitative	July 2	*Anabaena, Aphanizomenon*	147
46. Alburg Center	Quantitative	Aug 24	*Anabaena, Microcystis*	48
50. Missisquoi Bay	Alert 1	July 21	*Anabaena, Aphanizomenon, Microcystis*	5,969

UVM monitoring stations – Missisquoi Bay, St. Albans Bay, and the Champlain Bridge

Location	Monitoring Status	Date Achieved	Highest Microcystin (µg/L) Observed	Cyanobacteria Present	Maximum Density of Potentially Toxic Cells/mL (net plankton)
Alburg	Alert 1,2	July 21	104.6 (Sept 21 wwp)	*Anabaena, Aphanizomenon, Microcystis*	12,574 (Jul 26)
Chapman Bay	Alert 1,2	July 26	17.7 (Sept 21 wwp)	*Anabaena, Aphanizomenon, Microcystis*	14,158 (Aug 17)
Highgate Cliffs	Alert 1,2	July 13	191.1 (Sept 21 wwp)	*Anabaena, Aphanizomenon, Microcystis*	18,073 (Aug 4)

Highgate Springs	Alert 1,2	July 21	89.6 (Aug 4 wwp) -	*Anabaena, Aphanizomenon, Microcystis*	13,409 (Aug 17)
Rte. 78 Access	Alert 1,2	July 26	6490 (Sept 1 - shoreline)	*Anabaena, Aphanizomenon, Microcystis*	30,400,000 (Sept 1 - shoreline)
St. Albans Boatlaunch	Alert 1	Aug 10	22.4 (Sept 21 - shoreline)	*Anabaena, Aphanizomenon, Microcystis*	121,067 (Sept 21 - shoreline)
McCuen Slang Boatlaunch	Quantitative	July 20	Not measured	*Anabaena, Aphanizomenon*	15 (Jul 20)

Missisquoi Bay Area Lay Monitoring Samples – Whole water samples, analyzed by Sedgewick-Rafter cell following net sample protocol.

Location	Monitoring Status	Date Achieved	Highest Microcystin (µg/L) Observed	Cyanobacteria Present	Maximum Density of Potentially Toxic Cells/mL
Alburg Springs	Alert 1,2	July 18	282.8 (July 25)	*Anabaena, Aphanizomenon, Microcystis*	189,333 (Aug 15)
Comolli Campsite	Alert 1,2	July 12	7.7 (Aug 16)	*Anabaena, Aphanizomenon, Microcystis*	862,000 (Aug 16)
High Rocks	Alert 1,2	July 12	48.8 (Jul 26)	*Anabaena, Aphanizomenon, Microcystis*	254,000 (Aug 16)
Highgate Springs Shipyard	Alert 1,2	July 5	33.5 (Aug 16)	*Anabaena, Aphanizomenon, Microcystis*	202,667 (Aug 16)
Maquam Bay	Alert	Aug 2	0.5 (Aug 23)	*Anabaena, Aphanizomenon, Microcystis*	20,000 (Aug 9)
Raake's Point	Alert 1,2	July 26	40.1 (Jul 26)	*Anabaena, Aphanizomenon, Microcystis*	266,667 (Aug 16)

Burlington Bay – UVM monitoring stations

Location	Monitoring Status	Date Achieved	Highest Microcystin (µg/L) Observed	Cyanobacteria Present	Maximum Density of Potentially Toxic Cells/mL (net plankton)
Burlington Water	Quantitative	July 20	Not Measured	*Anabaena, Aphanizomenon, Microcystis*	647

Champlain Water	Quantitative	July 20	Not Measured	*Anabaena, Aphanizomenon, Microcystis*	528
North Beach	Quantitative	July 20	Not Measured	*Anabaena, Aphanizomenon, Microcystis*	661
Red Rocks Beach	Quantitative	July 7	Not Measured	*Anabaena, Aphanizomenon, Microcystis*	270

Lake Champlain Lay Monitors (VT DEC): whole water samples, collected when bloom conditions were apparent, June – August

Location	Monitoring Status	Date Achieved	Highest Microcystin (µg/L) Observed	Cyanobacteria Present	Maximum Density of Potentially Toxic Cells/mL
Button Bay	Qualitative	6/28/2004	Not measured	None noted	0
Larabee's Point	Alert 1	7/7/2004	Not measured	*Anabaena*	5333
Littlefield Shore	Alert 1	7/4/2004	Not collected	*Anabaena*	>4000*
Thompson's Point	Qualitative	7/3/2004	Not measured	None noted	0

* count may not indicate true whole water density because monitor appeared to sample sediment

The highest concentrations of microcystins were found in Missisquoi Bay (Table 5). Most sites in the bay showed concentrations above 1 µg/L, the level of human health concern, on many dates in July and August. Other sites in Lake Champlain showing elevated concentration of microcystin include St. Albans Bay, Maquam Bay, and Alburg Passage.

No measurable concentrations of anatoxin were detected at any sites in 2004

Different patterns of bloom development and persistence were observed at the sites monitored in Missisquoi Bay. Highest concentrations of microcystin were measured in a shoreline sample at the Rte. 78 Boatlaunch site (Table 5, Figure 4) presents the alert status over the summer season at the Rte. 78 Boatlaunch site. At this location, samples were collected at both our off-shore site and along the shoreline in the visible cyanobacteria scums when these scums were present. Alert Level was achieved on July 26, when concentrations along the shoreline where already well above 1µg/L. On all three dates when shoreline samples were collected, the cell densities in these samples were higher than the offshore samples.

Table 5. Number of samples tested by ELISA at UVM and maximum concentrations of microcystin measured in 2004.

Lake Section	Collected by	Location	Number of Samples Tested	Maximum Microcystin Concentration (µg/L)
Missisquoi Bay	Lay monitor	Alburg Springs	7	282.7
		Comolli Campsite	9	7.7
		High Rocks	6	48.8
		Highgate Springs Shipyard	9	33.5
		Raake's Point	6	40.1
	UVM	Alburg	23	53.3
		Alburg Springs	4	7.4
		Chapman Bay	36	17.8
		Highgate Cliffs	32	132.2
		Highgate Springs	19	89.6
		Highgate Springs Shipyard	5	0.8
		Rte 78 Access	36	10.5
		Rte 78 Access- shore	6	6490.1
St. Albans Bay	UVM	St. Albans Boatlaunch	25	3.0
		St. Albans-shore	2	22.5
Other sections of Lake Champlain	Lay monitor	Maquam Bay	7	0.5
	UVM	Alburg Passage	1	0.5
		Dillenbeck Bay	1	0.5
		Maquam Bay	1	2.2
	VTDEC	Alburg Passage	1	17.6
Total Number of Samples Tested			**236**	

At Highgate Cliffs (Figure 5), on the east side of Missisquoi Bay near the Canadian border, Alert Level was reached on July 13. Cell counts remained high at this site for the remainder of the summer. Similar patterns were observed at both Chapman Bay (Figure 6), on the west side of the bay, and at the Highgate Springs site (Figure 7), but at these sites at the Alburg site (Figure 8) there was more variability in the microcystin concentrations among the samples. At all of these sites, the dates of highest toxin concentration did not correspond with the dates when highest cell densities were achieved.

Figure 4. Alert status at the Rte 78 Boatlaunch over the summer 2004. Shoreline samples were collected where surface accumulations were present.

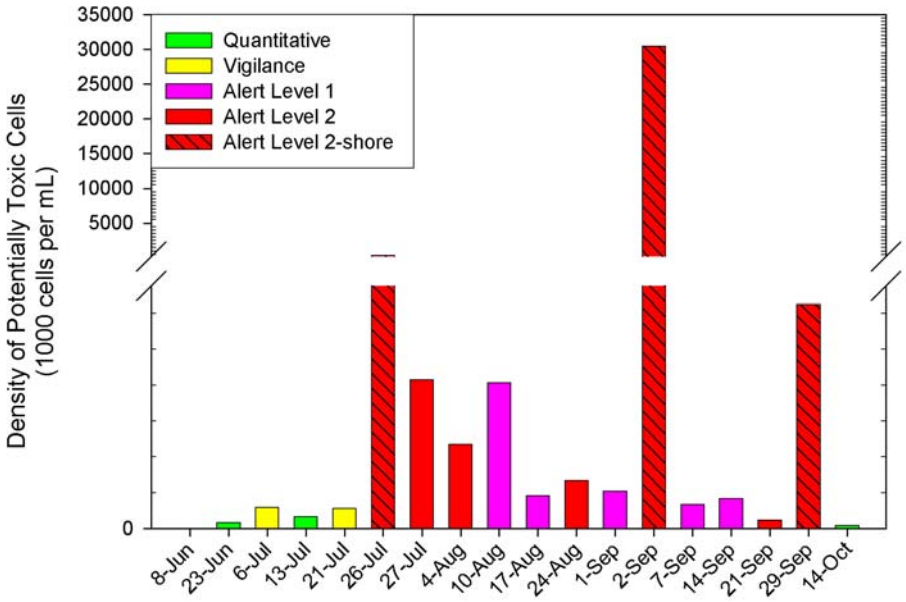


Figure 5. Alert status at the Highgate Cliffs site over the summer 2004.

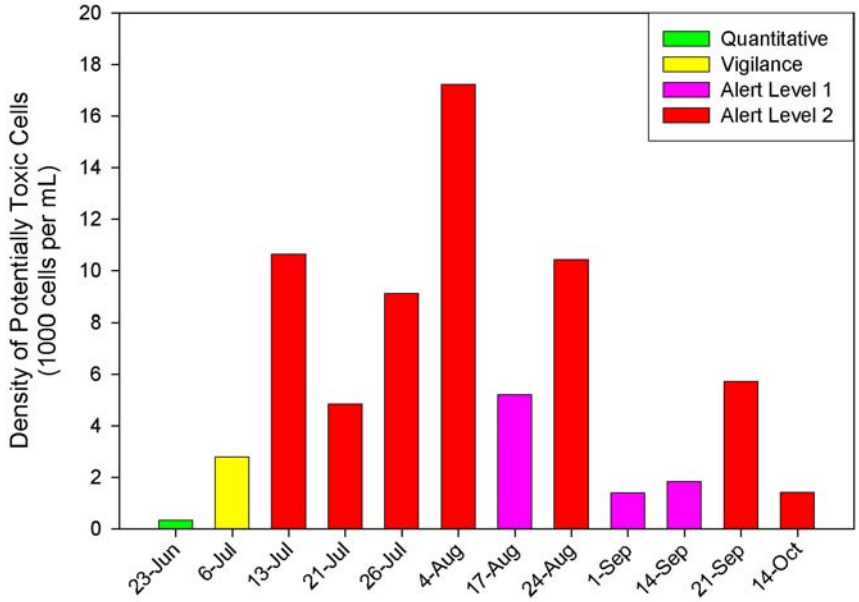


Figure 6. Alert status at the Chapman Bay site over the summer 2004.

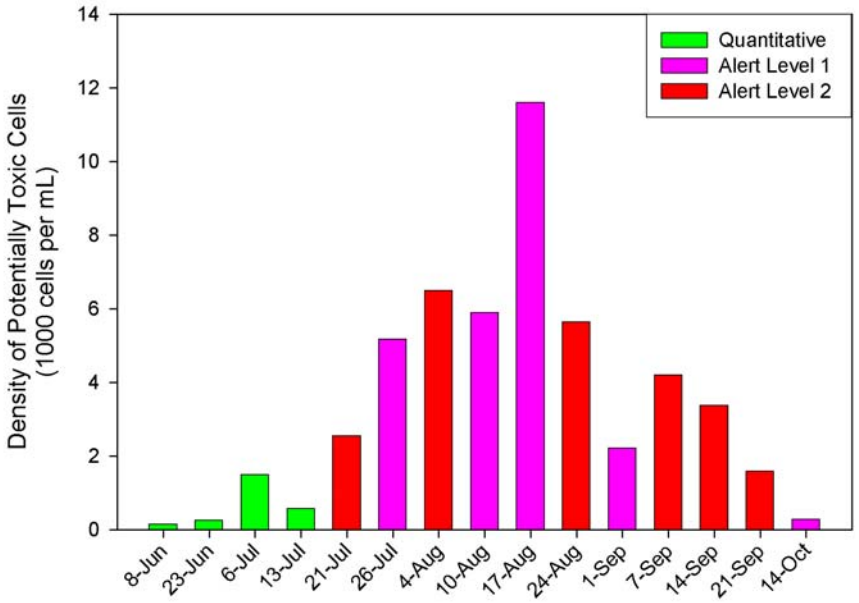


Figure 7. Alert status at the Highgate Springs site over the summer 2004.

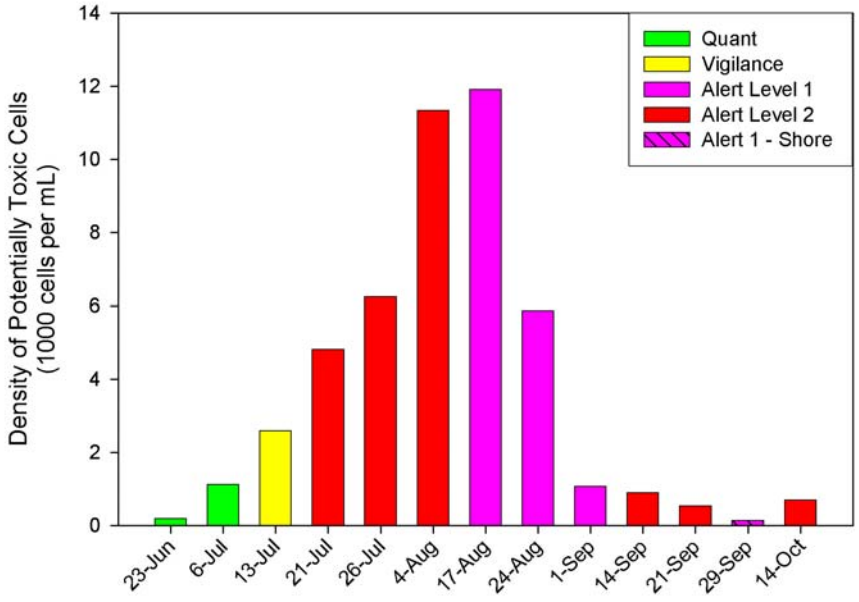
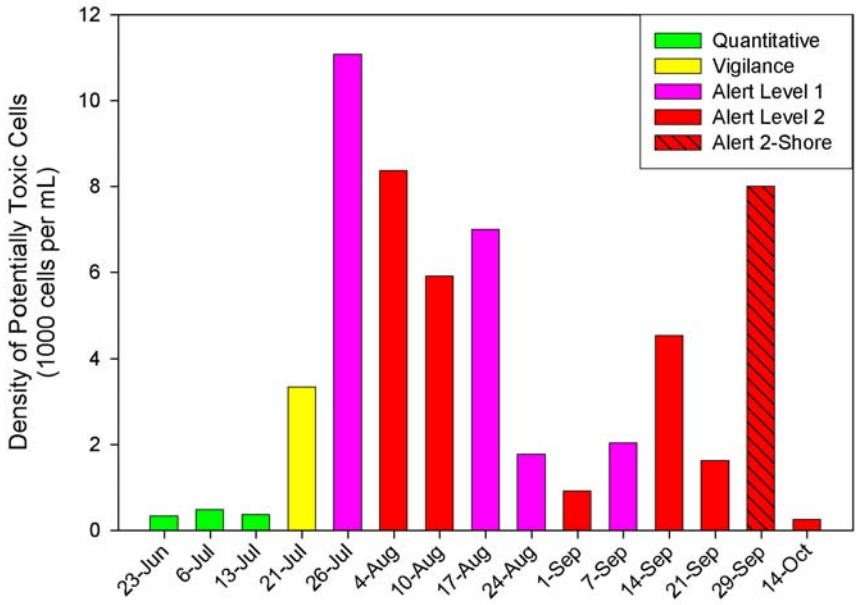


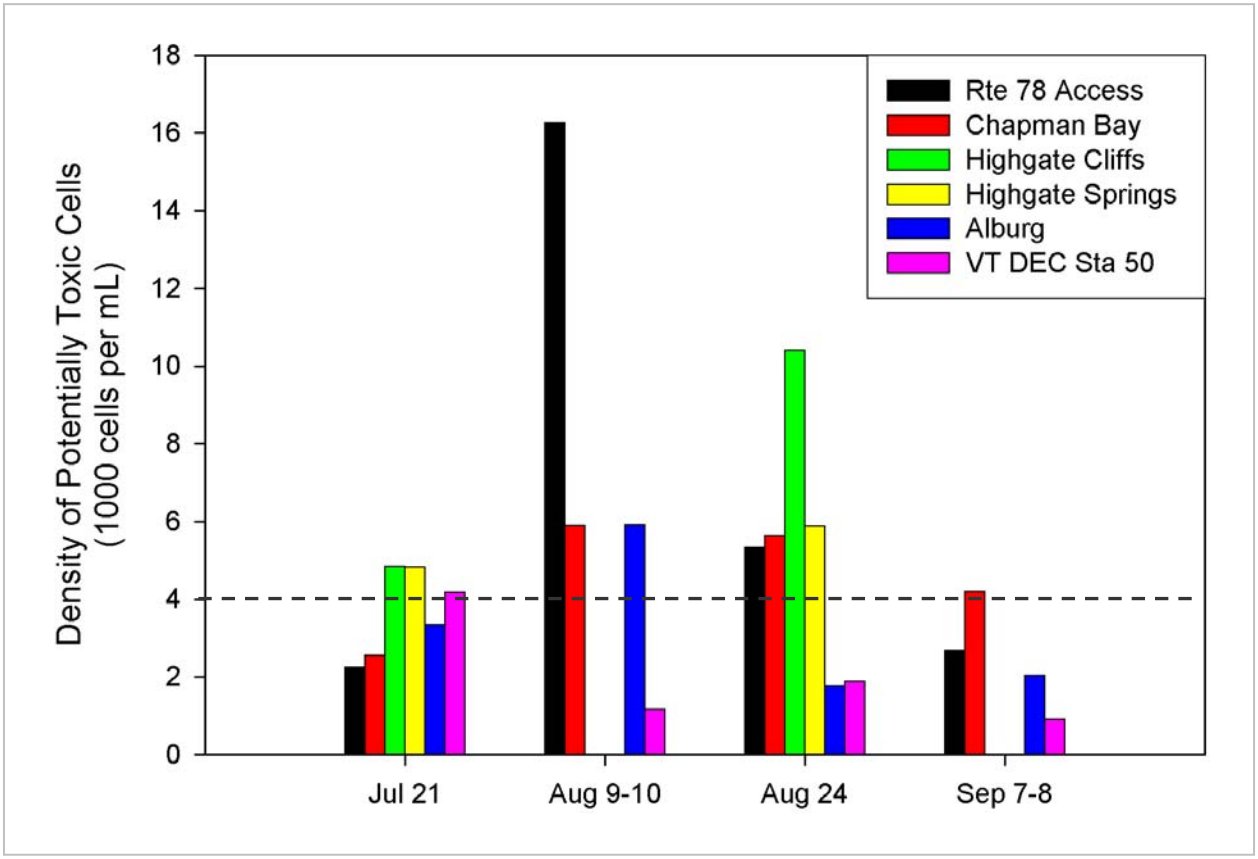
Figure 8. Alert status at the Alburg site over the summer 2004.



The samples collected by VT DEC at Station 50 in Missisquoi Bay generally showed much lower densities of potentially toxic cells than the other sites. June 21 was the only date when cell counts at this station reached the Alert Level (Figure 9). On this date, conditions were similar throughout the bay.

More frequently though, there was considerable spatial variability throughout the bay both among the UVM sites (for example, on August 9 and 10, Figure 9) and among the shoreline samples that were collected from Missisquoi Bay (Figure 10). All of the shoreline samples were collected where algal densities were high or scum was accumulating. Because they were collected with a different protocol than the boat-based samples, strict comparisons between these two sample sets are not possible, but it is clear that these shoreline scum areas represent potential problem areas. Cell densities in these samples were often an order of magnitude higher than those seen at the offshore sites.

Figure 9. Cyanobacteria densities in net plankton samples collected at Station 50 and at the regular UVM sites in Missisquoi Bay in 2004.



Summary of Cyanobacteria and Toxin Patterns in 2004

As in prior years, potential toxin-producing species of cyanobacteria frequently dominated the plankton, especially in July, August and September (Table 7). The most common potential toxin-producers included *Anabaena* spp., *Aphanizomenon flos-aquae*, and *Microcystis* spp. In Missisquoi Bay, *Microcystis* spp. were present in 92% of the samples, far exceeding the dominance seen in other parts of the lake.

In general, the lowest frequency of occurrence of potential toxin producing cyanobacteria was in the South Lake. Potential toxin producing species were present in these samples less than half of the time and *Microcystis* was observed in only 6% of these samples, in striking contrast to its occurrence in the northern part of the Lake and Missisquoi Bay.

Only microcystins were detected in samples collected in 2004, in contrast to previous years when both toxins were observed (Rosen et al. 2001, Watzin et al. 2002, Watzin et al. 2003, Watzin et

al. 2004). There was a wide range in microcystin concentrations, but the highest concentration was again found in a shoreline scum.

Figure 10. Cell densities at sites in shoreline sampling sites in Missisquoi Bay on two dates in 2004.

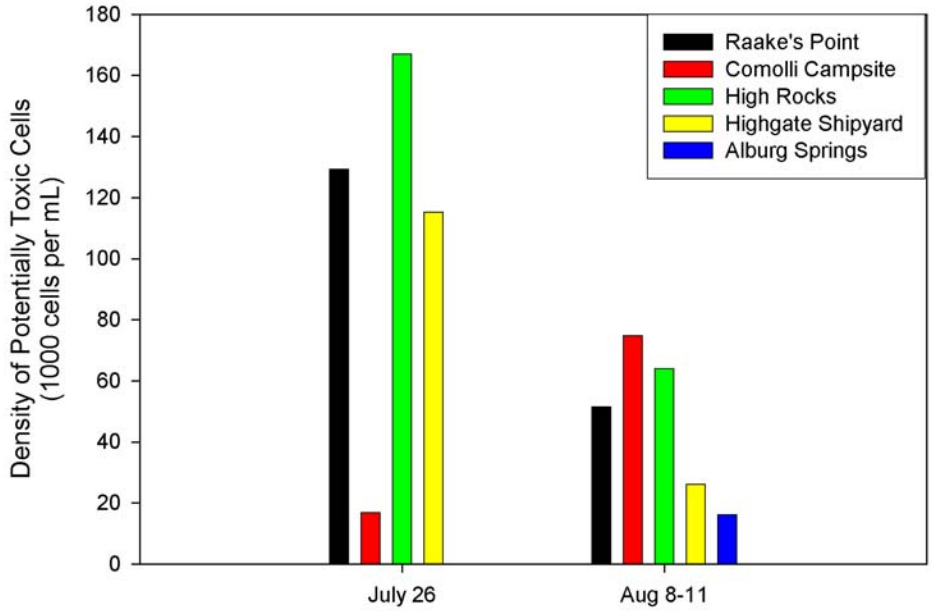


Table 7. Frequency of occurrence of cyanobacteria taxa in samples collected from Lake Champlain.

Taxon	2004 Percent Frequency of Occurrence			
	Main Lake	**South Lake**	**Missisquoi Bay**	**Northeastern Bays**
Anabaena flos-aquae	37	13	32	47
Anabaena spp	30	44	15	35
Microcystis spp.	44	6	92	71
Coelosphaerium spp.	23	0	0	38
Gloeotrichia spp.	0	0	6	15
Aphanizomenon flos-aquae	68	19	34	64
Samples Analyzed	82	16	191	55

Nutrients at the Cyanobacteria Monitoring Sites

Concentrations of total phosphorus (TP) and total nitrogen (TN) were averaged by date for monitoring sites in Burlington Bay, St. Albans Bay and Missisquoi Bay. Mean concentrations of both nutrients were almost always highest in Missisquoi Bay, intermediate in St. Albans Bay, and lowest at Burlington Bay. Total phosphorus concentrations in Missisquoi Bay frequently exceeded 100 µg/L in late summer and fall (Figure 11).

We also looked at the variability in TP and TN concentrations across selected study sites and at Station 50. For Station 50, we used the data collected by Vermont DEC. We found TN and TP data for nine sample dates at Station 50, while generally we had 25-30 samples for our stations. There were statistically significant differences in both nutrients between sites (one-way analysis of variance on log-transformed data, $P \leq 0.05$). Concentrations of TP (Figure 12) were higher at our Highgate Cliffs site than at Chapman Bay; however there was no significant difference in the concentrations at Alburg, Station 50 and Highgate Cliffs (SNK, $P \leq 0.05$). Similarly, TN was also higher at Highgate Cliffs and our Alburg site (Figure 13); the TN concentrations at both these sites were significantly different from the concentrations at Station 50 and Chapman Bay (SNK $P \leq 0.05$).

Figure 11. Mean total phosphorus concentrations (± one standard error) in Burlington Bay, Missisquoi Bay and St. Albans Bay, 2004.

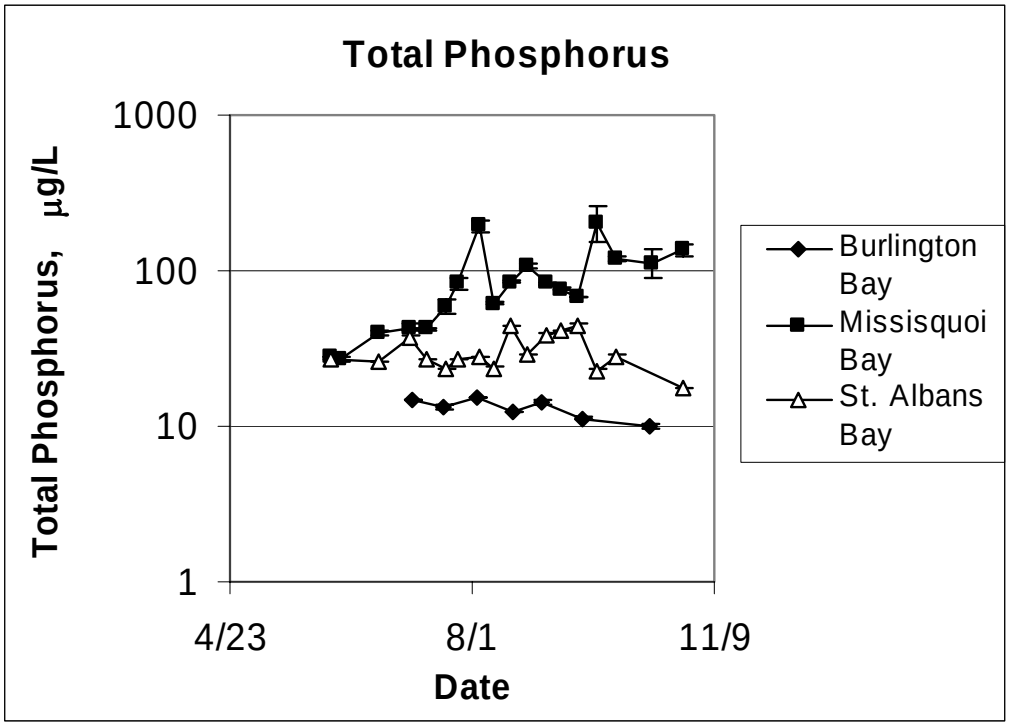


Figure 12. Mean concentrations of total phosphorus across sample sites in Missisquoi Bay in 2004.

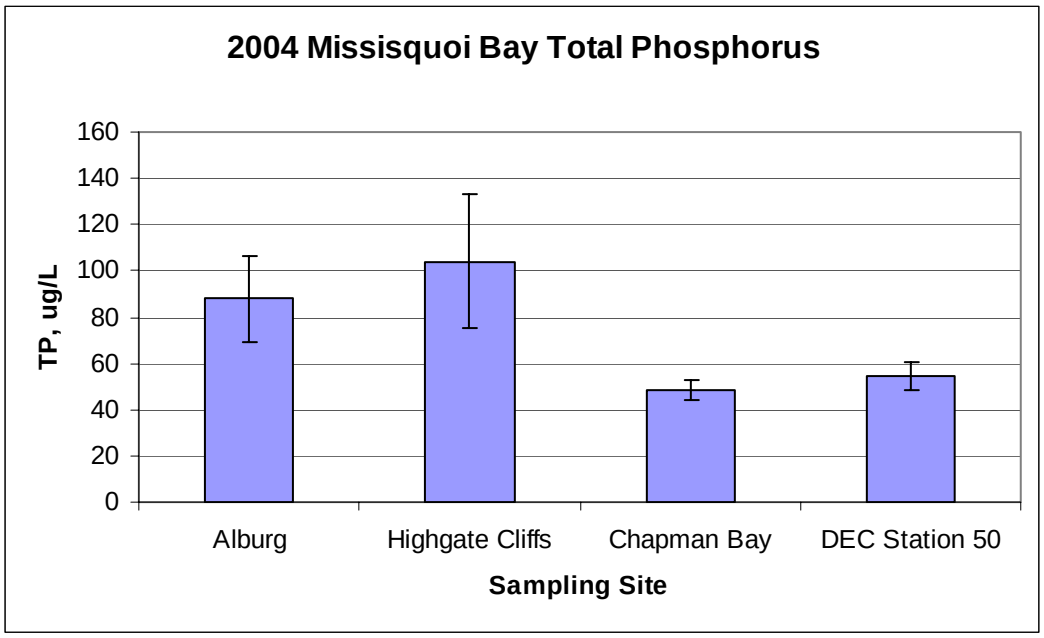
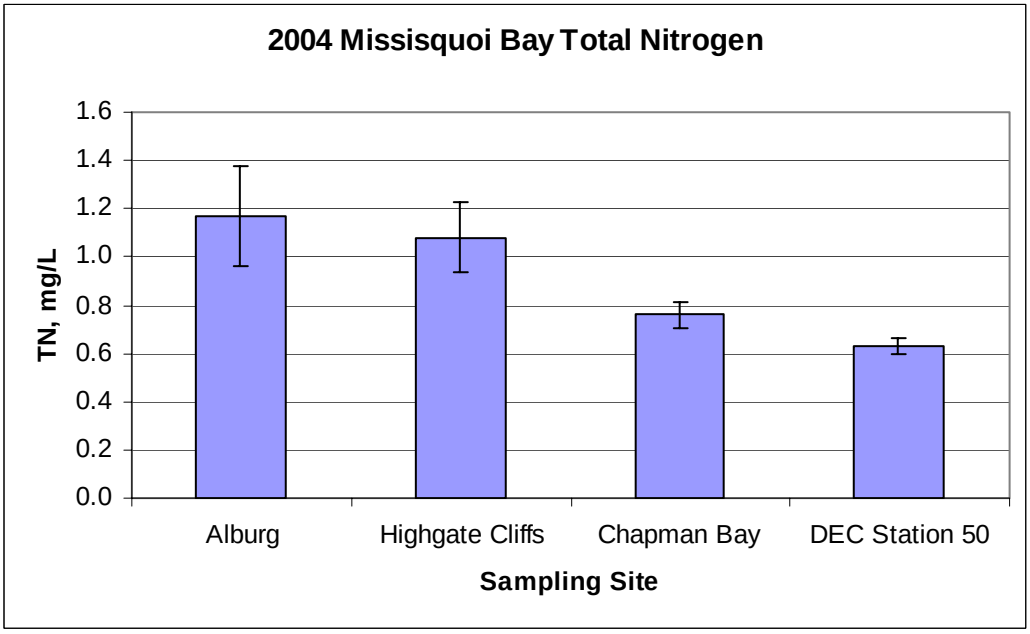


Figure 13. Mean concentrations of total nitrogen across sample sites in Missisquoi Bay in 2004.



We also calculated the ratio of TN:TP in Burlington Bay, St. Albans Bay, and Missisquoi Bay (Figure 14). We found significantly lower ratios at Missisquoi Bay and St. Albans Bay compared to Burlington Bay. Ratios less than 64 are commonly used to indicate nitrogen limitation (Smith 1983). Both Missisquoi Bay and St. Albans Bay show these conditions. In Missisquoi Bay, comparing our same four sites and using the VTDEC data for Station 50, we found all ratios were low but there were differences between sites. The lowest ratios were found at Highgate Cliffs, with very little difference between Alburg, Chapman Bay, and Station 50 (Table 8).

Figure 14. TN:TP ratios in Burlington Bay, St. Albans Bay, and Missisquoi Bay.

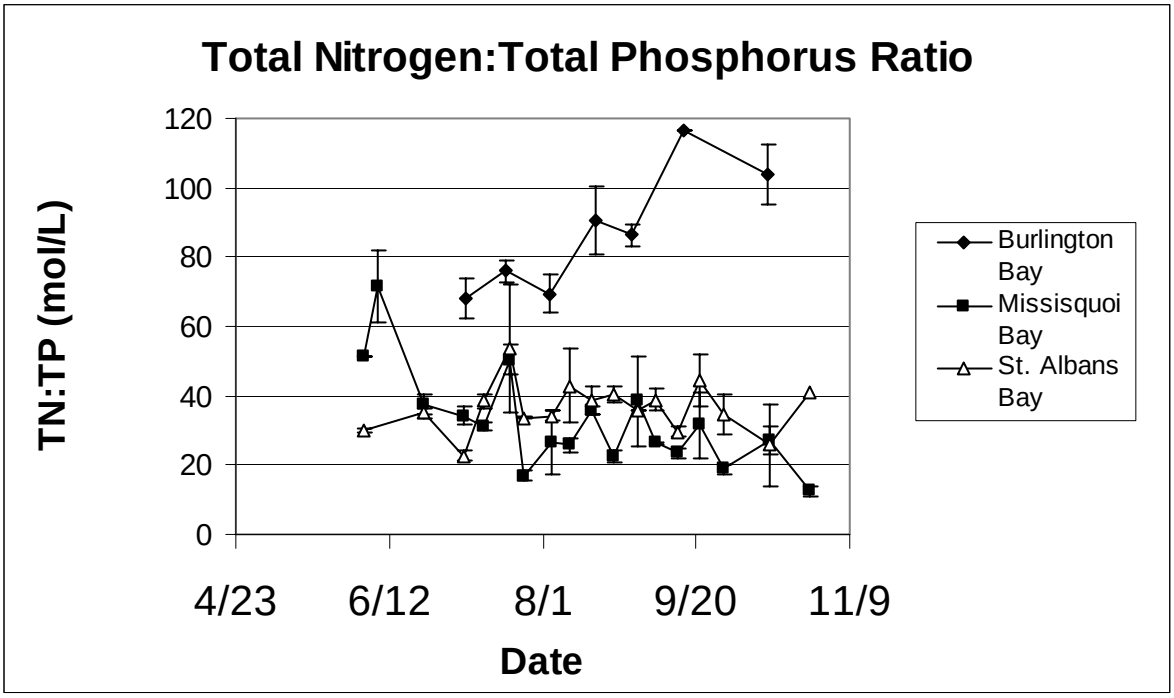


Table 8. Ratio of TN:TP at selected sampling stations in Missisquoi Bay.

Station:	**TN:TP**
Alburg	28.8
Highgate Cliffs	22.7
Chapman Bay	28.6
DEC Station 50	27.4

Coordination

Coordination meetings were held with Vermont Health Department officials in June 2004, and an e-mail distribution list was established for regular information sharing over the summer season. Beginning in early July, weekly e-mail updates on monitoring results were distributed to these officials and to other professionals with an interest in bloom conditions and public health. The e-mail contained information about sampling sites, potentially toxic cell densities, and toxin concentrations.

DISCUSSION AND CONCLUSIONS

Patterns of Cyanobacteria and Toxin Distribution in Lake Champlain

Like previous years, cyanobacteria were common in Lake Champlain in 2004. The areas of highest cyanobacteria dominance are also the areas of highest nutrient enrichment. Although cyanobacteria dominated in late summer in all three bays, the strongest dominance was seen in the northern bays, the locations that also had the lowest TN:TP ratios. This pattern suggests N limitation, however, even though N:P ratios less than 64 can be associated with cyanobacteria dominance, they are not always (e.g., Jensen et al. 1994, Scheffer et al. 1997). Ratios calculated on the basis of TN:TP also do not necessarily track available forms of these nutrients (Hyenstrand et al. 1998).

Because of the tendency of cyanobacteria to accumulate along the shoreline, the samples collected by the lay monitors in 2004, as in 2003, were especially important. Highest toxin concentrations were found in the algal accumulations and scum areas along the shoreline. The goal of the cyanobacteria monitoring program is to protect human health. Because many people who recreate on the lake do so from the shoreline, the risks associated with these sites must be assessed. The regular, boat-based sampling conducted as part of the Long-term Biomonitoring Program cannot represent conditions in these locations, and even the UVM boat-based samples, while capturing a larger range of conditions in Missisquoi Bay and finding areas of significant concern (Appendix C), did not fully capture conditions at the shoreline, where scums accumulated.

As in previous years, the highest concentrations of microcystin were found in samples collected from visible surface and shoreline accumulations in Missisquoi Bay, but the samples with the highest cell densities were not always the samples that showed the highest toxin concentrations (Figures 5-9). In a somewhat disturbing trend, we found that critical toxin concentrations were reached at lower cell densities in 2004 than in 2003 (Watzin et al. 2004) at several of our Missisquoi Bay sites. Figure 15 shows an example of this. At Highgate Cliffs, cell densities that were generally an order of magnitude lower in 2004 produced similar, and more numerous high toxin concentrations compared to those in 2003. Similarly, both the range of microcystin concentrations and the seasonal averages were higher in 2004 than 2003 (Table 7). The seasonal average concentration of microcystin in 2004 was about 49 µg/L, well above the level of concern for protecting human health. The reasons for this pattern are not clear.

Figure 15. Cell densities and high toxin concentrations at the Highgate Cliffs sampling site in 2003 and 2004.

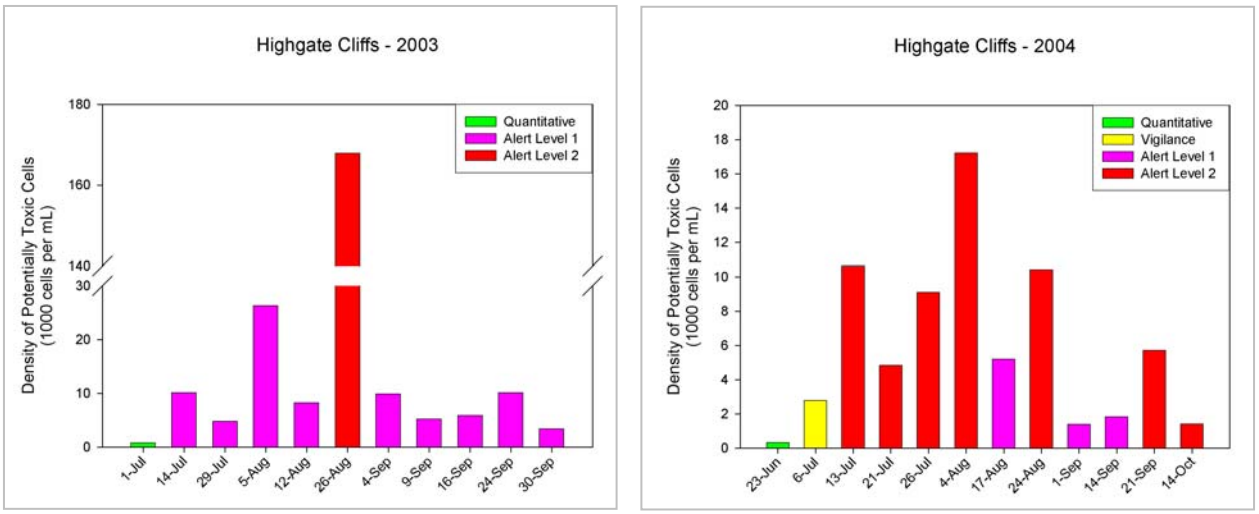


Table 7. Microcystin concentration data (µg/L) for lake segments in both 2003 and 2004.

Lake Segment		**2003**	**2004**
South Lake	seasonal average:	0.7	none
	range:	n.d. - 1.4	
	# of samples:	3	
Main Lake	seasonal average:	0.04	none
	range:	n.d. - 0.12	
	# of samples:	9	
St. Albans Bay	seasonal average:	0.11	2.2
	range:	n.d. - 0.46	n.d. - 22.5
	# of samples:	18	22
Missisquoi Bay	seasonal average:	1.2	49.3
	range:	n.d. - 23.9	n.d.- 6490
	# of samples:	182	142
Northeastern Bays	seasonal average:	0.06	2.7
	range:	n.d. - 0.18	n.d.- 17.5
	# of samples:	6	8

Effectiveness of the Prototype Monitoring and Alert Framework

After two full years of implementation (2003 and 2004), we are confident that the tiered alert system is effective at identifying locations where potentially toxic algal populations are developing in a timely manner. The cell density triggers worked well as thresholds to move from level to level; however, to maintain efficiency, we are continuing to perform our cell counts during the bloom season using net sample protocols even at the Alert Level. By doing this, we avoided the delay of settling whole water samples for cell counts and were able to provide data to the public health agencies in a timely manner. While the net sample protocols are less precise, post season counts using whole water methods can be done if these data are needed for other purposes.

The Alert Level 2 trigger of 1 μg/L microcystin was suggested by the World Health Organization (WHO) based on health data related to chronic exposure to microcystin by consuming contaminated drinking water (WHO 1998, Chorus and Bartrum 1999). The WHO (2003) also recently suggested a framework for establishing recreation guidelines. The trigger for Alert Level 2 can be adjusted based on the judgments of Public Health officials. As the three jurisdictions continue to consider both drinking water and recreational levels of concern, adjustments should be made in future applications of the method to accommodate local standards.

The patchy nature of the cyanobacteria bloom and the corresponding spatial variability in toxin concentrations that is readily apparent in Lake Champlain means that prudence is continually warranted in issuing public health advisories. In Missisquoi Bay, the concentration of microcystins in samples from nearby sites can vary by several orders of magnitude (Appendix C, Watzin et al. 2003, 2004), so extra caution is necessary wherever scums accumulate.

In 2004, anatoxin was not found in any of the samples that were tested. However, anatoxin-producing species such as *Anabaena* spp. have remained common in Lake Champlain, and therefore, the addition of a more rapid anatoxin screening method to the protocols would still be valuable.

Coordination

The e-mail notitfication system has evolved into a useful tool for rapid communication among the professional community. However, differences in closure procedures in the three jurisdictions and general confusion among the public about the hazards and appropriate behavior when bloom conditions occur remain. Clear information about the risks to both people and their pets should be issued on a regular basis once the bloom begins. Recreational users of areas such as Missisquoi and St. Albans Bays would benefit from posted materials at beaches and other public access sites. Because weather conditions can greatly affect the distribution and intensity of the bloom in different areas, warning people to avoid visible accumulations of algae, especially shoreline scums, seems most appropriate. Because recreationists sometimes travel around the lake, widely publicized advisories, beyond the immediate area of the bloom, also seem wise.

General Recommendations

The tiered alert system is effective and should continue to be implemented in the future. Because the highest concentrations of toxin are likely to occur in the dense shoreline accumulations of algae, and these areas are also where recreational users of the lake are most likely to be exposed to the toxins, any monitoring program must sample in these shoreline locations, not just out in the open water, where most monitoring programs tend to focus. Once again, our lay monitors greatly enhanced the sampling capability, and should be used where volunteers can be recruited.

Because weather conditions influence where greatest algal densities occur and these bloom locations can change rapidly, it is extremely difficult to promptly identify areas of greatest risk. Essentially, this places the burden of deciding when and where to recreate in waters subject to cyanobacteria blooms on the recreational user, and suggests that educational materials should be available through multiple venues in order to help swimmers and others make informed decisions. While newspaper and radio announcements reach a broad audience, additional materials, such as permanent postings at recreational accesses and fact sheets distributed via websites and public health offices, would provide a tangible way for recreational users to determine whether the algal accumulations they encounter should be avoided.

ACKNOWLEDGMENTS

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Appendix A. Results of screening of qualitative samples collected from Lake Champlain 2004.

Date	Sample Locations	BGA?	Microcystis	Aphanizomenon	Gloeotrichia	Coelosphaerium	Anabaena	Status
6/8/04	Rte. 78 Access	yes	x					Go to quantitative
6/8/04	Chapman Bay	yes	x		x			Go to quantitative
6/8/04	Chapman Bay	yes	x					Go to quantitative
6/8/04	Highgate Cliffs	yes	x	x			x	Go to quantitative
6/8/04	Highgate Cliffs	yes	x				x	Go to quantitative
6/8/04	Highgate Springs	yes	x	x			x	Go to quantitative
6/8/04	Highgate Springs	yes	x	x				Go to quantitative
6/8/04	St. Albans Boatlaunch	yes		x				Go to quantitative
6/8/04	St. Albans Boatlaunch	yes		x				Go to quantitative
6/8/04	Alburg	yes	x					Go to quantitative
6/8/04	Alburg	yes	x					Go to quantitative
6/4/04	Sta 21	yes	x	x				Go to quantitative
6/4/04	Sta 19	yes	x	x				Go to quantitative
6/4/04	Sta 16	yes	x	x				Go to quantitative
6/8/04	Sta 04	no						Qualitative
6/11/04	Sta 34	yes		one sm. flake			flos-aquae. A few big tangles.	Go to quantitative
6/9/04	Sta 25	yes				x	flos-aquae. A few big tangles. Lots of Vorticella on them.	Go to quantitative
6/10/04	Sta 50	yes	x				circ.	Go to quantitative
6/10/04	Sta 46	no						Qualitative
6/11/04	Sta 40	no						Qualitative
6/21/04	Sta 36	yes					flos-aquae. A few tangles.	Go to quantitative
6/21/04	Sta 33	yes		one tiny fragment				Qualitative
6/23/04	Sta 02	no						Qualitative
6/23/04	Sta 04	no						Qualitative
6/28/04	Sta 19	yes		two filaments		x	flos-aquae. Several small tangles.	Go to quantitative

6/28/04	Sta 21	yes	x	x		Go to quantitative
7/7/04	Burlington Water Bay	yes		rare	x	Go to quantitative
7/7/04	Burlington Water Bay	yes	x		x	Go to quantitative
7/7/04	Champlain Water Bay	yes	x	1 trichome	x	Go to quantitative
7/7/04	Champlain Water Bay	yes	1 colony		few	Go to quantitative
7/7/04	North Beach	yes	x	x	x	Go to quantitative
7/7/04	North Beach	yes	x		x	Go to quantitative
7/7/04	Red Rocks	yes	x	x	x	Go to quantitative
7/7/04	Red Rocks	no				Qualitative
7/3/04	Thompson's Point	no				Qualitative
6/28/04	Button Bay	no				Qualitative
7/9/04	Sta 33	no				Qualitative
7/9/04	Sta 36	no				Qualitative
7/6/04	Maquam Bay	yes	x	x	x	Go to quantitative
7/5/04	Alburg	yes	x			Go to quantitative
7/5/04	Missiquoi	yes	x			Go to quantitative
7/6/04	Sta 07	no				Qualitative
7/6/04	Sta 09	no				Qualitative
7/12/04	Maquam Bay	no				Qualitative
7/5/04	Highgate Springs-Shipyard	no				Qualitative
7/14/04	Sta 19	no				Qualitative
7/4/04	Button Bay	no				Qualitative
7/12/04	Highgate Springs-Shipyard	no				Qualitative
7/12/04	Raake's Point	no				Qualitative
7/19/04	Raake's Point	no				Qualitative
7/21/04	Sta 46	no				Qualitative
7/22/04	Sta 07	no				Qualitative
7/26/04	Maquam Bay	no				Qualitative
7/26/04	Sta 33	no				Qualitative
7/19/04	Thompson's Point	no				Qualitative
7/28/04	Sta 02	no				Qualitative
9/7/04	Sta 02	no				Qualitative

Appendix B. Counts of algae in quantitative samples collected from Lake Champlain 2004.

					Algal Cells per mL Lakewater								
Date	Location	Sample Type	Collection Source	Rep	Diatoms	Greens	Chryso-phytes	Cryptop-hytes	Dinoflag-ellates	Eugleno-phytes	Cyanobacteria	Potential Toxin Producers	Total
6/8/04	Rte 78 Access	net	UVM	2	39.28	2.57	0.26				12.84	13.00	54.95
6/8/04	Chapman Bay	net	UVM	2	218.59	21.18					148.27	148.00	388.04
6/8/04	VTDEC Sta04	net	UVM	1	99.41		0.82						100.23
6/23/04	Rte 78 Access	net	UVM	1	55.94						618.68	619.00	674.62
6/23/04	Rte 78 Access	net	UVM	2	14.92						716.30	716.00	731.22
6/23/04	Alburg	net	UVM	1	2.05	12.84					243.90	244.00	258.79
6/23/04	Alburg	net	UVM	2	3.40						425.22	425.00	428.62
6/23/04	Chapman Bay	net	UVM	1	20.67						221.44	221.00	242.11
6/23/04	Chapman Bay	net	UVM	2	6.07	14.44					274.39	274.00	294.90
6/23/04	Highgate Cliffs	net	UVM	1	11.36	18.93					365.44	365.00	395.73
6/23/04	Highgate Cliffs	net	UVM	2	14.25	19.26					288.83	289.00	322.34
6/23/04	Highgate Springs	net	UVM	1	3.05						182.93	183.00	185.98
6/23/04	Highgate Springs	net	UVM	2	3.55						177.47	177.00	181.02
6/23/04	St. Albans Boat Launch	net	UVM	1	120.90	0.75			8.26		270.35	270.00	400.26
7/6/04	Rte 78 Access	net	UVM	1							1,154.91	1,155.00	1,154.91
7/6/04	Rte 78 Access	net	UVM	2	18.52						765.88	766.00	784.40
7/6/04	Chapman Bay	net	UVM	2	4.81						770.22	770.00	775.03
7/6/04	Highgate Cliffs	net	UVM	1	2.02	101.09					12,095.86	3,672.00	12,198.97
7/6/04	Highgate Cliffs	net	UVM	2		17.25					9,499.85	2,311.00	9,517.10
7/6/04	Highgate Springs	net	UVM	1		53.14					555.02	555.00	608.16

7/6/04	St. Albans Boat Launch	net	UVM	1	14.83	72.79				13.48	13.00	101.10
7/6/04	St. Albans Boat Launch	net	UVM	2	127.09	23.11			2.31	12,188.67	58.00	12,341.18
7/6/04	Alburg	net	UVM	1						131.90	132.00	131.90
7/6/04	Alburg	net	UVM	2	18.40					832.32	832.00	850.72
7/7/04	Red Rocks Beach	net	UVM	2	2,091.01							2,091.01
7/3/04	Thompson's Point	water1	Lay monitor	1	2,400.00							2,400.00
6/28/04	Button Bay	water1	Lay monitor	1	14,800.00	7,400.00						22,200.00
7/4/04	Littlefield Shore	water1	Lay monitor	1	157,600.00	3,800.00				92,000.00	92,000.00	253,400.00
7/2/04	VTDEC Sta40	net	VT DEC	1	78.87	15.71	2.46		13.56	146.96	147.00	257.56
7/2/04	VTDEC Sta34	net	VT DEC	1	202.18	3.21			3.53	77.98	78.00	288.18
7/13/04	Rte 78 Access	net	UVM	1	52.84	161.75			1.08	808.73	809.00	1,024.40
7/13/04	Rte 78 Access	net	UVM	2	152.21	11.78				1,753.90	1,754.00	1,917.89
7/13/04	Chapman Bay	net	UVM	1	80.30	122.46				664.31	664.00	867.07
7/13/04	Chapman Bay	net	UVM	2	32.11	78.95	0.53			473.68	474.00	585.27
7/13/04	Highgate Cliffs	net	UVM	1		238.77				14,182.76	11,198.00	14,421.53
7/13/04	Highgate Cliffs	net	UVM	2		108.79				10,045.95	10,046.00	10,154.74
7/13/04	Highgate Springs	net	UVM	1		103.98				8,225.80	3,027.00	8,329.78
7/13/04	Highgate Springs	net	UVM	2	6.74	202.18				7,194.98	2,140.00	7,403.90
7/13/04	St. Albans Boat Launch	net	UVM	1	373.68	10.03			41.01	9,260.05	146.00	9,689.33
7/13/04	St. Albans Boat Launch	net	UVM	2	308.73	3.80	4.75		22.80	238.43	238.00	578.51
7/13/04	Alburg	net	UVM	1	5.46					545.57	546.00	551.03
7/13/04	Alburg	net	UVM	2	30.81	75.99				179.72	180.00	286.52
7/9/04	VTDEC Sta33	net	VT DEC	1	114.76							114.76
7/9/04	VTDEC Sta36	net	VT DEC	1	175.13				0.69			175.82
7/6/04	VTDEC	net	VT DEC	1	1,219.56		10.01					1,229.57

	Sta07										
7/6/04	VTDEC Sta09	net	VT DEC	1	510.91						510.91
7/12/04	Maquam Bay	water1	Lay monitor	1			400.00				400.00
7/12/04	Missisquoi Bay - Comolli Camp	water1	Lay monitor	1			173.91		18,434.78	18,435.00	18,608.69
7/5/04	Highgate Springs-Shipyard	water1	Lay monitor	1			600.00				600.00
7/13/04	VTDEC Sta04	net	VT DEC	1	257.64			0.77	32.73	33.00	291.14
7/13/04	VTDEC Sta02	net	VT DEC	1	167.68		1.47		15.00	15.00	184.15
7/14/04	VTDEC Sta21	net	VT DEC	1	230.18		8.28		54.09	54.00	292.55
7/14/04	VTDEC Sta16	net	VT DEC	1	162.93				11.22	11.00	174.15
7/14/04	VTDEC Sta19	net	VT DEC	1	459.24						459.24
7/21/04	Rte 78 Access	net	UVM	1	75.31	263.59			2,706.93	2,707.00	3,045.83
7/21/04	Rte 78 Access	net	UVM	2	32.82	209.54			1,792.97	1,793.00	2,035.33
7/21/04	Chapman Bay	net	UVM	1		95.31			2,560.78	2,561.00	2,656.09
7/21/04	Chapman Bay	net	UVM	2	4.66	21.18			2,531.12	2,531.00	2,556.96
7/21/04	Highgate Cliffs	net	UVM	1	24.31	81.03			7,395.90	5,370.00	7,501.24
7/21/04	Highgate Cliffs	net	UVM	2	7.05	132.22			13,110.98	4,296.00	13,250.25
7/21/04	Highgate Springs	net	UVM	1		102.70			26,534.47	5,995.00	26,637.17
7/21/04	Highgate Springs	net	UVM	2		166.88			45,357.21	3,637.00	45,524.09
7/21/04	St. Albans Boat Launch	net	UVM	2	168.68		21.08	20.38	97.69	98.00	307.83
7/21/04	Alburg	net	UVM	1	26.70	28.04			2,503.20	2,503.00	2,557.94
7/21/04	Alburg	net	UVM	2	17.29	172.87			4,171.37	4,171.00	4,361.53
7/20/04	Burlington Water Bay	net	UVM	1	234.13	15.66	0.78	3.13	86.14	8.00	339.84
7/20/04	Champlain Water Bay	net	UVM	1	14.37	31.24	12.49	0.62	68.72	69.00	127.44

7/20/04	Champlain Water Bay	net	UVM	2	57.89	22.76	3.25		3.90		119.67	120.00	207.47
7/20/04	North Beach	net	UVM	1	117.55	38.76	3.18				90.87	91.00	250.36
7/20/04	North Beach	net	UVM	2	88.49	48.27			1.61		48.27	48.00	186.64
7/20/04	Red Rocks Beach	net	UVM	1	4.45	41.72			2.78		71.76	72.00	120.71
7/20/04	Red Rocks Beach	net	UVM	2	13.76	10.75			3.44		21.50	22.00	50.31
7/20/04	McCuen Slang Boat Launch	net	UVM	1	5.86	11.72	2.34	2.34		65.66	11.72	12.00	99.64
7/20/04	McCuen Slang Boat Launch	net	UVM	2	5.86	76.21				69.17	15.24	15.00	166.48
7/16/04	VTDEC Sta25	net	VT DEC	1	12.82	8.22			0.33		16.43	16.00	37.80
7/7/04	Larrabee's Point	water1	Lay monitor	1	6,933.33						5,333.33	5,333.00	12,266.66
7/19/04	Button Bay	water1	Lay monitor	0	5,600.00	3,200.00							8,800.00
7/12/04	Highgate Springs-Shipyard	water1	Lay monitor	1		266.67	800.00						1,066.67
7/12/04	Raake's Point	water1	Lay monitor	1	600.00		400.00		200.00				1,200.00
7/19/04	Raake's Point	water1	Lay monitor	1			200.00						200.00
7/19/04	Highgate Springs-Shipyard	water1	Lay monitor	1							13,333.33	13,333.00	13,333.33
7/12/04	High Rocks	water1	Lay monitor	1		160.00	320.00	160.00			8,000.00	8,000.00	8,640.00
7/19/04	High Rocks	water1	Lay monitor	1							213,333.33	213,333.00	213,333.33
7/19/04	Maquam Bay	water1	Lay monitor	1	200.00		800.00						1,000.00
7/18/04	Alburg Springs	water1	Lay monitor	1			600.00				50,000.00	50,000.00	50,600.00
7/19/04	Missisquoi Bay - Comolli Camp	water1	Lay monitor	1	200.00		400.00						600.00
7/19/04	VTDEC Sta34	net	VT DEC	1	116.73	8.47	7.06		16.00		1,429.48	135.00	1,577.74
7/19/04	VTDEC Sta40	net	VT DEC	1	77.02				6.85		122.81	80.00	206.68
7/21/04	VTDEC Sta46	net	VT DEC	0	37.48	0.62	1.25	0.62					39.97

7/21/04	VTDEC Sta50	net	VT DEC	1	1.14				1.14	5,968.77	5,969.00	5,971.05
7/26/04	Rte 78 Access	net	UVM	1	36.71	108.47				19,009.32	19,009.00	19,154.50
7/26/04	Rte 78 Access	net	UVM	2	28.50					14,170.63	14,171.00	14,199.13
7/26/04	Chapman Bay	net	UVM	1	62.30	38.94				5,851.71	5,852.00	5,952.95
7/26/04	Chapman Bay	net	UVM	2	37.38	11.68				4,488.08	4,488.00	4,537.92
7/26/04	Highgate Cliffs	net	UVM	1		155.33				10,536.35	10,536.00	10,691.68
7/26/04	Highgate Cliffs	net	UVM	2	9.50	142.49			0.95	7,664.06	7,664.00	7,817.00
7/26/04	Highgate Springs	net	UVM	1	6.42	19.26				5,122.58	5,123.00	5,148.26
7/26/04	Highgate Springs	net	UVM	2	10.53					7,348.40	7,348.00	7,358.93
7/26/04	St. Albans Boat Launch	net	UVM	1	1,542.06	217.21			4.32	195.63	196.00	1,959.22
7/26/04	St. Albans Boat Launch	net	UVM	2	83.18	69.32			5.55	149.73	150.00	307.78
7/26/04	Alburg	net	UVM	1	41.98					9,565.11	9,565.00	9,607.09
7/26/04	Alburg	net	UVM	2						12,574.30	12,574.00	12,574.30
7/22/04	VTDEC Sta07	net	VT DEC	1	452.89	23.11			0.46			476.46
7/22/04	VTDEC Sta09	net	VT DEC	1	279.59	11.55	1.93	0.39		24.26	24.00	317.72
7/26/04	Rte 78 - surface grab	water1	UVM	1						1,674,400.00	341,067.00	1,674,400.00
7/26/04	Raake's Point	water1	Lay monitor	1	266.67	13,333.33				129,333.33	129,333.00	142,933.33
7/26/04	Missisquoi Bay - Comolli Camp	water1	Lay monitor	1						16,800.00	16,800.00	16,800.00
7/26/04	High Rocks	water1	Lay monitor	1						833,600.00	166,933.00	833,600.00
7/26/04	VTDEC Sta33	net	VT DEC	1	16.94				1.23			18.17
7/26/04	VTDEC Sta36	net	VT DEC	1		28.37		0.44	0.44	4.36	4.00	33.61
7/28/04	VTDEC Sta02	net	VT DEC	1	3.34				0.67			4.01
7/28/04	VTDEC Sta04	net	VT DEC	1	382.16			0.56	2.23	297.05	297.00	682.00
7/28/04	VTDEC	net	VT DEC	1	122.00					22.64	23.00	144.64

	Sta19										
7/29/04	VTDEC Sta16	net	VT DEC	1	28.24	0.47	2.35		29.65	30.00	60.71
7/29/04	VTDEC Sta21	net	VT DEC	1	92.49	5.27	1.44		50.32	50.00	149.52
8/4/04	Rte 78 Access	net	UVM	1	51.86				8,842.34	8,842.00	8,894.20
8/4/04	Rte 78 Access	net	UVM	2	94.39				9,889.78	9,890.00	9,984.17
8/4/04	Chapman Bay	net	UVM	1	22.68	113.39			4,853.22	4,853.00	4,989.29
8/4/04	Chapman Bay	net	UVM	2	221.05				8,147.35	8,147.00	8,368.40
8/4/04	Highgate Cliffs	net	UVM	1	290.11				16,343.14	16,343.00	16,633.25
8/4/04	Highgate Cliffs	net	UVM	2	106.97	267.44			18,073.34	18,073.00	18,447.75
8/4/04	Highgate Springs	net	UVM	1		2.90			11,282.57	11,283.00	11,285.47
8/4/04	Highgate Springs	net	UVM	2					11,395.64	11,396.00	11,395.64
8/4/04	St. Albans Boat Launch	net	UVM	1	10.14	50.71			3,410.48	824.00	3,471.33
8/4/04	St. Albans Boat Launch	net	UVM	2			1.35		4,497.87	1,061.00	4,499.22
8/4/04	Alburg	net	UVM	2	192.55				9,023.08	9,023.00	9,215.63
8/3/04	Burlington Water Bay	net	UVM	1	394.25	4.81	0.96		156.45	108.00	556.47
8/3/04	Burlington Water Bay	net	UVM	2	49.70		1.71		230.21	173.00	281.62
8/3/04	Champlain Water Bay	net	UVM	1	41.93				238.67	206.00	280.60
8/3/04	Champlain Water Bay	net	UVM	2	99.74	11.40			87.63	52.00	198.77
8/3/04	North Beach	net	UVM	1	55.36		0.96		9.63	10.00	65.95
8/3/04	North Beach	net	UVM	2	6.56		0.94		67.00	20.00	74.50
8/3/04	Red Rocks Beach	net	UVM	1	64.75	12.02	3.34		144.85	45.00	224.96
8/3/04	Red Rocks Beach	net	UVM	2	11.86	9.04	3.39	0.56	76.82	77.00	101.67
8/3/04	McCuen Slang Boat Launch	net	UVM	1	2.79						2.79

8/3/04	McCuen Slang Boat Launch	net	UVM	2	11.91					7.45	7.00	19.36
8/2/04	Missisquoi Bay - Comolli Camp	water1	Lay monitor	1						42,000.00	42,000.00	42,000.00
7/26/04	Highgate Springs-Shipyard	water1	Lay monitor	1		3,000.00				115,200.00	115,200.00	118,200.00
8/2/04	Highgate Springs-Shipyard	water1	Lay monitor	1	400.00					40,000.00	40,000.00	40,400.00
8/2/04	Raake's Point	water1	Lay monitor	1		200.00				12,000.00	12,000.00	12,200.00
8/2/04	High Rocks	water1	Lay monitor	1						54,600.00	54,600.00	54,600.00
8/2/04	Maquam Bay	water1	Lay monitor	1	200.00	1,600.00				4,600.00	4,600.00	6,600.00
8/1/04	Alburg Springs	water1	Lay monitor	1	13,400.00				200.00	14,000.00	14,000.00	27,600.00
8/10/04	Rte 78 Access	net	UVM	1						22,428.70	22,429.00	22,428.70
8/10/04	Rte 78 Access	net	UVM	2	105.26	263.16				10,105.24	10,105.00	10,473.66
8/10/04	Chapman Bay	net	UVM	1	92.72		2.99			5,204.35	5,204.00	5,300.06
8/10/04	Chapman Bay	net	UVM	2	264.53					6,589.12	6,589.00	6,853.65
8/10/04	St. Albans Boat Launch	net	UVM	1	136.89	33.12			4.42	5,235.06	4,904.00	5,409.49
8/10/04	St. Albans Boat Launch	net	UVM	2	148.42				3.16	5,485.25	5,012.00	5,636.83
8/10/04	Alburg	net	UVM	1	106.29	132.86				6,377.39	6,377.00	6,616.54
8/10/04	Alburg	net	UVM	2	94.74					5,431.57	5,432.00	5,526.31
8/9/04	Maquam Bay	water1	Lay monitor	0		266.67		266.67		13,333.33	13,333.00	13,866.67
8/9/04	Missisquoi Bay - Comolli Camp	water1	Lay monitor	0		8,000.00				74,666.67	74,667.00	82,666.67
8/8/04	Alburg Springs	water1	Lay monitor	0	266.67		266.67			16,000.00	16,000.00	16,533.34
8/10/04	VTDEC Sta34	net	VT DEC	1	140.03	0.46			6.93	321.18	298.00	468.60
8/12/04	VTDEC Sta36	net	VT DEC	1	77.75				4.73	82.48	49.00	164.96
8/12/04	VTDEC	net	VT DEC	1	10.21			2.38	0.68	8.84	9.00	22.11

	Sta33											
8/9/04	VTDEC Sta46	net	VT DEC	1	9.70	0.92			0.23	1.39	1.00	12.24
8/10/04	VTDEC Sta40	net	VT DEC	1	114.00	11.20			1.98	210.87	145.00	338.05
8/11/04	VTDEC Sta09	net	VT DEC	1	149.85	44.07	0.88		9.70	49.36	49.00	253.86
8/11/04	VTDEC Sta07	net	VT DEC	1	347.11	0.67			4.01	88.78	89.00	440.57
8/9/04	VTDEC Sta50	net	VT DEC	1	23.62					1,169.98	1,170.00	1,193.60
8/9/04	Carry Bay	water1	VT DEC	1			266.67	266.67		16,000.00		16,533.34
8/9/04	Maquam shore	water1	VT DEC	1	200.00					2,020,000.00	20,000.00	2,020,200.00
8/17/04	Rte 78 Access	net	UVM	1	63.16					2,865.20	2,865.00	2,928.36
8/17/04	Rte 78 Access	net	UVM	2	133.50					4,472.39	4,472.00	4,605.89
8/17/04	Chapman Bay	net	UVM	1	80.10				2.00	9,031.56	9,032.00	9,113.66
8/17/04	Chapman Bay	net	UVM	2	140.18	8.01				14,158.12	14,158.00	14,306.31
8/17/04	Highgate Cliffs	net	UVM	1	25.16					4,906.28	4,906.00	4,931.44
8/17/04	Highgate Cliffs	net	UVM	2						5,494.21	5,494.00	5,494.21
8/17/04	Highgate Springs	net	UVM	1	65.38					10,395.87	10,396.00	10,461.25
8/17/04	Highgate Springs	net	UVM	2						13,409.85	13,410.00	13,409.85
8/17/04	St. Albans Boat Launch	net	UVM	1	153.48	2.52				6,592.65	271.00	6,748.65
8/17/04	St. Albans Boat Launch	net	UVM	2	183.04					2,014.72	442.00	2,197.76
8/17/04	Alburg	net	UVM	1	150.19	75.10				5,089.85	5,090.00	5,315.14
8/17/04	Alburg	net	UVM	2	168.68	28.11				8,902.42	8,902.00	9,099.21
8/18/04	Burlington Water Bay	net	UVM	1	141.82		2.31		0.58	65.85	51.00	210.56
8/18/04	Burlington Water Bay	net	UVM	2	94.29					46.20	46.00	140.49
8/18/04	Champlain Water Bay	net	UVM	1	95.07	9.51	10.78		1.27	591.36	528.00	707.99
8/18/04	Champlain Water Bay	net	UVM	2	308.09		2.88		0.82	531.96	121.00	843.75
8/18/04	North Beach	net	UVM	1	29.95	0.29	5.71		0.29	68.18	54.00	104.42

8/18/04	North Beach	net	UVM	2	84.57				0.78		10.18	10.00	95.53
8/18/04	Red Rocks Beach	net	UVM	1	112.97	44.50	11.30				118.78	119.00	287.55
8/18/04	Red Rocks Beach	net	UVM	2	267.27		7.32		0.39		105.13	86.00	380.11
8/18/04	McCuen Slang Boat Launch	net	UVM	1	2.50	33.38		0.83		3.34			40.05
8/18/04	McCuen Slang Boat Launch	net	UVM	2	0.83	13.35	0.83			2.50			17.51
8/9/04	Highgate Springs-Shipyard	water1	Lay monitor	1							26,000.00	26,000.00	26,000.00
8/16/04	Maquam Bay	water1	Lay monitor	1							2,000.00	2,000.00	2,000.00
8/11/04	Raake's Point	water1	Lay monitor	1							51,466.67	51,467.00	51,466.67
8/11/04	High Rocks	water1	Lay monitor	1							64,000.00	64,000.00	64,000.00
8/16/04	Missisquoi Bay - Comolli Camp	water1	Lay monitor	1			800.00	200.00			862,000.00	862,000.00	863,000.00
8/16/04	High Rocks	water1	Lay monitor	1			200.00	1,000.00			254,000.00	254,000.00	255,200.00
8/16/04	Raake's Point	water1	Lay monitor	1							266,666.67	266,667.00	266,666.67
8/24/04	Rte 78 Access	net	UVM	1	225.29						5,932.59	5,933.00	6,157.88
8/24/04	Rte 78 Access	net	UVM	2	288.06	130.94					4,739.91	4,740.00	5,158.91
8/24/04	Chapman Bay	net	UVM	1	118.10						4,723.99	4,724.00	4,842.09
8/24/04	Chapman Bay	net	UVM	2	130.29						6,540.81	6,541.00	6,671.10
8/24/04	Highgate Cliffs	net	UVM	1	82.93						10,089.41	10,089.00	10,172.34
8/24/04	Highgate Cliffs	net	UVM	2	25.25						10,729.54	10,730.00	10,754.79
8/24/04	Highgate Springs	net	UVM	1	26.02		2.60				7,154.45	7,154.00	7,183.07
8/24/04	St. Albans Boat Launch	net	UVM	1	243.12	37.87			6.82		974.75	975.00	1,262.56
8/24/04	St. Albans Boat Launch	net	UVM	2	127.60	45.57			13.67		731.87	641.00	918.71
8/24/04	Alburg	net	UVM	1	265.72						1,270.86	1,271.00	1,536.58

8/24/04	Alburg	net	UVM	2	207.96				1.16		2,264.44	2,264.00	2,473.56
8/16/04	Highgate Springs-Shipyard	water1	Lay monitor	1			266.67				202,666.67	202,667.00	202,933.34
8/23/04	Missisquoi Bay - Comolli Camp	water1	Lay monitor	1			347.83	695.65			8,695.65	8,696.00	9,739.13
8/23/04	Maquam shore - Swanton Beach	water1	Lay monitor	1	533.33	266.67							800.00
8/22/04	Alburg Springs	water1	Lay monitor	1			200.00	200.00			90,000.00	90,000.00	90,400.00
8/24/04	Alburg Passage	water1	VT DEC	1							786,666.67	786,667.00	786,666.67
8/24/04	Dillenbeck Bay	water1	UVM	1							14,533.33	14,533.00	14,533.33
8/24/04	Maquam Bay	water1	UVM	1			100.00				80,000.00	80,000.00	80,100.00
8/24/04	VTDEC Sta50	net	VT DEC	1	45.26						2,594.35	2,594.00	2,639.61
8/24/04	VTDEC Sta46	net	VT DEC	0	546.88	6.55					48.01	48.00	601.44
8/30/04	Burlington Water Bay	net	UVM	1	204.47				3.95		647.37	647.00	855.79
8/30/04	Burlington Water Bay	net	UVM	2	302.28		4.21		3.15		533.59	534.00	843.23
8/30/04	Champlain Water Bay	net	UVM	1	476.17		10.47		2.62		101.69	102.00	590.95
8/30/04	Champlain Water Bay	net	UVM	2	535.35			7.01	2.67		225.96	226.00	770.99
8/30/04	North Beach	net	UVM	1	1,219.45	0.29	8.95		4.91		689.73	661.00	1,923.33
8/30/04	North Beach	net	UVM	2	511.39		0.31		2.52		378.98	206.00	893.20
8/30/04	Red Rocks Beach	net	UVM	1	1,080.01	39.54	9.08		0.65		270.33	270.00	1,399.61
8/30/04	Red Rocks Beach	net	UVM	2	678.87		14.69		0.67		126.83	127.00	821.06
9/2/04	McCuen Slang Boat Launch	net	UVM	1	12.94	60.01	80.02	2.35	14.12	10.59			180.03
9/2/04	McCuen Slang Boat Launch	net	UVM	2	11.30	33.89	2.26	1.13	19.20	11.30	11.30	11.00	90.38
9/1/04	Rte 78 Access	net	UVM	1	442.10						2,947.36	2,947.00	3,389.46

9/1/04	Rte 78 Access	net	UVM	2	402.05		2.23				5,360.71	5,361.00	5,764.99
9/1/04	Chapman Bay	net	UVM	1	108.24						2,557.46	2,557.00	2,665.70
9/1/04	Chapman Bay	net	UVM	2	173.30						1,860.07	1,860.00	2,033.37
9/1/04	Highgate Cliffs	net	UVM	1	39.54				0.66		1,258.62	1,259.00	1,298.82
9/1/04	Highgate Cliffs	net	UVM	2	55.11						1,495.93	1,496.00	1,551.04
9/1/04	Highgate Springs	net	UVM	1	70.86						1,031.41	1,031.00	1,102.27
9/1/04	Highgate Springs	net	UVM	2	53.40						1,112.53	1,113.00	1,165.93
9/1/04	St. Albans Boat Launch	net	UVM	1	208.99	0.95			2.85		661.15	661.00	873.94
9/1/04	St. Albans Boat Launch	net	UVM	2	269.63	0.76			1.51		1,407.97	1,237.00	1,679.87
9/1/04	Alburg	net	UVM	1	117.84	10.40					1,282.41	1,282.00	1,410.65
9/1/04	Alburg	net	UVM	2	96.45	29.95					545.14	545.00	671.54
8/23/04	Highgate Springs-Shipyard	water1	UVM	1	2,000.00		1,600.00	1,800.00					5,400.00
8/29/04	Alburg Springs	water1	UVM	1	2,000.00						24,000.00	24,000.00	26,000.00
8/30/04	Highgate Springs-Shipyard	water1	Lay monitor	1	2,000.00		400.00				10,000.00	10,000.00	12,400.00
8/31/04	Maquam Bay	water1	Lay monitor	1			200.00	200.00					400.00
9/1/04	Rte 78 - surface grab	water1	UVM	1							24,320,000.00	24,320,000.00	24,320,000.00
9/7/04	Rte 78 Access	net	UVM	1	146.44	1.59					2,546.85	2,547.00	2,694.88
9/7/04	Rte 78 Access	net	UVM	2	136.07						2,789.47	2,789.00	2,925.54
9/7/04	Chapman Bay	net	UVM	1	74.45						4,374.19	4,374.00	4,448.64
9/7/04	Chapman Bay	net	UVM	2	54.69						4,010.26	4,010.00	4,064.95
9/7/04	Highgate Springs-Shipyard	water1	UVM	2			400.00				20,000.00	20,000.00	20,400.00
9/7/04	St. Albans Boat Launch	net	UVM	1	95.94	111.14	0.95		1.90		1,206.42	1,016.00	1,416.35

9/7/04	St. Albans Boat Launch	net	UVM	2	64.66	116.03				1,564.23	1,166.00	1,744.92
9/7/04	Alburg	net	UVM	1	155.66					1,821.56	1,822.00	1,977.22
9/7/04	Alburg	net	UVM	2	101.24					2,241.76	2,242.00	2,343.00
9/7/04	Missisquoi Bay - Comolli Camp	water1	Lay monitor	1		11,000.00	400.00	200.00		10,000.00	10,000.00	21,600.00
9/1/04	VTDEC Sta25	net	VT DEC	1	96.79	0.67	1.34	2.00		117.48	84.00	218.28
9/1/04	VTDEC Sta40	net	VT DEC	1	27.11	0.62						27.73
9/1/04	VTDEC Sta34	net	VT DEC	1	24.01	29.24	0.87	0.44	0.87	261.87	175.00	317.30
9/2/04	VTDEC Sta36	net	VT DEC	1	304.49	5.13				120.67	121.00	430.29
9/2/04	VTDEC Sta33	net	VT DEC	1	60.82					27.46	27.00	88.28
9/3/04	VTDEC Sta07	net	VT DEC	1	46.73	25.37			2.67	23.14	23.00	97.91
9/7/04	VTDEC Sta02	net	VT DEC	1	15.02		0.39	0.39	0.39			16.19
9/7/04	VTDEC Sta04	net	VT DEC	1	223.36		22.28					245.64
9/8/04	VTDEC Sta46	net	VT DEC	1	3.85	0.13				6.42	6.00	10.40
9/8/04	VTDEC Sta50	net	VT DEC	1	51.18		0.39			914.49	914.00	966.06
9/14/04	Rte 78 Access	net	UVM	1	151.91	37.36				2,266.23	2,266.00	2,455.50
9/14/04	Rte 78 Access	net	UVM	2	127.01	24.90	2.49			4,358.14	4,358.00	4,512.54
9/14/04	Chapman Bay	net	UVM	1	78.73					4,031.14	4,031.00	4,109.87
9/14/04	Chapman Bay	net	UVM	2	152.16	32.61	2.17			2,717.15	2,717.00	2,904.09
9/14/04	Highgate Cliffs	net	UVM	1	185.78				0.92	1,571.24	1,571.00	1,757.94
9/14/04	Highgate Cliffs	net	UVM	2	197.18	35.60				2,081.30	2,081.00	2,314.08
9/14/04	Highgate Springs	net	UVM	1	105.45	7.83	16.71		1.04	1,132.82	1,133.00	1,263.85
9/14/04	Highgate Springs	net	UVM	2	136.59		29.27	0.49		639.02	639.00	805.37
9/14/04	St. Albans Boat Launch	net	UVM	1	15.15	228.73			1.51	4,854.80	4,097.00	5,100.19

9/14/04	St. Albans Boat Launch	net	UVM	2	156.90	425.16				4,674.22	3,915.00	5,256.28
9/14/04	Alburg	net	UVM	1	71.63		2.39			4,918.60	4,919.00	4,992.62
9/14/04	Alburg	net	UVM	2	234.40					4,155.32	4,155.00	4,389.72
9/16/04	Burlington Water Bay	net	UVM	1	24.60	11.34	0.27		0.41	46.60	26.00	83.22
9/16/04	Burlington Water Bay	net	UVM	2	64.77	41.95			1.47	451.16	414.00	559.35
9/16/04	Champlain Water Bay	net	UVM	1	126.30	23.33			0.80	137.56	121.00	287.99
9/16/04	Champlain Water Bay	net	UVM	2	31.54	7.97	3.12		1.39	52.68	35.00	96.70
9/16/04	North Beach	net	UVM	1	8.78	0.46	0.23	0.23	0.23	51.99	40.00	61.92
9/16/04	North Beach	net	UVM	2	231.18	18.61	0.37		0.74	51.37	51.00	302.27
9/16/04	Red Rocks Beach	net	UVM	1	39.77					12.12	12.00	51.89
9/16/04	Red Rocks Beach	net	UVM	2	75.23	7.57	1.01	1.01	0.50	13.13	13.00	98.45
9/6/04	Highgate Springs-Shipyard	water1	Lay monitor	1	533.33		2,400.00	533.33		13,333.33	13,333.00	16,799.99
9/7/04	Maquam shore - Swanton Beach	water1	Lay monitor	1	1,666.67			66.67		3,333.33	3,333.00	5,066.67
9/12/04	Alburg Springs	water1	Lay monitor	1	177.78	177.78	177.78			4,444.44	4,444.00	4,977.78
9/13/04	Missisquoi Bay - Comolli Camp	water1	Lay monitor	1	1,466.67	533.33	400.00	133.33				2,533.33
9/21/04	Rte 78 Access	net	UVM	1	434.02	26.96	8.99			521.18	521.00	991.15
9/21/04	Rte 78 Access	net	UVM	1	411.98	47.57	9.51			637.47	637.00	1,106.53
9/21/04	Rte 78 Access	net	UVM	2	637.44	107.60				1,320.54	1,321.00	2,065.58
9/21/04	Chapman Bay	net	UVM	1	309.46					1,702.01	1,702.00	2,011.47
9/21/04	Highgate Cliffs	net	UVM	1	423.62	25.42				6,015.39	7,625.00	6,464.43
9/21/04	Highgate Cliffs	net	UVM	1	372.78	25.42				7,625.14	6,015.00	8,023.34
9/21/04	Highgate Cliffs	net	UVM	2	233.12					5,070.33	5,070.00	5,303.45

9/21/04	Highgate Springs	net	UVM	1	192.04	34.92	2.33			535.39	535.00	764.68
9/21/04	Highgate Springs	net	UVM	2	113.91		1.75			532.48	532.00	648.14
9/21/04	St. Albans Boat Launch	net	UVM	1	15.15	48.47				469.58	242.00	533.20
9/21/04	St. Albans Boat Launch	net	UVM	2	1.28	96.28				1,001.28	897.00	1,100.12
9/21/04	St. Albans Boat Launch	net	UVM	2	1.18	88.87				897.01	1,001.00	988.24
9/21/04	Alburg	net	UVM	1	372.99					1,437.74	1,438.00	1,810.73
9/21/04	Alburg	net	UVM	2	213.61	9.86				1,815.66	1,816.00	2,039.13
9/21/04	St. Albans shoreline grab	water1	UVM	1			266.67			214,400.00	121,067.00	214,666.67
9/29/04	Rte 78 Access-shore	water1	UVM	1	6,700.00					50,000.00	50,000.00	56,700.00
9/29/04	Rte 78 Access-shore	water1	UVM	2	5,300.00	100.00		100.00				5,500.00
9/29/04	Alburg-Shore	water1	UVM	1	2,400.00		640.00			16,000.00	16,000.00	19,680.00
9/29/04	Alburg-Shore	water1	UVM	2	5,733.33		133.33	266.67				6,133.33
9/29/04	Highgate Springs-Shipyard	water1	UVM	2	3,040.00		640.00			3,200.00	0.00	7,360.00
9/29/04	St. Albans Boat Launch	net	UVM	1	1.28	32.09			2.57	349.81	350.00	385.75
9/29/04	St. Albans Boat Launch	net	UVM	2	15.02	25.03			1.00	63.08	63.00	104.13
9/30/04	North Beach	net	UVM	1	20.35	18.86	0.50			35.74	36.00	75.45
9/30/04	North Beach	net	UVM	2	12.58	23.36	0.36			103.88	104.00	140.18
9/30/04	Burlington Water Bay	net	UVM	1	53.27	69.61	2.13		1.42	28.41	28.00	154.84
9/30/04	Burlington Water Bay	net	UVM	2	56.19	10.06			0.84	89.32	89.00	156.41
9/30/04	Champlain Water Bay	net	UVM	1	54.51	18.45			2.10	232.73	233.00	307.79

9/30/04	Champlain Water Bay	net	UVM	2	97.05	1.93	1.16		0.39	41.59	42.00	142.12
9/30/04	Red Rocks Beach	net	UVM	1	15.82	11.41	13.25		0.74	30.54	31.00	71.76
9/30/04	Red Rocks Beach	net	UVM	2	20.97	11.32			0.42	62.06	62.00	94.77
10/13/04	Burlington Water Bay	net	UVM	1	37.66	38.51				112.54	91.00	188.71
10/13/04	Champlain Water Bay	net	UVM	1	52.37	25.26	1.54		0.62	59.77	60.00	139.56
10/13/04	Champlain Water Bay	net	UVM	2	42.39	126.50				78.77	62.00	247.66
10/13/04	Red Rocks Beach	net	UVM	2	13.95	24.83						38.78
10/14/04	Rte 78 Access	net	UVM	1	470.01					593.70	594.00	1,063.71
10/14/04	Rte 78 Access	net	UVM	2	166.52		2.36			10.63	11.00	179.51
10/14/04	Chapman Bay	net	UVM	1	570.71					170.04	170.00	740.75
10/14/04	Chapman Bay	net	UVM	2	150.36					381.00	381.00	531.36
10/14/04	Highgate Cliffs	net	UVM	1	1,076.25		443.64			2,101.56	2,102.00	3,621.45
10/14/04	Highgate Cliffs	net	UVM	2	704.75					715.15	715.00	1,419.90
10/14/04	Highgate Springs	net	UVM	1	55.63	33.38				208.60	209.00	297.61
10/14/04	Highgate Springs	net	UVM	2	111.91		0.86			1,185.36	1,185.00	1,298.13
10/14/04	St. Albans Boat Launch	net	UVM	1	26.42	84.29				941.00	941.00	1,051.71
10/14/04	St. Albans Boat Launch	net	UVM	2	8.09	202.18				7,691.00	7,287.00	7,901.27
10/14/04	Alburg	net	UVM	1	381.26		0.58			57.77	58.00	439.61
10/14/04	Alburg	net	UVM	2	219.03					438.06	438.00	657.09
10/27/04	Highgate Springs-Shipyard	water1	UVM	1	833.33			800.00				1,633.33

Appendix C. Results of toxin analyses for samples collected from Lake Champlain 2004.

					Microcystin by ELISA			Microcystin by PPIA		Anatoxin-a by HPLC
Collection Dates	Sample Locations	Rep	Net, Plankton or Whole Water	Run by:	Toxin Conc. In Lakewater (ug/L)	Analysis Date	Sample % CV (if > ~15)	Mean Toxin Conc. In Lakewater (μg/L)	SD	Toxin Conc. in Lakewater (μg/L)
7/13/2004	Rte 78 Access	1	wwp	UVM	0.04	7/15/2004				
7/13/2004	Rte 78 Access	2	wwp	UVM	0.05	7/15/2004				
7/13/2004	Chapman Bay	1	wwp	UVM	0.02	7/15/2004	27.27			
7/13/2004	Chapman Bay	2	wwp	UVM	0.03	7/15/2004	22.56			
7/13/2004	Highgate Cliffs	1	wwp	UVM	0.90	11/16/2004				
7/13/2004	Highgate Cliffs	2	wwp	UVM	1.20	11/16/2004				
7/13/2004	Highgate Springs	1	wwp	UVM	2.40	6/14/2005				
7/13/2004	Highgate Springs	2	wwp	UVM	2.39	6/14/2005				
7/13/2004	Alburg	1	wwp	UVM	0.03	7/15/2004				
7/13/2004	Alburg	2	wwp	UVM	0.03	7/15/2004				
7/21/2004	Rte 78 Access	1	net	UVM	0.19	12/21/2004				
7/21/2004	Rte 78 Access	1	wwp	UVM	0.85	11/16/2004				
7/21/2004	Rte 78 Access	2	net	UVM	0.17	12/15/2004				
7/21/2004	Rte 78 Access	2	wwp	UVM	0.73	11/16/2004				
7/21/2004	Chapman Bay	1	net	UVM	0.28	12/21/2004				
7/21/2004	Chapman Bay	1	wwp	UVM	1.02	11/29/2004				
7/21/2004	Chapman Bay	2	net	UVM	0.21	2/7/2005				
7/21/2004	Chapman Bay	2	wwp	UVM	1.42	11/23/2004				
7/21/2004	Highgate Cliffs	1	net	UVM	0.54	12/15/2004				
7/21/2004	Highgate Cliffs	1	wwp	UVM	6.02	11/29/2004				
7/21/2004	Highgate Cliffs	2	net	UVM	0.61	12/15/2004				
7/21/2004	Highgate Cliffs	2	wwp	UVM	5.24	11/29/2004				
7/21/2004	Highgate Springs	1	wwp	UVM	5.66	6/14/2005				
7/21/2004	Highgate Springs	2	wwp	UVM	4.37	6/14/2005				
7/21/2004	St. Albans Boatlaunch	1	wwp	UVM	0.01	7/22/2004				
7/21/2004	St. Albans Boatlaunch	2	wwp	UVM	0.01	7/22/2004				
7/21/2004	Alburg	1	wwp	UVM	0.47	7/22/2004				
7/21/2004	Alburg	2	wwp	UVM	0.57	7/22/2004				
7/12/2004	Highgate Springs	1	wwp	UVM	0.07	7/22/2004				

	Shipyard					
7/12/2004	Raake's Point	1	wwp	UVM	0.05	7/28/2004
7/19/2004	Raake's Point	1	wwp	UVM	0.01	7/22/2004
7/19/2004	Highgate Springs Shipyard	1	wwp	UVM	0.01	7/22/2004
7/12/2004	High Rocks	1	wwp	UVM	0.02	7/22/2004
7/19/2004	High Rocks	1	wwp	UVM	30.82	5/27/2005
7/19/2004	Maquam Bay	1	wwp	UVM	0.09	7/22/2004
7/18/2004	Alburg Springs	1	wwp	UVM	1.90	6/14/2005
7/19/2004	Comolli Campsite	1	wwp	UVM	0.03	7/22/2004
7/26/2004	Rte 78 Access	1	net	UVM	0.98	12/15/2004
7/26/2004	Rte 78 Access	1	wwp	UVM	4.83	11/29/2004
7/26/2004	Rte 78 Access	2	net	UVM	0.91	2/7/2005
7/26/2004	Rte 78 Access	2	wwp	UVM	5.17	11/29/2004
7/26/2004	Chapman Bay	1	net	UVM	0.77	12/15/2004
7/26/2004	Chapman Bay	1	wwp	UVM	0.72	7/28/2004
7/26/2004	Chapman Bay	2	net	UVM	0.38	12/15/2004
7/26/2004	Chapman Bay	2	wwp	UVM	0.14	7/28/2004
7/26/2004	Highgate Cliffs	1	net	UVM	0.33	12/15/2004
7/26/2004	Highgate Cliffs	1	wwp	UVM	4.32	11/29/2004
7/26/2004	Highgate Cliffs	2	net	UVM	0.65	12/15/2004
7/26/2004	Highgate Cliffs	2	wwp	UVM	7.52	11/29/2004
7/26/2004	Highgate Springs	1	wwp	UVM	1.01	7/28/2004
7/26/2004	Highgate Springs	2	wwp	UVM	1.00	7/28/2004
7/26/2004	St. Albans Boatlaunch	1	wwp	UVM	0.00	7/28/2004
7/26/2004	St. Albans Boatlaunch	2	wwp	UVM	0.01	7/28/2004
7/26/2004	Alburg	1	wwp	UVM	0.38	6/14/2005
7/26/2004	Alburg	2	wwp	UVM	0.39	6/14/2005
7/26/2004	Rte 78 - dock	1	wwp	UVM	78.28	12/21/2004
7/26/2004	Raake's Point	1	wwp	UVM	40.11	6/14/2005
7/26/2004	Comolli Campsite	1	wwp	UVM	0.94	7/28/2004
7/25/2004	Alburg Springs	1	wwp	UVM	282.71	6/14/2005
7/26/2004	High Rocks	1	wwp	UVM	48.82	6/14/2005
7/26/2004	Maquam Bay	1	wwp	UVM	0.13	7/28/2004
8/4/2004	Rte 78 Access	1	net	UVM	1.67	12/21/2004
8/4/2004	Rte 78 Access	1	wwp	UVM	10.48	11/29/2004
8/4/2004	Rte 78 Access	2	wwp	UVM	9.75	11/29/2004
8/4/2004	Rte 78 Access	2	net	UVM	0.16	5/27/2005
8/4/2004	Chapman Bay	1	net	UVM	0.41	12/21/2004
8/4/2004	Chapman Bay	1	wwp	UVM	1.44	8/5/2004
8/4/2004	Chapman Bay	2	net	UVM	0.53	12/21/2004

8/4/2004	Chapman Bay	2	wwp	UVM	1.37	8/5/2004	34.00			
8/4/2004	Highgate Cliffs	1	net	UVM	0.44	12/21/2004				
8/4/2004	Highgate Cliffs	1	wwp	UVM	2.50	8/5/2004				
8/4/2004	Highgate Cliffs	2	net	UVM	0.56	12/15/2004				
8/4/2004	Highgate Cliffs	2	wwp	UVM	2.68	8/5/2004				
8/4/2004	Highgate Springs	1	wwp	UVM	89.56	6/14/2005				
8/4/2004	Highgate Springs	2	wwp	UVM	4.74	8/5/2004				
8/4/2004	St. Albans Boatlaunch	2	wwp	UVM	0.05	8/5/2004	33.00			
8/4/2004	Alburg	1	wwp	UVM	53.26	5/27/2005	24.63			
8/4/2004	Alburg	2	wwp	UVM	8.04	8/5/2004				
8/4/2004	Alburg	2	wwp	SUNY-ESF				5.92	0.06	nd
8/3/2004	Burlington Water Bay	1	wwp	SUNY-ESF				1.19	0.05	nd
8/3/2004	McCuen Slang Boatlaunch	1	wwp	SUNY-ESF				3.04	0.50	nd
8/2/2004	Comolli Campsite	1	wwp	UVM	1.30	8/5/2004				
7/26/2004	Highgate Springs Shipyard	1	wwp	UVM	23.28	5/27/2005				
8/2/2004	Highgate Springs Shipyard	1	wwp	UVM	0.58	5/27/2005				
8/2/2004	Raake's Point	1	wwp	UVM	0.87	6/14/2005	16.15			
8/2/2004	High Rocks	1	wwp	UVM	0.45	8/5/2004	65.00			
8/10/2004	Rte 78 Access	1	wwp	UVM	0.59	12/21/2004				
8/10/2004	Rte 78 Access	1	net	UVM	0.71	5/27/2005				
8/10/2004	Rte 78 Access	1	wwp	SUNY-ESF				0.83	0.02	nd
8/10/2004	Rte 78 Access	2	net	UVM	0.33	2/7/2005				
8/10/2004	Rte 78 Access	2	wwp	UVM	0.72	5/27/2005				
8/10/2004	Chapman Bay	1	net	UVM	0.12	2/7/2005				
8/10/2004	Chapman Bay	1	wwp	UVM	0.55	11/29/2004				
8/10/2004	Chapman Bay	1	wwp	SUNY-ESF				0.75	0.05	nd
8/10/2004	Chapman Bay	2	net	UVM	0.15	2/7/2005				
8/10/2004	Chapman Bay	2	wwp	UVM	0.52	11/29/2004				
8/10/2004	St. Albans Boatlaunch	1	wwp	UVM	0.03	8/12/2004	26.07			
8/10/2004	St. Albans Boatlaunch	1	wwp	SUNY-ESF				0.18		nd
8/10/2004	St. Albans Boatlaunch	2	wwp	UVM	0.03	8/12/2004	25.28			
8/10/2004	Alburg	1	wwp	SUNY-ESF				0.93	0.03	nd
8/10/2004	Alburg	2	wwp	UVM	0.41	6/14/2005				
8/9/2004	Comolli Campsite	1	wwp	UVM	0.87	6/14/2005				
8/8/2004	Alburg Springs	1	wwp	UVM	0.29	6/14/2005				

8/17/2004	Rte 78 Access	1	net	UVM	0.04	2/7/2005				
8/17/2004	Rte 78 Access	1	wwp	UVM	0.68	12/21/2004				
8/17/2004	Rte 78 Access	1	wwp	SUNY-ESF				0.68	0.02	nd
8/17/2004	Rte 78 Access	2	net	UVM	0.09	3/15/2005				
8/17/2004	Rte 78 Access	2	wwp	UVM	0.75	12/21/2004				
8/17/2004	Chapman Bay	1	net	UVM	0.22	3/15/2005				
8/17/2004	Chapman Bay	1	wwp	UVM	0.72	8/19/2004				
8/17/2004	Chapman Bay	2	net	UVM	0.29	2/7/2005				
8/17/2004	Chapman Bay	2	wwp	UVM	0.66	8/19/2004				
8/17/2004	Chapman Bay	2	wwp	SUNY-ESF				1.06	0.08	nd
8/17/2004	Highgate Cliffs	1	net	UVM	0.95	12/21/2004				
8/17/2004	Highgate Cliffs	1	wwp	UVM	0.47	8/19/2004				
8/17/2004	Highgate Cliffs	2	net	UVM	0.54	12/15/2004				
8/17/2004	Highgate Cliffs	2	wwp	UVM	0.86	8/19/2004	29.72			
8/17/2004	Highgate Springs	1	wwp	UVM	0.97	8/19/2004				
8/17/2004	Highgate Springs	2	wwp	UVM	0.88	8/19/2004	45.98			
8/17/2004	St. Albans Boatlaunch	1	wwp	UVM	0.08	8/19/2004				
8/17/2004	St. Albans Boatlaunch	2	wwp	UVM	0.04	8/19/2004				
8/17/2004	St. Albans Boatlaunch	2	wwp	SUNY-ESF				<0.3		nd
8/17/2004	Alburg	1	wwp	UVM	0.43	8/19/2004				
8/17/2004	Alburg	1	wwp	SUNY-ESF				0.54	0.04	nd
8/17/2004	Alburg	2	wwp	UVM	0.59	8/19/2004	26.52			
8/9/2004	Highgate Springs Shipyard	1	wwp	UVM	1.67	8/19/2004	17.45			
8/16/2004	Maquam Bay	1	wwp	UVM	0.21	8/19/2004	62.26			
8/15/2004	Alburg Springs	1	wwp	UVM	3.84	8/19/2004				
8/11/2004	Raake's Point	1	wwp	UVM	0.75	8/19/2004				
8/11/2004	High Rocks	1	wwp	UVM	1.12	8/19/2004	28.37			
8/16/2004	Comolli Campsite	1	wwp	UVM	7.73	6/14/2005				
8/16/2004	High Rocks	1	wwp	UVM	1.33	8/19/2004				
8/16/2004	Raake's Point	1	wwp	UVM	7.30	8/19/2004				
8/24/2004	Rte 78 Access	1	net	UVM	0.14	2/7/2005				
8/24/2004	Rte 78 Access	1	wwp	UVM	1.22	8/26/2004	24.52			
8/24/2004	Rte 78 Access	2	net	UVM	0.14	2/7/2005				
8/24/2004	Rte 78 Access	2	wwp	UVM	0.85	8/26/2004	20.18			
8/24/2004	Rte 78 Access	2	wwp	SUNY-ESF				1.00	0.04	nd
8/24/2004	Chapman Bay	1	net	UVM	0.20	2/7/2005				
8/24/2004	Chapman Bay	1	wwp	UVM	0.98	8/26/2004				

8/24/2004	Chapman Bay	2	net	UVM	0.31	3/15/2005				
8/24/2004	Chapman Bay	2	wwp	UVM	1.25	8/26/2004				
8/24/2004	Chapman Bay	2	wwp	SUNY-ESF				1.21	0.07	nd
8/24/2004	Highgate Cliffs	1	net	UVM	0.47	12/21/2004				
8/24/2004	Highgate Cliffs	1	wwp	UVM	1.83	11/29/2004				
8/24/2004	Highgate Cliffs	2	net	UVM	0.36	12/15/2004				
8/24/2004	Highgate Cliffs	2	wwp	UVM	2.05	8/26/2004				
8/24/2004	Highgate Cliffs	2	wwp	SUNY-ESF				1.90	0.17	nd
8/24/2004	Highgate Springs	1	wwp	UVM	0.56	8/26/2004				
8/24/2004	Highgate Springs	2	wwp	UVM	0.62	8/26/2004	21.31			
8/24/2004	Highgate Springs	2	wwp	SUNY-ESF				0.56	0.03	nd
8/24/2004	St. Albans Boatlaunch	1	wwp	UVM	0.04	8/26/2004				
8/24/2004	St. Albans Boatlaunch	2	wwp	UVM	0.04	8/26/2004				
8/24/2004	Alburg	1	wwp	UVM	0.69	8/26/2004				
8/24/2004	Alburg	2	wwp	UVM	0.78	8/26/2004				
8/24/2004	Alburg	2	wwp	SUNY-ESF				0.96	0.03	nd
8/16/2004	Highgate Springs Shipyard	1	wwp	UVM	33.52	5/27/2005				
8/23/2004	Comolli Campsite	1	wwp	UVM	1.01	8/26/2004	24.89			
8/23/2004	Maquam Bay	1	wwp	UVM	0.52	8/26/2004	20.18			
8/22/2004	Alburg Springs	1	wwp	UVM	0.88	8/26/2004	22.45			
8/24/2004	Alburg Passage	1	wwp	UVM	17.56	8/26/2004				
8/24/2004	Alburg Passage	1	wwp	UVM	0.50	8/26/2004				
8/24/2004	Dillenbeck Bay	1	wwp	UVM	0.53	8/26/2004	27.32			
8/24/2004	Maquam Bay	1	wwp	UVM	2.18	8/26/2004				
9/1/2004	Rte 78 Access	1	wwp	UVM	0.85	9/2/2004				
9/1/2004	Rte 78 Access	2	wwp	UVM	0.55	9/2/2004				
9/1/2004	Chapman Bay	1	wwp	UVM	0.33	9/2/2004				
9/1/2004	Chapman Bay	2	wwp	UVM	0.36	9/2/2004	29.36			
9/1/2004	Chapman Bay	2	wwp	SUNY-ESF				0.51	0.02	nd
9/1/2004	Highgate Cliffs	1	wwp	UVM	0.26	9/9/2004	25.08			
9/1/2004	Highgate Cliffs	1	wwp	UVM	0.26	9/9/2004				
9/1/2004	Highgate Cliffs	2	wwp	UVM	0.35	9/2/2004	21.97			
9/1/2004	Highgate Cliffs	2	wwp	SUNY-ESF				0.36	0.02	nd
9/1/2004	Highgate Springs	1	wwp	UVM	0.18	9/9/2004				
9/1/2004	Highgate Springs	2	wwp	UVM	0.13	9/9/2004				
9/1/2004	Highgate Springs	2	wwp	SUNY-ESF				0.27	0.01	nd

9/1/2004	St. Albans Boatlaunch	1	wwp	UVM	0.03	9/2/2004				
9/1/2004	St. Albans Boatlaunch	2	wwp	UVM	0.05	9/2/2004				
9/1/2004	St. Albans Boatlaunch	2	wwp	SUNY-ESF				0.23	0.00	nd
9/1/2004	Alburg	1	wwp	UVM	1.57	9/2/2004				
9/1/2004	Alburg	2	wwp	UVM	2.08	9/2/2004				
9/1/2004	Alburg	2	wwp	SUNY-ESF				2.77	0.03	nd
8/23/2004	Highgate Springs Shipyard	1	wwp	UVM	0.50	9/2/2004				
8/29/2004	Alburg Springs	1	wwp	UVM	1.10	9/2/2004	24.51			
8/30/2004	Highgate Springs Shipyard	1	wwp	UVM	0.84	9/2/2004				
8/30/2004	Comolli Campsite	1	wwp	UVM	0.37	9/2/2004	18.22			
8/31/2004	Maquam Bay	1	wwp	UVM	0.30	9/2/2004				
9/1/2004	Rte 78 Access scum	1	wwp	UVM	6490.06	12/21/2004				
9/1/2004	Rte 78 Access scum	1	wwp	SUNY-ESF				7691.65	646.30	nd
9/7/2004	Rte 78 Access	1	wwp	UVM	0.55	9/9/2004	20.25			
9/7/2004	Rte 78 Access	2	wwp	UVM	0.44	9/9/2004				
9/7/2004	Chapman Bay	1	wwp	UVM	2.82	5/27/2005				
9/7/2004	Chapman Bay	2	wwp	UVM	2.38	9/9/2004				
9/7/2004	Highgate Springs Shipyard	1	wwp	UVM	0.83	9/9/2004				
9/7/2004	St. Albans Boatlaunch	1	wwp	UVM	0.05	9/9/2004	24.19			
9/7/2004	St. Albans Boatlaunch	2	wwp	UVM	0.04	9/9/2004				
9/7/2004	Alburg	1	wwp	UVM	0.77	9/9/2004				
9/7/2004	Alburg	2	wwp	UVM	1.10	9/9/2004				
9/7/2004	Comolli Campsite	1	wwp	UVM	0.36	9/9/2004				
9/14/2004	Rte 78 Access	1	wwp	UVM	0.52	9/17/2004				
9/14/2004	Rte 78 Access	2	wwp	UVM	0.54	9/17/2004				
9/14/2004	Chapman Bay	1	wwp	UVM	2.41	9/17/2004				
9/14/2004	Chapman Bay	2	wwp	UVM	2.40	9/17/2004				
9/14/2004	Highgate Cliffs	1	wwp	UVM	0.35	9/17/2004				
9/14/2004	Highgate Cliffs	2	wwp	UVM	0.92	9/17/2004				
9/14/2004	Highgate Springs	1	wwp	UVM	3.30	6/14/2005				
9/14/2004	Highgate Springs	2	wwp	UVM	1.40	9/17/2004				
9/14/2004	St. Albans Boatlaunch	1	wwp	UVM	0.30	9/17/2004				
9/14/2004	St. Albans Boatlaunch	2	wwp	UVM	0.44	9/17/2004				
9/14/2004	Alburg	1	wwp	UVM	1.43	9/17/2004				
9/14/2004	Alburg	2	wwp	UVM	1.49	9/17/2004				
9/6/2004	Highgate Springs Shipyard	1	wwp	UVM	0.11	9/17/2004				
9/7/2004	Maquam Bay	1	wwp	UVM	0.08	9/17/2004				

9/12/2004	Alburg Springs	1	wwp	UVM	1.91	9/17/2004				
9/13/2004	Comolli Campsite	1	wwp	UVM	1.39	9/17/2004				
9/21/2004	Rte 78 Access	1	wwp	UVM	1.32	10/1/2004				
9/21/2004	Rte 78 Access	1	wwp	SUNY-ESF				1.48	0.14	nd
9/21/2004	Rte 78 Access	2	wwp	UVM	1.95	10/1/2004				
9/21/2004	Chapman Bay	1	wwp	UVM	17.77	5/27/2005				
9/21/2004	Chapman Bay	1	wwp	SUNY-ESF				12.75	1.34	nd
9/21/2004	Chapman Bay	2	wwp	UVM	4.96	10/1/2004				
9/21/2004	Highgate Cliffs	1	wwp	UVM	132.18	5/27/2005	19.77			
9/21/2004	Highgate Cliffs	1	wwp	SUNY-ESF				191.14	15.76	nd
9/21/2004	Highgate Cliffs	2	wwp	UVM	101.99	10/1/2004				
9/21/2004	Highgate Cliffs	2	wwp	UVM	95.20	10/1/2004				
9/21/2004	Highgate Springs	1	wwp	SUNY-ESF				39.22	1.62	nd
9/21/2004	Highgate Springs	2	wwp	UVM	18.50	10/1/2004				
9/21/2004	St. Albans Boatlaunch	1	wwp	UVM	0.15	9/21/2004				
9/21/2004	St. Albans Boatlaunch	2	wwp	UVM	0.11	9/21/2004				
9/21/2004	Alburg	1	wwp	SUNY-ESF				104.65	9.29	nd
9/21/2004	Alburg	2	wwp	UVM	31.43	10/1/2004				
9/15/2004	Maquam Bay	1	wwp	UVM	0.15	9/21/2004	29.50			
9/21/2004	St. Albans - shoreline	1	wwp	UVM	22.48	9/21/2004				
9/21/2004	St. Albans - shoreline	1	wwp	UVM	19.66	9/21/2004				
9/21/2004	St. Albans - shoreline	1	wwp	SUNY-ESF				65.99	7.24	nd
9/29/2004	Rte 78 Access- shore	1	wwp	UVM	2.09	5/27/2005				
9/29/2004	Rte 78 Access- shore	2	wwp	UVM	1.88	6/14/2005				
9/29/2004	Alburg- shore	1	wwp	UVM	7.44	12/15/2004				
9/29/2004	Alburg- shore	2	wwp	UVM	1.07	10/1/2004				
9/29/2004	Highgate Springs Shipyard	1	wwp	UVM	0.77	10/1/2004				
9/29/2004	Highgate Springs Shipyard	2	wwp	UVM	0.54	10/1/2004				
9/29/2004	St. Albans Boatlaunch	1	wwp	UVM	0.06	6/14/2005				
9/29/2004	St. Albans Boatlaunch	2	wwp	UVM	0.03	10/1/2004				
10/14/2004	Rte 78 Access	1	wwp	UVM	0.03	10/28/2004				
10/14/2004	Rte 78 Access	2	wwp	UVM	0.04	10/28/2004	46.97			
10/14/2004	Chapman Bay	2	wwp	UVM	0.09	10/19/2004	26.57			
10/14/2004	Chapman Bay	2	wwp	UVM	0.11	10/19/2004				
10/14/2004	Highgate Cliffs	1	wwp	UVM	1.04	10/19/2004				
10/14/2004	Highgate Cliffs	2	wwp	UVM	1.19	10/19/2004				

10/14/2004	Highgate Springs	1	wwp	UVM	1.41	10/19/2004			
10/14/2004	Highgate Springs	2	wwp	UVM	2.28	10/19/2004			
10/14/2004	St. Albans Boatlaunch	1	wwp	UVM	3.02	10/19/2004			
10/14/2004	St. Albans Boatlaunch	2	wwp	UVM	2.52	10/19/2004			
10/14/2004	Alburg	1	wwp	UVM	0.58	10/19/2004			
10/14/2004	Alburg	2	wwp	UVM	6.08	10/28/2004	17.31		
10/14/2004	Alburg	2	wwp	UVM	7.13	10/28/2004			
10/27/2004	Highgate Springs Shipyard	1	ww	UVM	0.05	10/28/2004	36.61		
10/27/2004	Highgate Springs Shipyard	2	ww	UVM	0.05	10/28/2004			
10/27/2004	Rte 78 Access- shore	1	ww	UVM	0.23	10/28/2004			
10/27/2004	Rte 78 Access- shore	2	ww	UVM	0.17	10/28/2004	18.01		
10/27/2004	Alburg- shore	1	ww	UVM	0.22	10/28/2004	25.46		
10/27/2004	Alburg- shore	2	ww	UVM	0.31	10/28/2004	18.01		
10/27/2004	St. Albans Boatlaunch	1	ww	UVM	0.02	10/28/2004	19.41		
10/27/2004	St. Albans Boatlaunch	2	wwp	UVM	0.01	4/26/2005	29.56		

Appendix D. Chlorophyll and nutrient concentrations in samples collected from Lake Champlain 2004.

Date	Location	Time of Sampling	Rep	Whole Water Chl a, µg/L	Net Chl a, µg/L	Total P, µg/L	Total N, mg/L
6/4/2004	Rte 78 Access	12:50 PM	1	8.71	0.14	27.98	0.72
6/8/2004	Rte 78 Access	12:50 PM	2	10.08	0.14	25.80	0.63
6/8/2004	Chapman Bay	10:45 AM	1	5.50	0.09	26.09	0.70
6/8/2004	Highgate Cliffs	11:15 AM	1	8.71	0.08	18.35	1.00
6/8/2004	Highgate Cliffs	11:15 AM	2	7.79	0.09	25.63	1.11
6/8/2004	Highgate Springs	11:20 AM	1	10.69	0.17	22.75	1.16
6/8/2004	Highgate Springs	11:20 AM	2	12.83	0.10	31.94	1.12
6/4/2004	St. Albans Boat Launch	12:00 PM	1	NA	NA	27.16	0.37
6/4/2004	St. Albans Boat Launch	12:00 PM	2	NA	NA	26.79	0.37
6/8/2004	Alburg	10:30 AM	1	5.50	0.07	30.53	0.70
6/8/2004	Alburg	10:30 AM	2	4.58	0.08	33.23	0.59
6/23/2004	Rte 78 Access	10:45 AM	1	5.04	0.34	30.58	0.54
6/23/2004	Rte 78 Access	10:45 AM	2	4.58	0.21	33.30	0.55
6/23/2004	Alburg	10:31 AM	1	2.75	0.20	49.43	0.55
6/23/2004	Alburg	10:31 AM	2	4.58	0.17	34.37	0.65
6/23/2004	Chapman Bay	10:25 AM	1	5.04	0.14	27.27	0.67
6/23/2004	Chapman Bay	10:25 AM	2	4.58	0.22	28.37	0.60
6/23/2004	Highgate Cliffs	9:53 AM	1	10.54	0.65	64.76	0.74
6/23/2004	Highgate Cliffs	9:53 AM	2	6.87	0.79	56.85	0.78
6/23/2004	Highgate Springs	9:37 AM	1	6.87	0.24	38.29	0.61
6/23/2004	Highgate Springs	9:37 AM	2	6.87	0.28	36.82	0.67
6/23/2004	St. Albans Boat Launch	11:45 AM	1	4.12	0.34	25.92	0.43
6/23/2004	St. Albans Boat Launch	11:45 AM	2	3.67	0.44	26.33	0.40
7/6/2004	Rte 78 Access	1:40 PM	1	1.83	0.03	33.14	0.61
7/6/2004	Rte 78 Access	1:40 PM	2	5.04	0.00	34.21	0.54
7/6/2004	Chapman Bay	12:05 PM	1	2.29	0.00	28.31	0.45
7/6/2004	Chapman Bay	12:05 PM	2	4.58	NA	30.16	0.51
7/6/2004	Highgate Cliffs	12:25 PM	1	9.62	0.00	75.58	0.99
7/6/2004	Highgate Cliffs	12:25 PM	2	NA	0.12	72.68	0.83
7/6/2004	Highgate Springs	12:35 PM	1	1.37	0.04	54.77	0.69
7/6/2004	Highgate Springs	12:35 PM	2	3.67	0.04	48.36	1.15
7/6/2004	St. Albans Boat Launch	2:45 PM	1	0.00	0.05	34.72	0.38
7/6/2004	St. Albans Boat Launch	2:45 PM	2	0.46	NA	39.46	0.38
7/6/2004	Alburg	11:55 AM	1	5.04	NA	35.15	0.43
7/6/2004	Alburg	11:55 AM	2	3.21	0.00	29.26	0.47
7/7/2004	Burlington Water Bay	12:45 PM	2	4.12	1.88	14.36	0.42
7/7/2004	Champlain Water Bay	1:25 PM	1	4.12	2.62	15.63	0.46
7/7/2004	Champlain Water Bay	1:25 PM	2	4.58	1.83	16.77	0.48
7/7/2004	North Beach	12:25 PM	1	2.29	0.90	12.97	0.42
7/7/2004	Red Rocks Beach	1:10 PM	1	2.29	3.01	14.90	0.43
7/7/2004	Red Rocks Beach	1:10 PM	2	1.37	1.97	16.24	0.48
7/21/2004	Rte 78 Access	11:55 AM	1	12.37	2.51	26.66	0.53
7/21/2004	Rte 78 Access	11:55 AM	2	11.92	2.78	35.29	0.91
7/21/2004	Chapman Bay	10:28 AM	1	12.83	2.93	42.66	0.80
7/21/2004	Chapman Bay	10:28 AM	2	7.33	2.38	28.16	0.72

7/21/2004	Highgate Cliffs	10:50 AM	1	74.86	4.29	50.34	1.61
7/21/2004	Highgate Cliffs	10:50 AM	2	80.97	11.48	110.93	1.11
7/21/2004	Highgate Springs	11:06 AM	1	159.64	41.78	64.55	2.56
7/21/2004	Highgate Springs	11:06 AM	2	48.89	7.55	166.94	3.38
7/21/2004	St. Albans Boat Launch	1:10 PM	1	4.58	2.79	22.43	0.36
7/21/2004	St. Albans Boat Launch	1:10 PM	2	4.58	3.01	24.62	0.78
7/21/2004	Alburg	11:37 AM	1	16.50	4.63	42.88	0.65
7/21/2004	Alburg	11:37 AM	2	15.58	6.07	39.85	0.90
7/20/2004	Champlain Water Bay	11:47 AM	1	0.92	0.00	14.77	0.34
7/20/2004	North Beach	12:11 PM	1	1.37	0.33	10.97	0.42
7/20/2004	North Beach	12:11 PM	2	1.37	0.00	14.22	0.42
7/20/2004	Red Rocks Beach	11:32 AM	1	NA	0.18	14.58	0.56
7/20/2004	Red Rocks Beach	11:32 AM	2	0.92	0.21	14.38	0.54
7/20/2004	McCuen Slang Boat Launch	10:06 AM	1	2.29	0.69	245.12	0.90
7/20/2004	McCuen Slang Boat Launch	10:06 AM	2	3.67	0.39	185.27	1.09
7/26/2004	Rte 78 Access	a	1	126.03	25.81	127.43	0.61
7/26/2004	Rte 78 Access	a	2	134.43	16.98	151.96	1.20
7/26/2004	Chapman Bay	a	1	31.62	11.49	50.00	0.41
7/26/2004	Chapman Bay	a	2	29.79	6.34	47.62	0.61
7/26/2004	Highgate Cliffs	a	1	90.13	11.21	153.24	0.56
7/26/2004	Highgate Cliffs	a	2	174.15	15.84	97.83	0.67
7/26/2004	Highgate Springs	a	1	49.65	11.40	57.59	0.52
7/26/2004	Highgate Springs	a	2	44.30	6.93	62.08	0.50
7/26/2004	St. Albans Boat Launch	a	1	5.50	0.91	27.01	0.50
7/26/2004	St. Albans Boat Launch	a	1	5.50	0.91	27.01	0.34
7/26/2004	St. Albans Boat Launch	a	2	4.58	0.71	28.07	0.40
7/26/2004	Alburg	a	1	44.00	11.54	66.50	0.59
7/26/2004	Alburg		2	43.54	13.20	68.79	0.52
8/4/2004	Rte 78 Access	12:00 PM	1	197.07	12.38	415.87	0.81
8/4/2004	Rte 78 Access	12:00 PM	2	214.48	9.40	121.35	3.46
8/4/2004	Chapman Bay	10:35 AM	1	60.50	7.52	131.38	0.54
8/4/2004	Chapman Bay	10:35 AM	2	79.74	12.12	173.78	1.36
8/4/2004	Highgate Cliffs	11:00 AM	1	168.04	19.43	362.58	0.50
8/4/2004	Highgate Cliffs	11:00 AM	2	107.70	36.62	143.58	0.68
8/4/2004	Highgate Springs	11:15 AM	1	82.49	16.20	189.29	1.39
8/4/2004	Highgate Springs	11:15 AM	2	45.94	10.08	244.66	0.72
8/4/2004	St. Albans Boat Launch	1:00 PM	1	10.15	1.97	28.10	0.46
8/4/2004	St. Albans Boat Launch	1:00 PM	2	11.00	1.46	26.86	0.40
8/4/2004	Alburg	10:30 AM	1	138.41	13.41	97.66	3.78
8/4/2004	Alburg	10:30 AM	2	109.99	13.56	159.02	3.61
8/3/2004	Burlington Water Bay	10:05 AM	1	NA	NA	16.29	0.40
8/3/2004	Champlain Water Bay	10:48 AM	1	NA	NA	15.38	0.41
8/3/2004	Champlain Water Bay	10:48 AM	2	NA	NA	15.96	0.35
8/3/2004	North Beach	9:55 AM	1	NA	NA	15.37	0.50
8/3/2004	North Beach	9:55 AM	2	NA	NA	17.32	0.46
8/3/2004	Red Rocks Beach	10:30 AM	1	NA	NA	13.10	0.60
8/3/2004	Red Rocks Beach	10:30 AM	2	NA	NA	14.64	0.38
8/3/2004	McCuen Slang Boat Launch	2:50 PM	1	3.21	0.27	161.37	0.70
8/3/2004	McCuen Slang Boat Launch	2:50 PM	2	1.83	0.29	164.08	0.71

8/10/2004	Rte 78 Access	10:45 AM	1	26.73	17.47	65.50	0.67
8/10/2004	Rte 78 Access	10:45 AM	2	29.03	13.14	67.93	0.77
8/10/2004	Chapman Bay	10:10 AM	1	21.39	8.35	56.98	0.59
8/10/2004	Chapman Bay	10:10 AM	2	25.97	9.82	54.46	0.88
8/10/2004	St. Albans Boat Launch	11:25 AM	1	8.71	3.52	26.65	0.39
8/10/2004	St. Albans Boat Launch	11:25 AM	2	6.87	2.85	22.99	0.48
8/10/2004	Alburg	10:00 AM	1	25.97	8.55	61.50	0.79
8/10/2004	Alburg	10:00 AM	2	27.50	10.77	62.15	0.59
8/17/2004	Rte 78 Access	9:10 AM	1	34.37	3.68	90.70	1.55
8/17/2004	Rte 78 Access	9:10 AM	2	34.37	NA	87.06	1.62
8/17/2004	Chapman Bay	9:30 AM	1	44.68	15.14	79.24	1.43
8/17/2004	Chapman Bay	9:30 AM	2	40.10	23.29	81.90	1.19
8/17/2004	Highgate Cliffs	10:30 AM	1	41.25	12.22	80.67	1.43
8/17/2004	Highgate Cliffs	10:30 AM	2	34.37	12.08	83.87	1.25
8/17/2004	Highgate Springs	10:45 AM	1	72.18	17.34	97.98	1.45
8/17/2004	Highgate Springs	10:45 AM	2	72.18	18.66	96.71	1.52
8/17/2004	St. Albans Boat Launch	11:47 AM	1	27.50	2.57	42.14	0.82
8/17/2004	St. Albans Boat Launch	11:47 AM	2	43.54	2.42	45.05	0.71
8/17/2004	Alburg	9:20 AM	1	21.77	7.17	72.26	1.00
8/17/2004	Alburg	9:20 AM	2	26.35	8.05	71.06	1.23
8/18/2004	Burlington Water Bay	9:50 AM	1	4.58	0.29	11.67	0.81
8/18/2004	Champlain Water Bay	10:30 AM	1	5.50	0.64	12.45	0.44
8/18/2004	Champlain Water Bay	10:30 AM	2	3.67	0.52	12.04	0.41
8/18/2004	North Beach	9:35 AM	1	2.29	0.24	11.82	0.38
8/18/2004	North Beach	9:35 AM	2	NA	0.22	12.21	0.50
8/18/2004	Red Rocks Beach	10:20 AM	1	3.21	NA	13.88	0.49
8/18/2004	Red Rocks Beach	10:20 AM	2	2.75	0.32	13.16	0.49
8/18/2004	McCuen Slang Boat Launch	9:35 AM	1	0.46	NA	140.17	0.53
8/18/2004	McCuen Slang Boat Launch	9:35 AM	2	5.96	NA	148.63	0.37
8/24/2004	Rte 78 Access	10:05 AM	1	NA	12.86	99.47	1.11
8/24/2004	Rte 78 Access	10:05 AM	2	NA	26.67	97.53	0.90
8/24/2004	Chapman Bay	10:20 AM	1	NA	16.79	108.37	1.16
8/24/2004	Chapman Bay	10:20 AM	2	NA	26.09	104.69	1.18
8/24/2004	Highgate Cliffs	10:44 AM	1	NA	39.98	154.44	1.62
8/24/2004	Highgate Cliffs	10:44 AM	2	NA	41.11	145.94	1.04
8/24/2004	Highgate Springs	10:50 AM	1	NA	22.06	106.84	0.69
8/24/2004	Highgate Springs	10:50 AM	2	NA	21.28	104.34	1.11
8/24/2004	St. Albans Boat Launch	12:00 PM	1	NA	2.32	28.59	0.50
8/24/2004	St. Albans Boat Launch	12:00 PM	2	NA	1.41	28.53	0.56
8/24/2004	Alburg	10:15 AM	1	NA	6.05	73.12	0.77
8/24/2004	Alburg	10:15 AM	2	NA	6.23	71.89	1.06
8/30/2004	Burlington Water Bay	11:45 AM	1	7.33	1.12	13.23	0.49
8/30/2004	Burlington Water Bay	11:45 AM	2	5.04	0.95	13.98	0.51
8/30/2004	Champlain Water Bay	10:15 AM	1	5.50	0.59	14.05	0.51
8/30/2004	Champlain Water Bay	10:15 AM	2	5.96	0.69	14.45	0.49
8/30/2004	North Beach	11:50 AM	1	4.58	0.91	11.27	0.51
8/30/2004	North Beach	11:50 AM	2	5.04	0.76	11.27	0.50
8/30/2004	Red Rocks Beach	10:05 AM	1	0.46	0.74	16.73	0.63
8/30/2004	Red Rocks Beach	10:05 AM	1	0.46	0.74	16.73	0.65
8/30/2004	Red Rocks Beach	10:05 AM	2	7.33	0.76	17.63	0.69
9/2/2004	McCuen Slang Boat	9:05 AM	1	NA	2.64	190.07	1.73

	Launch						
9/2/2004	McCuen Slang Boat Launch	9:05 AM	2	NA	2.47	186.88	1.03
9/1/2004	Rte 78 Access	10:10 AM	1	27.50	11.04	87.77	0.45
9/1/2004	Rte 78 Access	10:10 AM	1	27.50	11.04	87.77	0.98
9/1/2004	Rte 78 Access	10:10 AM	2	29.79	12.33	81.39	0.99
9/1/2004	Chapman Bay	10:25 AM	1	NA	7.14	68.38	0.76
9/1/2004	Chapman Bay	10:25 AM	2	18.33	6.92	69.08	0.79
9/1/2004	Highgate Cliffs	10:40 AM	1	16.04	2.55	75.62	1.25
9/1/2004	Highgate Cliffs	10:40 AM	2	18.33	6.39	76.75	1.07
9/1/2004	Highgate Springs	10:50 AM	1	23.68	5.71	95.80	0.91
9/1/2004	Highgate Springs	10:50 AM	2	26.73	5.86	94.60	0.67
9/1/2004	St. Albans Boat Launch	12:00 PM	2	14.51	2.60	38.68	0.63
9/1/2004	Alburg	10:15 AM	2	55.76	1.87	101.15	1.47
9/7/2004	Rte 78 Access	10:35 AM	1	12.99	6.16	69.55	0.86
9/7/2004	Rte 78 Access	10:35 AM	2	12.99	6.78	69.08	0.83
9/7/2004	Chapman Bay	10:45 AM	1	29.03	14.00	85.76	1.02
9/7/2004	Chapman Bay	10:45 AM	2	19.86	12.53	81.12	0.98
9/7/2004	St. Albans Boat Launch	12:20 PM	1	21.39	3.27	38.83	0.63
9/7/2004	Alburg	10:50 AM	1	21.39	3.48	79.30	0.93
9/7/2004	Alburg	10:50 AM	2	19.86	5.47	82.85	1.00
9/14/2004	Rte 78 Access	12:00 PM	1	0.00	6.06	63.66	0.65
9/14/2004	Rte 78 Access	12:00 PM	2	0.00	6.42	65.11	0.92
9/14/2004	Chapman Bay	10:40 AM	1	0.00	5.58	72.55	0.65
9/14/2004	Chapman Bay	10:40 AM	2	0.00	8.72	74.53	0.61
9/14/2004	Highgate Cliffs	11:20 AM	1	NA	3.81	64.54	0.76
9/14/2004	Highgate Cliffs	11:200 AM	2	3.06	3.91	66.13	0.87
9/14/2004	Highgate Springs	11:35 AM	1	NA	3.40	59.92	0.67
9/14/2004	Highgate Springs	11:35 AM	2	0.00	2.10	59.86	0.64
9/14/2004	St. Albans Boat Launch	12:50 PM	1	1.53	6.48	43.67	0.62
9/14/2004	St. Albans Boat Launch	12:50 PM	2	1.53	7.76	47.54	0.61
9/14/2004	Alburg	10:25 AM	1	NA	13.13	72.98	0.69
9/14/2004	Alburg	10:25 AM	2	0.00	12.63	77.13	0.68
9/16/2004	North Beach	9:20 AM	2	1.94	0.22	10.38	0.55
9/21/2004	Rte 78 Access	11:10 AM	1	22.92	2.97	72.93	0.85
9/21/2004	Rte 78 Access	11:10 AM	2	24.88	5.88	50.08	0.67
9/21/2004	Chapman Bay	10:25 AM	1	29.46	1.16	66.23	0.72
9/21/2004	Chapman Bay	10:25 AM	2	24.88	5.18	45.50	0.70
9/21/2004	Highgate Cliffs	10:45 AM	1	293.31	18.22	818.43	4.34
9/21/2004	Highgate Cliffs	10:45 AM	2	970.07	26.71	83.09	1.26
9/21/2004	Highgate Springs	10:50 AM	1	40.33	2.13	136.81	0.74
9/21/2004	Highgate Springs	10:50 AM	2	384.32	2.47	356.13	0.86
9/21/2004	St. Albans Boat Launch	12:05 AM	1	5.79	1.26	24.72	0.42
9/21/2004	St. Albans Boat Launch	12:05 AM	2	5.50	1.88	19.86	0.47
9/21/2004	Alburg	10:15 AM	1	304.77	4.75	41.17	1.92
9/21/2004	Alburg	10:15 AM	2	63.02	4.54	41.16	0.66
9/29/2004	St. Albans Boat Launch	11:30 AM	1	4.20	1.02	32.88	0.43
9/29/2004	St. Albans Boat Launch	11:30 AM	2	4.20	0.26	23.12	0.43
10/13/2004	Burlington Water Bay	10:40 AM	1	1.60	0.17	10.25	0.46
10/13/2004	Champlain Water Bay	11:00 AM	2	0.92	0.29	9.67	0.43
10/13/2004	North Beach	10:30 AM	2	NA	0.49	9.53	0.47
10/13/2004	Red Rocks Beach	10:55 AM	2	0.46	0.18	9.32	0.39
10/14/2004	Rte 78 Access	11:30 AM	1	1.83	1.15	33.06	0.52

10/14/2004	Rte 78 Access	11:30 AM	2	3.21	0.65	32.13	0.50
10/14/2004	Chapman Bay	11:10 AM	1	8.25	0.79	33.36	0.51
10/14/2004	Chapman Bay	11:10 AM	2	5.96	0.95	31.16	0.49
10/14/2004	Highgate Cliffs	10:50 AM	1	15.58	1.97	95.86	0.55
10/14/2004	Highgate Cliffs	10:50 AM	2	22.00	2.81	69.68	0.82
10/14/2004	Highgate Springs	10:45 AM	1	5.96	0.99	32.75	0.60
10/14/2004	Highgate Springs	10:45 AM	2	4.58	1.16	33.42	0.58
10/14/2004	St. Albans Boat Launch	12:15 PM	1	595.03	6.32	1520.45	26.01
10/14/2004	St. Albans Boat Launch	12:15 PM	2	180.26	33.01	397.05	2.50
10/14/2004	Alburg	11:20 AM	1	58.20	1.48	429.25	2.97
10/14/2004	Alburg	11:20 AM	2	56.37	2.20	468.45	0.59

a = time not recorded, sample most likely collected between 10 am and 12 pm.