

Cyanobacteria Monitoring on Lake Champlain Summer 2012

Final Report for the Lake Champlain Basin Program

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Executive Summary

Beginning in 2012, oversight of the established cyanobacteria monitoring program on Lake Champlain passed from the University of Vermont (UVM) to the Vermont Department of Environmental Conservation (VT DEC) as responsibility for the program transitions from the Lake Champlain Basin Program to the State of Vermont. The transition offered an opportunity to modify methodology and expand the monitoring network to underserved areas of the lake while providing the data necessary to inform recreational and public health response in a fiscally sustainable program.

Objectives

- continue to monitor for cyanobacteria at locations on Lake Champlain through the established partnership between state and local officials, UVM, the Lake Champlain Committee and citizen volunteers
- continue to use the tiered alert monitoring system developed by UVM to provide consistent, quantitative data at selected locations around Lake Champlain
- expand the geographical monitoring coverage with the assistance of trained citizen volunteers providing weekly qualitative observations of shoreline conditions
- test for the presence of microcystin and anatoxin when algal density and composition triggers are reached
- facilitate communication about lake conditions through weekly updates to stakeholders via email and to the general public through the Vermont Department of Health webpage
- continue to provide outreach and assistance to beach managers, lakeshore property owners and the general public so they can learn to recognize and respond appropriately to the presence of cyanobacteria blooms

Quantitative monitoring began by UVM and VT DEC in early June and continued through September. The volunteer monitoring effort began during the week of June 28 and ended in early September. Over the course of the summer, more than 600 reports were made by partners and volunteers. Weekly stakeholder emails provided this information to public health officials and beach managers while the Vermont Department of Health webpage made it available to the general public. By the end of the summer, their interactive online status map could be viewed on portable media, available to lake users while they were on the water.

Bloom conditions developed in several locations around Lake Champlain during 2012, including a three week period of widespread *Anabaena*-dominated blooms throughout the main lake. No microcystin or anatoxin was detected in samples collected during this event. Microcystins were present in Missisquoi Bay beginning in late July. Concentrations were below levels of concern in most locations, with the exception of the Highgate Spring Shipyard, where one sample reached 54µg/L. St. Albans Bay also experienced blooms but very little microcystin was detected. Anatoxin was detected in St. Albans Bay at very low levels on one date in August, the only time this toxin was detected in Lake Champlain during 2012. There were no reports of human or animal illness connected to algal blooms in 2012.

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Introduction

Lake Champlain is one of the largest lakes in the United States and an important water resource for the states of Vermont and New York, and the province of Quebec. It is primarily a recreational lake, but also serves as an important drinking water source for all three jurisdictions. Cyanobacteria blooms have been documented in the lake since the 1970s, with some areas experiencing extensive annual blooms. In 1999, several dog deaths were attributed to cyanobacteria toxins, raising health and safety concerns regarding drinking water supplies and recreational activities such as swimming, boating and fishing.

Since 2002, the Lake Champlain Basin Program (LCBP) has funded an annual cyanobacteria monitoring program which utilizes cell density and toxin data to evaluate recreational conditions around the lake. Results are communicated to stakeholders around the region through weekly updates. The University of Vermont (UVM) developed and implemented the program, in cooperation with the Lake Champlain Committee (LCC) and the Vermont Departments of Health (VDH) and Environmental Conservation (VT DEC). It has been well received locally and serves as a model at the regional and national level.

Beginning in 2012, oversight of the cyanobacteria monitoring program on Lake Champlain passed from UVM to the VT DEC as responsibility for the program transitioned from the LCBP to the State of Vermont. The transition offered an opportunity to modify methodology and expand the monitoring network to underserved areas of the lake while providing the data necessary to inform recreational and public health response in a fiscally sustainable program.

Objectives

- continue to monitor for cyanobacteria at locations on Lake Champlain through the established partnership between state and local officials, the University of Vermont, the Lake Champlain Committee and citizen volunteers
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Methods

The 2012 Champlain cyanobacteria monitoring program built upon the successful partnership established by the University of Vermont (UVM) over the last decade with the Lake Champlain Committee (LCC) and the State of Vermont Departments of Health (VDH) and Environmental

Conservation (DEC). The tiered alert protocol utilized since the program’s inception was supplemented with a visual monitoring protocol that allowed citizen volunteers to contribute observations about previously unmonitored areas of the lake via the internet.

Sampling Locations

A total of 88 locations were monitored during the summer of 2012 (Figure 1). Table 1 provides a summary of these by region, evaluation protocol, and proximity to shore. Full documentation of the sampling locations is located in Appendix A.

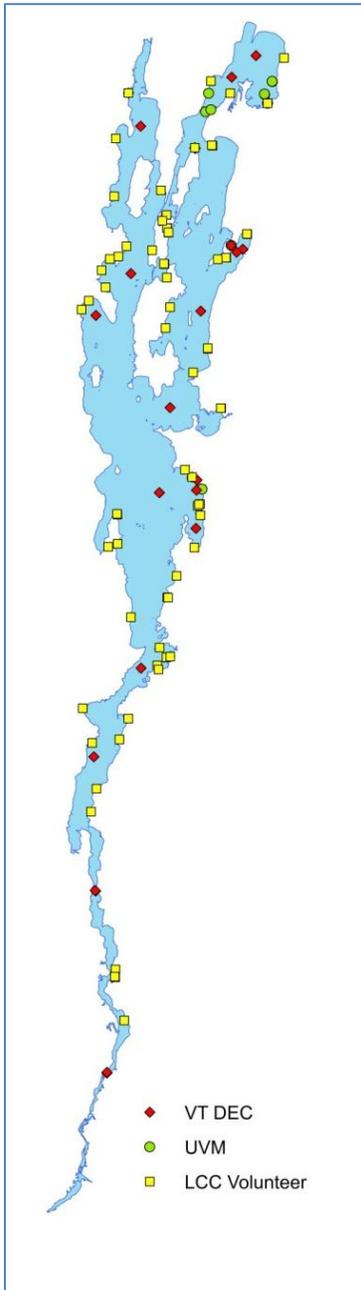


Figure 1. Cyanobacteria monitoring stations on Lake Champlain in 2012.

Table 1. Summary of 2012 Champlain monitoring locations.

Region	Assessment Type	Number of Stations	
		Open water	shoreline
Main Lake - north	Visual		12
	Tiered alert	3	
Main Lake - central	Visual		19
	Tiered alert	4	1
Main Lake - south	Visual		9
	Tiered alert	2	
Missisquoi/Maquam	Visual		6
	Tiered alert	6	2
St. Albans/the Islands	Visual		16
	Tiered alert	2	1
South Lake	Visual		4
	Tiered alert	2	

Monitoring Protocols

The Tiered Alert Protocol

Quantitative data on taxonomic distribution, cell density and the presence of toxins were collected following the Tiered Alert protocol developed by UVM (Table 2). Monitoring began the week of June 4th and continued through September 28th. UVM and the DEC utilized this protocol at selected stations around Lake Champlain (Figure 1). Samples were collected at weekly or biweekly intervals by UVM, following the cell density triggers outlined in the protocol. Samples were collected by the DEC at biweekly intervals, in conjunction with the water quality monitoring conducted for the Lake Champlain Long-term Water Quality and Biological Monitoring Program. Weekly water samples collected at three shoreline locations by experienced monitors were also evaluated using the tiered alert protocol.

Table 2. Outline of the Tiered Alert sampling protocol.

Framework Level	Frequency	Activity	Response
Qualitative	2/month	3m vertical plankton tow (63µm mesh), screened within 72 hrs.	If potentially toxic taxa observed, proceed to <i>Quantitative Level</i>
Quantitative	2/month	3m vertical plankton tow (63µm mesh), screened within 72 hrs.	If potentially toxic taxa densities >2000 cells/mL, proceed to <i>Vigilance Level</i>
Vigilance	1/week, midday	3m vertical plankton tow (63µm mesh), Full enumeration within 48 hrs.	If potentially toxic taxa densities >4000 cells/mL, proceed to <i>Alert Level 1</i> . Return to Quantitative Level if densities <4000 cells/mL.
Alert Level 1	1/week, midday	Collect whole water samples for phytoplankton and toxin analysis. Full enumeration and microcystin analysis with 48 hrs.	If microcystin >6µg/L (VT recreational standard) proceed to <i>Alert Level 2</i> . Return to Quantitative Level if densities <4000 cells/mL.
Alert Level 2	1/week, midday	As for Alert Level 1	If microcystin >6µg/L, the VT recreational standard, proceed to <i>Alert Level 2</i> . Return to Alert Level 1 if microcystin concentrations <6µg/L.

Field Methods

Plankton and toxin samples were collected as whole water surface grabs or an integrated 63 µm mesh plankton net concentrate. A single whole water sample was collected by placing a bucket carefully at the surface and tipping to fill. The sample was mixed thoroughly and decanted into sample bottles for subsequent enumeration or toxin analysis. Net concentrates were obtained by lowering the plankton net opening to 3m and drawing it steadily back to the surface. The total volume of the concentrate was noted before dividing into aliquots for analysis. The DEC completed processing for both sample types in the field while UVM processed upon return to the lab. All samples were kept on ice in coolers until they reached the lab.

Plankton Enumeration

All plankton samples were analyzed using an inverted compound microscope at 100 or 200x in a Sedgewick Rafter cell. 1ml aliquots were allowed to settle for 10 – 15 minutes before analysis. During qualitative analysis, SR cells were scanned rapidly for the presence of potentially toxic cyanobacteria, generating presence/absence data only. For quantitative analysis, estimates of cell density were obtained for all observed cyanobacteria using the size categories noted in Table 3. During the analysis, all cyanobacteria were identified to the lowest possible taxonomic level while most other algae were identified simply at the division level, e.g. green algae or diatoms. Identical counting protocols were used for whole water and plankton concentrates. Plankton samples were counted by staff at UVM and the DEC. DEC analysts were trained in the counting protocols by UVM staff and taxonomic identifications were discussed and confirmed over the course of the summer using photos. Additionally, 3 samples were split and identified independently by both labs.

Table 3. Cell factors used to estimate field densities of colonial algae.

Taxon	Unit Category	Estimated cells/unit	Cell factor
<i>Anabaena</i> <i>Aulocoseira</i> <i>Fragilaria</i>	Fragment	< 20	10
	Small (A)	20 – 100	60
	Medium (B)	100 – 1000	500
	Large (C)	>1000	1000
<i>Microcystis</i> <i>Coelosphaerium</i> <i>Woronichinia</i>	Small	<100	50
	Medium	100 – 1000	500
	Large	>1000	1000
<i>Gloeotrichia</i>	Fragment	Single trichome	20
	Small	Quarter of a colony	2500
	Medium	Half of colony	5000
	Large	Entire colony	10,000
<i>Aphanizomenon</i> <i>Limnothrix</i>	Fragment	Single trichome	Measured
	Small	Small flake	200
	Medium	Medium flake	500
	Large	Large flake	1000

The Visual Monitoring Protocol

In 2012, a new protocol providing visual qualitative data was added to the program. Staffing needs and analytical costs associated with plankton and toxin analyses had previously limited the spatial extent of the cyanobacteria monitoring program on Lake Champlain. Addition of a visual protocol implemented by trained volunteers allowed significant expansion of coverage around the lake, particularly in the South Lake and southern portion of the Main Lake.

Volunteer Recruitment and Training

Utilizing photographs and experience from the previous years of monitoring on Lake Champlain, a three-tiered visual system was developed in 2010 by the VDH for use on inland lakes (http://healthvermont.gov/enviro/bg_algae/documents/BGA_guide.pdf). This visual guidance was refined by the LCC for use by volunteers and aligned with the existing monitoring status categories utilized by the Champlain cyanobacteria monitoring program. Several long-time cyanobacteria

monitoring volunteers continued their involvement in 2012, providing continuity in reporting from Missisquoi and St. Albans Bays. The LCC recruited additional volunteers from their membership and by appealing to the general public through print and radio venues.

Volunteers were asked to commit to monitoring at one location for the duration of the monitoring period (late June to early September). While the LCC did recruit to gain as wide a geographic distribution as possible, no volunteer was turned away. In a few areas of the lake, this did lead to a cluster of observation points. All volunteers attended a mandatory training session to learn to recognize cyanobacteria, become familiar with the assessment protocol, and learn how to submit their weekly reports. LCC staff met with or interacted with each volunteer in the weeks following the training to ensure consistency among volunteers and their assessment skills. Not all volunteers were able to navigate the internet-based reporting system and instead submitted their reports by telephone or email.

Weekly Observation Process

Sixty-four volunteers were active around the lake in 2012 (Figure 1 and Appendix A), providing evaluations of lake conditions at their chosen location. Protocols for the observation process, supporting documentation and the submittal process are located in Appendix B. Volunteers were asked to provide a single observation each week, made between 10am and 2pm Sunday through Tuesday mornings. Volunteers evaluated algal conditions at their location using the prompts, photographs, and descriptions provided by the LCC, and assigned it one of the three categories:

- Category 1 – few or no cyanobacteria observed
- Category 2 – cyanobacteria present at less than bloom levels
- Category 3 – cyanobacteria bloom in progress

Each volunteer was asked to provide 3 photographs whenever category 2 or category 3 conditions were observed. All reports were submitted to the LCC by noon each Tuesday. LCC staff reviewed all reports and photos, conferring with volunteers as needed to verify the presence of cyanobacteria and appropriate status. The LCC collated reports and provided them to the DEC for inclusion in the weekly update by noon each Wednesday. Staff also followed up with volunteers when no reports were received.

In addition to the photos, two locations visited by volunteers were also assessed quantitatively. Each week, the volunteers at North Beach in Burlington and North Hero State Park in the Islands made a visual assessment and collected water samples from the shore. These unfiltered samples were tested analyzed for microcystin and cyanobacteria density.

Toxin Analysis

Toxin analyses were conducted by both UVM and the VDH laboratory. Microcystin analyses were conducted primarily by UVM while anatoxin analyses were conducted by the VDH. Plankton concentrates or whole water samples collected for microcystin analysis by UVM were filtered onto glass fiber filters and extracted with 50% methanol. Extracts were frozen and thawed three times to lyse cells, centrifuged, and then prepared for ELISA analysis following the manufacturer's instructions.

Microcystin samples processed by the VDH were collected from North Beach and North Hero State Park. Samples were analyzed as received, without filtration, unless algal biomass was high enough to interfere with analytical procedures. In that event, aliquots were filtered using glass fiber filters and both filtrate and filter were analyzed for the presence of microcystin by ELISA. Cells were lysed with 50% methanol and samples were frozen and thawed three times before centrifugation and preparation for analysis following the manufacturer’s instructions.

Communication and Outreach

Members of the partner institutions (UVM, LCC, VT DEC and VT VDH), the LCBP and the NY DEC comprised an internal communication group which shared all bloom reports upon receipt and provided updates on response activities as needed. The group also shared literature and other pertinent information.

Weekly email updates summarizing bloom reports, algae counts, species composition and toxin data were provided to a group of stakeholders responsible for public health. These were primarily state and local health officials, state and local waterfront managers, Champlain water suppliers, and researchers. Updates were released typically on Thursday afternoons but stakeholders also received notification of intense or extensive blooms as they occurred.

Notification of the Public

The Vermont Department of Health reported current cyanobacteria status on Lake Champlain on-line (http://healthvermont.gov/enviro/bg_algae/weekly_status.aspx). Status was presented both as text and an interactive web map that allows viewers to find information by location around the lake. Results of the assessments translated to one of three map status categories:

VDH Map Status	Tiered Alert Protocol	Visual
Generally Safe	Qualitative, Quantitative, Vigilance	Category 1
Low Alert	Alert Level 1	Category 2
High Alert	Alert Level 2	Category 3

Updates to the map in 2012 created an interactive format allowing viewers to see not only data for the current week at each site but also to review any previous data collected for that site. Links connected viewers with photographic examples of the alert categories and other pertinent information. By the end of the summer, the interactive map was accessible using many commonly used browsers and also by iPad and iPhone.

Response to Bloom Reports

Three jurisdictions were covered by the monitoring program efforts (New York, Vermont and Quebec). While the monitoring program provided a lake-wide system of assessing and reporting bloom intensity, and shared that information via the VDH webpage, response for specific bloom events were coordinated and implemented by the appropriate jurisdiction following their own response protocols.

Outreach and Assistance

Project partners provided outreach and assistance in many ways. Primarily, partners fielded phone calls and emails from individuals requesting information about bloom locations and appearance. They provided guidance and assistance to town health officers and beach managers during bloom events. The VT DEC and VDH worked with water suppliers and homeowners whenever drinking water concerns arose. LCC staff walked the beaches in the greater Burlington area, providing information to beach goers and pet owners through one-on-one interactions. All partners maintained webpages with resources and contact information for anyone seeking information about cyanobacteria.

Results

Overall effort

More than 600 site-specific reports were made by project partners and volunteers during 2012 (Table 4, Appendix C). The majority of these were from the main lake. Reports based on the visual assessment protocol represented 73% of the total. The remaining reports were based on data obtained with the tiered alert protocol.

Table 4. Summary of the 2012 cyanobacteria monitoring station reports distributed through the email update and on-line status map. Blooms refer to scums or high densities of cyanobacteria reported from locations other than regularly monitored sites.

Location	Monitor	Assessment Method		
		Blooms	Tiered Alert	Visual
Main Lake - central	LCC volunteer		9	148
	VT DEC	2	21	
	UVM	3		
Main Lake – northern	LCC volunteer			79
	VT DEC		16	
Main Lake – southern	LCC volunteer			71
	VT DEC		10	
Missisquoi Bay/Maquam	LCC volunteer		18	52
	VT DEC		13	
	UVM		49	
South Lake	LCC volunteer			26
	VT DEC		10	
St. Albans/the islands	LCC volunteer			102
	VT DEC		12	
	UVM		14	
Total reports		5	172	478

The number of samples obtained and analyzed following the tiered alert protocol are summarized in Table 5. More than 250 water samples were analyzed for phytoplankton density and over 300 filters were obtained during site visits. Approximately one-third of these were analyzed for toxins after phytoplankton densities were found to exceed 4000 cells/mL of potentially toxic taxa.

Table 5. Number of water samples collected and analyzed by the partners in 2012. *denotes samples not collected in conjunction with net plankton samples. **Analysis conducted by UVM. ***Analysis conducted by the VDH.

Sample Type	Phytoplankton		Microcystin**	Anatoxin***
	Net	Whole Water*	Whole Water	Whole Water
UVM - Number of Samples Collected/analyzed	101/101	44/44	145/41	145/38
DEC & LCC - Number of Samples Collected/analyzed	86/86	27/27	24/21	1/1
Total	187	71	169/62	146/39

Assessments using the quantitative Tiered Alert Protocol

The tiered alert protocol was implemented at 24 stations, primarily by UVM and the VT DEC. Six algal blooms were reported from non-monitored locations and were also evaluated using the tiered alert protocol. Two volunteer monitors collected water samples for phytoplankton and microcystin analysis at the same time as they made their visual assessment at the North Beach and North Hero sites each week. A third volunteer at the Highgate Springs – Shipyard site collected plankton samples when scums or bloom conditions were observed. These water samples were also evaluated following the tiered alert protocol. A full summary of samples, assessment type and results can be found in Appendix C.

The majority of the stations assessed using the quantitative methods were open water stations. The exceptions were the three volunteer locations, the bloom samples, and the St. Albans Boat launch. Occasionally, weather conditions prevented the UVM team from sampling the open water stations. On these days, shoreline samples were collected.

With the exception of stations in Missisquoi Bay, none of the VT DEC open water locations exceeded the quantitative level of the tiered alert protocol (e.g. density of potentially toxic cyanobacteria was always <2000 cells/mL) (Table 6). UVM stations located on the western side of Missisquoi Bay also remained at the quantitative level, with the exception of the Rt. 78 Access. At this location, densities of potentially toxic cyanobacteria reached 3800 cells/mL and the vigilance level of the protocol.

UVM and volunteer monitor stations located on the eastern side of Missisquoi Bay, the two VT DEC stations in Missisquoi and the boat launch in St. Albans Bay had one or more dates when the number of potentially toxic cyanobacteria exceeded 4000 cells/mL (Alert Level 1). Alert Level 1 was also reached at the shoreline of North Beach on July 3, when *Anabaena* densities exceeded 59,000 cells/ml.

Table 6. Highest status reached at each monitored station in 2012 following the tiered alert protocol. *indicates quantitative samples collected by LCC volunteers to evaluate effectiveness of the visual system. +status achieved during routine sampling. Additional blooms samples were taken at some stations. ++samples collected only when scums or bloom conditions observed.

Region	Station	Assessment method	Status+	Date Achieved	Highest Microcystin achieved	Highest Anatoxin achieved	Maximum Density of Potentially Toxic Cyanobacteria (cells/mL)	Cyanobacteria present when Max Density Achieved
Main Lake - central	LTM 16	VT DEC (Tiered Alert)	quantitative	8/13/2012	0.03 (7/10/2012, surface bloom)	Not tested	117	<i>Anabaena, Aphanizomenon, Aphanothece, Microcystis, Woronichinia/Coelosphaerium</i>
	LTM 19	VT DEC (Tiered Alert)	quantitative	8/13/2012	Not tested	Not tested	218	<i>Anabaena, Aphanizomenon, Woronichinia/Coelosphaerium</i>
	LTM 21	VT DEC (Tiered Alert)	quantitative	8/30/2012	Not tested	Not tested	194	<i>Anabaena, Aphanizomenon, Microcystis</i>
	LTM 25	VT DEC (Tiered Alert)	quantitative	6/6/2012	Not tested	Not tested	104	<i>Anabaena, Aphanothece, Microcystis, Woronichinia/Coelosphaerium</i>
	North Beach, Burlington VT	LCC (Visual)*	Alert Level 1	7/3/2012	Below detection	Not tested	59,700	<i>Anabaena</i>
Main Lake - northern	LTM 33	VT DEC (Tiered Alert)	quantitative	9/7/2012	Not tested	Not tested	121	<i>Anabaena, Aphanizomenon, Microcystis, Woronichinia/Coelosphaerium</i>
	LTM 36	VT DEC (Tiered Alert)	quantitative	9/7/2012	Not tested	Not tested	359	<i>Anabaena, Aphanizomenon, Microcystis, Woronichinia/Coelosphaerium</i>
	LTM 46	VT DEC (Tiered Alert)	quantitative	9/14/2012	Not tested	Not tested	53	<i>Microcystis</i>
Main Lake - southern	LTM 07	VT DEC (Tiered Alert)	quantitative	8/20/2012	Not tested	Not tested	639	<i>Anabaena, Aphanizomenon</i>
	LTM 09	VT DEC (Tiered Alert)	quantitative	8/20/2012	Not tested	Not tested	184	<i>Anabaena, Aphanizomenon, Woronichinia/Coelosphaerium</i>
Missisquoi Bay/Maquam	LTM 50	VT DEC (Tiered Alert)	Alert level 1	8/21/2012 surface bloom	0.04 (7/3/2012)	Not tested	44700	<i>Anabaena, Aphanizomenon, Microcystis</i>
	LTM 51	VT DEC (Tiered Alert)	Alert Level 1	8/21/2012 surface bloom	13.42 (7/3/2012)	Not detected	13900	<i>Anabaena, Aphanizomenon, Microcystis</i>

Region	Station	Assessment method	Status+	Date Achieved	Highest Microcystin achieved	Highest Anatoxin achieved	Maximum Density of Potentially Toxic Cyanobacteria (cells/mL)	Cyanobacteria present when Max Density Achieved
Missisquoi Bay/Maquam	Rte. 78 Access	UVM (Tiered Alert)	Vigilance	9/11/2012	not tested	Not tested	3835 (09/11/12)	<i>Anabaena, Aphanizomenon, Microcystis</i>
	Rte. 78 shoreline	UVM (Tiered Alert)	Quantitative	7/17/2012	not tested	Not tested	1754 (09/18/12)	<i>Microcystis</i>
	Alburg	UVM (Tiered Alert)	Quantitative	6/4/2012	not tested	Not tested	783 (08/07/12)	<i>Anabaena, Aphanizomenon, Microcystis</i>
	Alburg shoreline	UVM (Tiered Alert)	Quantitative	9/4/2012	not tested	Not tested	1184 (09/04/12)	<i>Anabaena, Aphanizomenon, Microcystis</i>
	Highgate Cliffs	UVM (Tiered Alert)	Alert 2	9/11/2012	9.63 (09/11/12)	Not detected	104793 (08/21/12)	<i>Anabaena, Aphanizomenon, Microcystis</i>
	Highgate Springs	UVM (Tiered Alert)	Alert 1	7/30/2012	2.24 (08/28/12)	Not detected	63014 (07/31/12)	<i>Anabaena, Aphanizomenon, Microcystis</i>
	Highgate Springs Shipyard	LCC (Visual)++	Alert 2	7/29/2012	54.76 (09/02/12)	Not detected	4506667 (08/19/12)	<i>Anabaena, Aphanizomenon</i>
	Highgate Springs Shipyard	UVM (Tiered Alert)	Alert 1	8/4/2012	0.39	Not detected	146800 (8/4/12)	<i>Aphanizomenon, Anabaena, Microcystis</i>
	North Hero State Park VT	LCC (Visual)*	quantitative	8/6/2012	Below detection	Not tested	347	<i>Anabaena</i>
South Lake	LTM 02	VT DEC (Tiered Alert)	quantitative	8/7/2012	Not tested	Not tested	37	<i>Anabaena, Aphanizomenon, Woronichinia/Coelosphaerium</i>
	LTM 04	VT DEC (Tiered Alert)	quantitative	9/17/2012	Not tested	Not tested	428	<i>Anabaena, Aphanizomenon</i>
St. Albans/the islands	LTM 34	VT DEC (Tiered Alert)	quantitative	8/3/2012	Not tested	Not tested	75	<i>Anabaena, Woronichinia/Coelosphaerium</i>
	LTM 40	VT DEC (Tiered Alert)	quantitative	8/3/2012	Not tested	Not tested	1970	<i>Anabaena, Aphanizomenon, Gloeotrichia</i>
	St. Albans Boat launch	UVM (Tiered Alert)	Alert 1	8/14/2012	0.04 (08/14/12)	Present, < 0.001 (8/14/2012)	28462 (09/04/12)	<i>Anabaena, Aphanizomenon, Microcystis</i>

Table 7. Status reached when events were reported outside of routinely monitored locations in 2012.

Region	Station	Assessment Method	Status	Date	Microcyst in	Anatoxin	Potentially toxic cells/mL	Potentially toxic taxa present	Reported by
Main Lake - central	Burlington Waterfront - Rubenstein Lab Boat slip	Tiered Alert	Alert Level 1	6/21/12	Not detected	Not detected	422,000	Anabaena	UVM
	Essex, NY	Visual	2	7/2/12	not tested	not tested	-	-	General public
	Willsboro Bay	Visual	2	7/2/12	not tested	not tested	-	-	General public
	Burlington Waterfront - Rubenstein Lab Boat slip	Tiered Alert	Alert Level 1	7/3/12	<0.26	not detected	163,680	Anabaena	UVM
	Burlington Waterfront - Rubenstein Lab Boat slip	Bloom event	Alert Level 1	7/10/12	not detected	Not detected	1,826,000	Anabaena	UVM
	LTM 16	Bloom event	Alert Level 1	7/10/12	not detected	Not detected	52900	Anabaena	VT DEC
	Burlington, VT - Texaco Beach	Bloom event	Alert Level 1	7/11/12	not detected	Not detected	1360000	Anabaena	VT DEC

The density of potentially toxic cyanobacteria cells exceeded 4000 cells/mL during the bloom events in the Burlington area (Table 7). No microcystin or anatoxin was detected during any of these bloom events, which all occurred between mid-June and mid-July. The LCC received two additional reports of blooms on the New York side of the lake, which were assessed as category 2 events.

A total of 76 samples were analyzed for the presence of microcystin in 2012 (Table 8). No detectable microcystin was found in the 35 unfiltered water samples submitted from North Beach, North Hero State Park and Texaco Beach (46% of total microcystin samples). Forty-one samples of filtered plankton tested positive. Four of these exceeded the Vermont recreational standard for microcystin (6µg/L), with an observed maximum concentration of 54µg/L along the shore at the Highgate Springs - Shipyard. Two additional samples were just below the standard, at 5.6 and 5.8µg/L microcystin.

Thirty-three samples were tested for anatoxin. Anatoxin was not detected in the majority of the samples, with very low levels present in only 2 samples (6% of the total).

Table 8. Number of cyanotoxin samples tested and maximum concentrations measured in 2012.

Region	Location	Microcystin		Anatoxin	
		No. Samples Tested	Maximum Microcystin (µg/L)	No. Samples Tested	Maximum Anatoxin (µg/L)
Main Lake - central	Burlington Waterfront - Rubenstein Lab Boat slip	4	0.64	3	Not detected
	LTM 16	1	0.03	1	Not detected
	North Beach	16	Not detected	Not tested	N/A
	Texaco Beach, Burlington VT	2	Not detected	Not tested	N/A
St. Albans/the islands	St. Albans boat launch	3	0.04	2	Present, <0.0013
Missisquoi Bay/Maquam	Rte. 78 Access	Not tested	N/A	Not tested	N/A
	Rte. 78 shoreline	Not tested	N/A	Not tested	N/A
	Alburg	Not tested	N/A	Not tested	N/A
	Alburg shoreline	Not tested	N/A	Not tested	N/A
	Highgate Cliffs	12	9.63	12	Not detected
	Highgate Springs	10	2.24	8	Not detected
	Highgate Springs - Shipyard	10	54.76	6	Not detected
	LTM 50	1	0.04	Not tested	N/A
	LTM 51	1	13.42	1	Not detected
	North Hero State Park	17	Not detected	- Not tested	N/A
TOTAL		76	-	33	-

Eighteen cyanobacteria taxa were observed in Lake Champlain during the 2012 monitoring period (Table 9). Of these, six were reported by this program for the first time in 2012, though some had been noted previously by the Lake Champlain Long-term Water Quality and Biological Monitoring Program (LTM, unpublished data) or Quebec's MDDEP (unpublished data). The majority of cyanobacteria taxa observed in the 2012 monitoring samples are identified as potential toxin producers in the scientific literature.

Table 9. Cyanobacteria taxa observed in Lake Champlain cyanobacteria monitoring samples. *first noted by this program in 2012. Documentation of the new species is located in Appendix D.

Name	Toxin producer	Present in 2012	Year of first report
<i>Anabaena circinalis</i>	yes	x	
<i>Anabaena planctonica</i>	yes	x	
<i>Anabaena</i> spp	yes	x	
* <i>Aphanizomenon</i> spp. (likely <i>A. gracile</i>)	yes	x	2012
<i>Aphanizomenon flos-aquae</i>	yes	x	
<i>Aphanocapsa</i> spp.	no	x	
<i>Aphanothece</i> spp.	yes	x	
* <i>Arthrospira</i> spp.	no	x	2012
<i>Chroococcus</i> spp.	no	x	
<i>Gloeotrichia</i> spp.	yes	x	
* <i>Limnothrix</i> spp.	possible	x	2012
<i>Microcystis</i> spp.	yes	x	
<i>Microcystis Wesenbergii</i>	yes		
<i>Oscillatoria</i> spp.	yes	x	
* <i>Pseudanabaena</i> spp	yes	x	2012
* <i>Radiocystis</i> spp.	possible	x	2012
* <i>Scytonema crispum</i> (synonym <i>Lyngbya cinncinata</i>)	yes	x	2012
<i>Snowella</i> spp	no	x	
<i>Woronichinia</i> spp	yes	x	

The first report of a benthic cyanobacteria mat in Lake Champlain was received from the volunteer monitor at Rouses Point, NY in late August (Figures 2, 3). Subsequent sampling identified the mat organism as *Lyngbya* spp. Dr. Barry Rosen (USGS, Orlando FL) confirmed the identification as most likely *L. cinncinata*, a synonym for the species *Scytonema crispum*. The NY DEC worked with the Clinton NY County Health Department to respond to this bloom.



Figure 2. *Scytonema crispum* mat visible at Rouses Point, NY.



Figure 3. Microscopic view of *S. crispum*.

Reproducibility of Assessment Results

Environmental variability

Phytoplankton composition and density is highly variable in natural environments such as Lake Champlain. Cyanobacteria, in particular, exhibit extreme variation in population density within very short distances and time intervals. The effectiveness of the tiered alert protocol in light of this variability was documented by Rogalus and Watzin (2008). In 2012, consistency between field duplicates was very good (Table 10). Of the 72 field duplicates collected, 68 returned the same assessment level for each of the paired samples. The 4 pairs of duplicates returning different assessments were evenly divided between sampling method (whole water vs. net plankton).

Table 10. Comparability of phytoplankton quality control samples.

Test	N	Status Identical
Field duplicates	72	68
Laboratory replicates	8	7
Split samples	3	0

Laboratory Variability

Assessment results for laboratory replicates (e.g. repeated counts on a single sample by a single analyst) were consistent, however, assessment results for split samples analyzed by both UVM and VT DEC were variable (Table 10). Taxa identification was consistent between the laboratories in two samples. In the third, VT DEC reported one genus that UVM did not. The number of colonies/cells and the proportion falling within each cell count category did vary between labs.

There was no consistent bias by either lab. Side-by-side analysis of a single sample by analysts from UVM and VT DEC had returned nearly identical results during initial training sessions in June, suggesting the differences in total cell densities reflected actual differences in the aliquots analyzed. These may be an artifact of the process used to split the samples or the length of time the samples were stored before analysis, which was several weeks. Colonies become less stable as storage time increases and this would have influenced how cell counts were assigned by VT DEC. In 2013, cell counts will be completed at a single laboratory and QA/QC counts will be analyzed more promptly, rather than leaving them until the end of the field season.

Assessments made using the Visual Protocol

LCC volunteers provided 468 assessments from 59 locations around Lake Champlain during the summer of 2012 (Table 11). Most, but not all, reported each week from the beginning of July through the first week of September (Table 12). More than 90% of the reports documented category 1 conditions, e.g. little to no cyanobacteria present, at the time of assessment. Approximately 4% of the reports noted cyanobacteria were present (category 2), with just 2% reporting a bloom was in progress (category 3). The highest monitoring category reached at each volunteer station is presented in Table 13. A full summary of locations, sampling dates, assessment type and results can be found in Appendix C.

Category 3 reports came primarily from the main lake area of Vermont and New York, the Inland Sea/St. Albans area and Missisquoi Bay. Most, but not all, corresponded to periods when results of the tiered alert assessments were indicating elevated densities of potentially toxic cyanobacteria. The Rouses Point *Scytonema* was an exception to this as there were no other monitoring stations in the vicinity.

Table 11 – number of volunteer reports and their distribution by lake segment. Category descriptions are 1 – little to no cyanobacteria present, 2 – cyanobacteria present at less than bloom levels, and 3 – cyanobacteria bloom in progress.. From the LCC final report submitted to the LCBP in December 2012

Lake Section	# Sites Reporting	# Reports	Category 1	Category 2	Category 3
South of Crown Pt. Bridge	3	28	28	0	0
South Main Lake	9	64	59	3	2
Burlington Area	8	67	65	1	1
Inland Sea and Islands	17	132	125	6	1
Missisquoi Bay	4	33	25	4	4
New York	17	135	130	3	2
Mallets Bay	1	9	9	0	0
Totals	59	468	441	17	10

TABLE 12: Summary of volunteer blue-green algae reports by week for the ten week monitoring season. Category descriptions are 1 – little to no cyanobacteria present, 2 – cyanobacteria present at less than bloom levels, and 3 – cyanobacteria bloom in progress. From the LCC final report submitted to the LCBP in December 2012

Week of:	Jul 2	Jul 9	Jul 16	Jul 30	Aug 6	Aug 13	Aug 20	Aug 27	Sep 3	Sep 10	Season Total	Percent of total
# Observations	39	49	52	46	44	45	46	51	52	44	468	
Category 1	32	47	51	45	40	44	45	49	47	41	441	94.2%
Category 2	5	2	1	1	3	1	0	1	2	1	17	3.6%
Category 3	2	0	0	0	1	0	1	1	3	2	10	2.1%

Table 13. Highest level reached at each monitored station in 2012 following the visual assessment protocol.

Region	Station	Assessment method	Status	Date Achieved
Main Lake - central	Beggs Park Beach, Essex	LCC (Visual)	2	7/3/2012
	Buena Vista Park, Willsboro	LCC (Visual)	2	7/3/2012
	Charlotte Beach	LCC (Visual)	1	9/2/2012
	Chazy Boat Launch	LCC (Visual)	1	7/2/2012
	Essex	LCC (Visual)	2	7/2/2012
	LaPlatte R. at Shelburne Bay	LCC (Visual)	1	9/16/2012
	Leddy Park, Burlington	LCC (Visual)	1	9/24/2012
	Niquette Bay State Park	LCC (Visual)	2	8/7/2012
	North Beach	LCC (Visual)	1	9/24/2012
	North Beach, Burlington VT	LCC (Visual)	Alert Level 1	7/3/2012
	Oakledge Park Blanchard Beach	LCC (Visual)	2	7/15/2012
	Oakledge Park Oakledge Cove	LCC (Visual)	1	9/10/2012
	Oakledge Park rocky shoreline	LCC (Visual)	1	9/10/2012
	Red Rocks, South Burlington	LCC (Visual)	3	7/2/2012
	Shelburne Beach	LCC (Visual)	1	9/17/2012
	Teddy Bear Point Cove, Willsboro, NY	LCC (Visual)	1	9/2/2012
	Thompsons Point, Charlotte	LCC (Visual)	1	9/2/2012
Willsboro Bay	LCC (Visual)	2	7/2/2012	
Willsboro Boat Launch	LCC (Visual)	2	9/11/2012	
Main Lake - northern	Alburgh Dunes State Park	LCC (Visual)	2	7/11/2012
	Beekmantown	LCC (Visual)	1	9/4/2012

Region	Station	Assessment method	Status	Date Achieved
	Chazy Boat Launch	LCC (Visual)	1	9/3/2012
	Eagle Acres Rd, Chazy, NY	LCC (Visual)	1	8/27/2012
	Oliver Bay, Plattsburgh	LCC (Visual)	1	9/5/2012
	Plattsburgh City Beach	LCC (Visual)	1	8/29/2012
	Pt. Au Roche S.P. beach	LCC (Visual)	1	9/3/2012
	Pt. Au Roche S.P. Deep Bay	LCC (Visual)	1	9/3/2012
	Pt. Au Roche S.P., Beekmantown, NY	LCC (Visual)	1	7/2/2012
	Rouses Pt water intake	LCC (Visual)	3	9/5/2012
	Treadwells Bay, Beekmantown, NY	LCC (Visual)	1	9/2/2012
	Wilcox Dock, Plattsburgh	LCC (Visual)	1	8/29/2012
	Main Lake - southern	Arnold Bay	LCC (Visual)	1
Button Bay Boat Launch		LCC (Visual)	1	8/27/2012
Camp Dudley - Westport		LCC (Visual)	1	9/4/2012
DAR State Park		LCC (Visual)	1	8/29/2012
Kingsland Bay State Park		LCC (Visual)	3	7/2/2012
Long Pt, Ferrisburgh		LCC (Visual)	3	8/21/2012
Tri-Town Water		LCC (Visual)	1	9/5/2012
Westport Boat Launch		LCC (Visual)	1	9/3/2012
Missisquoi Bay/Maquam	Chapman Bay, Alburgh	LCC (Visual)	1	9/2/2012
	Donaldson Point	LCC (Visual)	3	8/26/2012
	Maquam Bay, Swanton	LCC (Visual)	2	7/30/2012
	North Hero State Park	LCC (Visual)	1	9/10/2012
	Phillipsburg, PQ	LCC (Visual)	3	8/12/2012
	Shipyards, Highgate Springs	LCC (Visual)	3	9/2/2012
South Lake	Allen Bay, Orwell	LCC (Visual)	1	9/2/2012
	Beadles Cove, Shoreham	LCC (Visual)	1	9/2/2012
	Marlena Bay	LCC (Visual)	1	9/5/2012
St. Albans/the islands	Alburgh Dunes State Park	LCC (Visual)	2	8/25/2012
	Burton Island	LCC (Visual)	1	9/6/2012
	Carry Bay - Savage Point	LCC (Visual)	1	9/2/2012

Region	Station	Assessment method	Status	Date Achieved
	City Bay	LCC (Visual)	1	9/2/2012
	Folsom Harbor	LCC (Visual)	1	9/3/2012
	Grand Isle State Park	LCC (Visual)	1	9/4/2012
	Kill Kare S.P.	LCC (Visual)	2	9/3/2012
	Knight Point State Park	LCC (Visual)	1	8/28/2012
	Milton	LCC (Visual)	1	9/2/2012
	Pelots Bay	LCC (Visual)	1	9/3/2012
	Sandbar S.P.	LCC (Visual)	1	8/28/2012
	St. Albans Bay Park	LCC (Visual)	3	8/26/2012
	The Gut	LCC (Visual)	1	9/2/2012
	West Shore Rd. North Hero	LCC (Visual)	1	8/21/2012

Volunteer training

Volunteer trainings were conducted by LCC staff at locations around the Lake Champlain Basin. One hundred fourteen volunteers were trained during 21 sessions, ranging in attendance from one to 18 people. Two training sessions were conducted over the telephone. Numerous media interviews and appearance alerted the public to the opportunity to become a volunteer monitor. LCC staff also conducted informal education and outreach by visiting beaches during blooms, when they were able to converse directly with families, pet owners and others about bloom conditions and the potential health risks associated with exposure.

Training sessions provided information about cyanobacteria – causes, conditions that favor the development of blooms, appearance, associated health concerns, and management efforts aimed at reducing the bloom frequency. Monitors were taught to distinguish cyanobacteria from other phenomena they might see in the lake such as green algae and pollen. Training sessions also introduced volunteers to the on-line LCC cyanobacteria resources and reporting form.

Fifty-nine volunteers, 51% of those trained, reported over the course of the summer. While the remaining volunteers may not have provided weekly reports, the training they received provided the information they needed to assess water conditions during their visits to Lake Champlain and to interpret the weekly status reports posted on the VDH webpage. Additionally, we expect that all workshop attendees had opportunity to share their knowledge with friends and family over the course of the summer.

Communication with the Stakeholders and the General Public

Results of the weekly assessments were communicated via email to state and municipal officials tasked with responding to bloom events. The 81 addresses were largely associated with the state or provincial governments of Vermont, New York and Quebec (49). More than half of these individuals (26) were in

the NY or VT departments of Health. Other recipients included staff at EPA, the Missisquoi Wildlife Refuge, city government, water suppliers, staff at non-profit organizations, and university researchers.

Information was shared with the general public via the VDH cyanobacteria webpages - http://healthvermont.gov/enviro/bg_algae/bgalgae.aspx . Between June 2012 and March 2013, these webpages received over 12,000 visits from 10,000 users. The new status map received 3300 visits from approximately 2500 users in the same period. The web application was released in late July and was compatible with Iphone, Ipads and most browsers by mid-August. The monitoring data was also accessible through the VDH's Environmental Public Health tracking portal at <http://healthvermont.gov/tracking/index.aspx>.

Typically, the VDH distributes a press release in early July that reminds parents, boaters, swimmers and pet owners to watch for cyanobacteria when enjoying the water. In 2012, the main lake area of Champlain experienced a widespread and highly visible bloom in late June. The VDH issued a press release in response to this bloom, reminding the public how to recognize cyanobacteria and where to go for assistance. It also used the opportunity to recruitment volunteers for the monitoring program (http://healthvermont.gov/news/2012/062912_algae_bloom_volunteers.aspx).

All project partners interacted with the public during bloom events, fielding calls from the media, local health officials and lake users. LCC staff walked the beaches when blooms were visible and identified cyanobacteria for swimmers, parents and dog owners who were unfamiliar with the appearance of these organisms. Many believed that they were observing masses of pollen. VDH, LCC and the VT DEC provided assistance to the City of Burlington when cyanobacteria blooms developed along the bike path and near several beaches in June.

Discussion

Success of the volunteer monitoring program

The visual monitoring protocol was implemented by trained citizen volunteers for the first time on Lake Champlain during the summer of 2012. Based on guidance developed to assist communities experiencing cyanobacteria blooms on Vermont's inland lakes, it significantly expanded the footprint of the monitoring program around the lake. It also served as an outreach and education tool as trained volunteers shared their knowledge with friends and family. In Vermont, it provided a common visual protocol to evaluate cyanobacteria blooms across the state.

Implementation of the protocol was not without challenges. LCC staff successfully developed a web-based reporting and support structure but also accommodated volunteers who had no internet access or limited computer skills. They tracked down missing reports from critical locations and interviewed volunteers reporting cyanobacteria scums to confirm that they were truly observing cyanobacteria. The first weeks of the volunteer monitoring effort coincided with an extensive cyanobacteria bloom occurring in the main lake along both Vermont and New York shores, a time when volunteers still felt

uncertain about their assessment abilities. Interaction with LCC not only ensured accurate assessment of conditions but built confidence in volunteers as the summer progressed.

There are still challenges to overcome. The intermediate category of the assessment, cyanobacteria present at less than bloom levels, can be difficult for volunteers. The cyanobacteria mat observed at Rouses Point in 2012 suggests that the protocol should be modified to accommodate future mats, but it will be difficult for volunteers to distinguish among the many filamentous algae present in Lake Champlain. Many volunteers have yet to understand that reports of no algae present are every bit as valuable as those noting bloom conditions. Protocols, training and support materials will be modified to address these areas for the 2013 volunteers.

Effectiveness of the visual monitoring protocols

Two stations, North Beach on the main lake and North Hero State Park in the northern lake, were selected to receive both a visual and quantitative assessment each week (Table 14). Volunteer monitors made a visual assessment and also collected whole water samples for phytoplankton and microcystin analysis, allowing comparison of results on a particular date. However, visual assessments were not made during the first two weeks of the monitoring period at either station. The paired collections continued until the end of August with only a few exceptions.

As noted previously, the categories pertaining to each of the assessment protocols were refined into three status levels for the web map – generally safe, low alert and high alert (see page 8). The two protocols should return the same web status level for locations assessed at the same time. At North Beach, all pairings were in agreement and generated the same map status level with one exception. On August 22, the visual assessment status was reported as “generally safe”. The tiered alert protocol status was determined to be “low alert” rather than “generally safe” because the density of potentially toxic cyanobacteria exceeded the trigger threshold of 4000 cells/mL by 600 cells. At North Hero State Park, cyanobacteria were rarely present in the water samples collected by the volunteer. On the one date when cyanobacteria were present, densities were very low. In all cases, the results of the two assessments were in agreement and generated a single map status level.

The conditions at North Beach on August 22 fell into a transition zone between assessment categories for the visual protocol. Volunteers have found the distinction between ‘little to no cyanobacteria’ and ‘cyanobacteria present at less than bloom levels’ to be a difficult one. While a similar situation can occur when cell densities approach trigger levels, the magnitude of the difference is quantifiable and aids in the decision-making process. Guidance was provided in 2012 to help volunteers make their assessment in such situations and we will work to improve this for 2013. Paired assessments at selected locations will continue in 2013 so that consistency between the two protocols can be evaluated.

Responding to cyanobacteria mats in Lake Champlain

The occurrence of an extensive mat of *Scytonema* at the surface near Rouses Point presented difficulties for the monitoring program as both assessment protocols exclusively target planktonic cyanobacteria. The biology of the genus *Scytonema* suggests that the mat will return again in 2013, though the extent and appearance are difficult to predict. *Scytonema* is a common alga in North America and it has likely

been present, but undocumented, in other parts of Champlain. The genus has been identified as a potential toxin producer and extensive mats along the shoreline do have implications for public health.

The primary emphasis of the 2013 program will continue to be planktonic cyanobacteria, known to be present throughout the lake each year and periodically produce cyanotoxins. We will, however, also ask volunteers to report filamentous mats observed during their weekly assessment if they meet certain criteria, yet to be defined. After assessment of their reports and supplementary photographs, volunteers may be contacted and asked to send samples. This information will be used to further evaluate the frequency of filamentous cyanobacteria mats around the lake.

Table 14. Paired reports from the North Beach and North Hero State Park locations, 2012. *Volunteers did not make visual assessments during the first two visits.

Date	Station	Assessment method	Status (Web Status)	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Other Algae and Non-Toxic Cyanobacteria Present	Microcystin (ug/L), if tested
03-Jul-12	North Beach, Burlington VT	Tiered Alert	Alert Level 1 (Low Alert)	59,700	Anabaena		Not detected
03-Jul-12	North Beach, Burlington VT	Visual	No data*				
10-Jul-12	North Beach, Burlington VT	Tiered Alert	Quantitative (Generally Safe)	1760.00		diatoms	Not detected
10-Jul-12	North Beach, Burlington VT	Visual	No data*				
17-Jul-12	North Beach, Burlington VT	Tiered Alert	Quantitative (Generally Safe)			Limnothrix (non-toxic cyanobacteria), chrysophytes, diatoms	Not detected
17-Jul-12	North Beach, Burlington VT	Visual	1a (Generally Safe)				
23-Jul-12	North Beach, Burlington VT	Tiered Alert	Quantitative (Generally Safe)			diatoms, green algae, Limnothrix	Not detected
23-Jul-12	North Beach, Burlington VT	Visual	1a (Generally Safe)				
31-Jul-12	North Beach, Burlington VT	Tiered Alert	Quantitative (Generally Safe)	0.00		green algae, Limnothrix	Not detected

Date	Station	Assessment method	Status (Web Status)	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Other Algae and Non-Toxic Cyanobacteria Present	Microcystin (ug/L), if tested
31-Jul-12	North Beach, Burlington VT	Visual	1a (Generally Safe)				
07-Aug-12	North Beach, Burlington VT	Visual	1b (Generally Safe)				
14-Aug-12	North Beach, Burlington VT	Tiered Alert	Quantitative (Generally Safe)	1590.00	Aphanizomenon		Not detected
14-Aug-12	North Beach, Burlington VT	Visual	1a (Generally Safe)				
22-Aug-12	North Beach, Burlington VT	Tiered Alert	Alert Level 1 (Low Alert)	4620	Anabaena, Microcystis, Woronichinia/Coelosphaerium	Limnothrix	Not detected
22-Aug-12	North Beach, Burlington VT	Visual	1a (Generally Safe)				
28-Aug-12	North Beach, Burlington VT	Tiered Alert	Quantitative (Generally Safe)	27	Anabaena	diatoms	Not detected
28-Aug-12	North Beach, Burlington VT	Visual	1c (Generally Safe)				
4-Sep-12	North Beach, Burlington VT	Tiered Alert	Quantitative (Generally Safe)	0		Limnothrix, diatoms	Not detected
4-Sep-12	North Beach,	Visual	1b (Generally				

Date	Station	Assessment method	Status (Web Status)	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Other Algae and Non-Toxic Cyanobacteria Present	Microcystin (ug/L), if tested
	Burlington VT		Safe)				
10-Sep-12	North Beach, Burlington VT	Visual	1a (Generally Safe)				
17-Sep-12	North Beach, Burlington VT	Visual	1a (Generally Safe)				
24-Sep-12	North Beach, Burlington VT	Visual	1a (Generally safe)				
02-Jul-12	North Hero State Park VT	Tiered Alert	Quantitative (Generally Safe)	0.00		diatoms	Not detected
02-Jul-12	North Hero State Park VT	Visual	No data*				
08-Jul-12	North Hero State Park VT	Tiered Alert	Quantitative (Generally Safe)		No cyanobacteria observed		Not detected
08-Jul-12	North Hero State Park VT	Visual	No data*				
15-Jul-12	North Hero State Park VT	Tiered Alert	Quantitative (Generally Safe)		No cyanobacteria observed		Not detected
15-Jul-12	North Hero State Park VT	Visual	1c (Generally Safe)				
22-Jul-12	North Hero State Park VT	Tiered Alert	Quantitative (Generally Safe)			green algae	Not detected
22-Jul-12	North Hero State Park	Visual	1a (Generally				

Date	Station	Assessment method	Status (Web Status)	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Other Algae and Non-Toxic Cyanobacteria Present	Microcystin (ug/L), if tested
	VT		Safe)				
29-Jul-12	North Hero State Park VT	Tiered Alert	Quantitative (Generally Safe)	0.00	No cyanobacteria observed		Not detected
29-Jul-12	North Hero State Park VT	Visual	1a (Generally Safe)				
06-Aug-12	North Hero State Park VT	Tiered Alert	Quantitative (Generally Safe)	347.00	Anabaena	green algae, diatoms	Not detected
12-Aug-12	North Hero State Park VT	Tiered Alert	Quantitative (Generally Safe)	0.00		diatoms	Not detected
12-Aug-12	North Hero State Park VT	Visual	1c (Generally Safe)				
19-Aug-12	North Hero State Park VT	Tiered Alert	Quantitative (Generally Safe)	0	No cyanobacteria observed		Not detected
19-Aug-12	North Hero State Park VT	Visual	1a (Generally Safe)				
26-Aug-12	North Hero State Park VT	Tiered Alert	Quantitative (Generally Safe)	0	No cyanobacteria observed		Not detected
26-Aug-12	North Hero State Park VT	Visual	1a (Generally Safe)				
10-Sep-12	North Hero State Park VT	Visual	1b (Generally Safe)				

Overview of Cyanobacteria and Toxins since 2003

Median cell densities of potentially toxic cyanobacteria in Lake Champlain since 2003 are presented in Figures 4 and 5. Generally, median cell densities for both whole water and net plankton samples since 2007 have been lower than densities in years prior. The 2012 data is consistent with this pattern, except in the central region of the main lake where the median cell densities in whole water samples were more than twice as high as those documented since 2007. This reflects the widespread bloom that occurred in the main lake during early July, an infrequent event for this region.

Microcystin concentrations observed in 2012 were similar to recent years (Table 16). Most samples had concentrations below levels of recreational concern (e.g. $<6 \mu\text{g/L}$). Also consistent with historical trends, the most frequently sampled location in 2012 was Missisquoi Bay, where several samples had concentrations above the recreational guideline for microcystin. The July bloom in the main lake and the validation samples collected at North Beach resulted in a larger number of toxin samples processed from this area in 2012, but microcystin concentrations were low and consistent with previous years. Cyanobacteria were present in the other regions of the lake, but cell densities remained low through the summer and, similar to previous years, did not trigger analysis for toxins.

Potential anatoxin producers were documented during 2012 and numerous samples were submitted for analysis (Table 8). Similar to previous years, anatoxin was below detection in most samples, detected at very low levels only on a single date in St. Albans Bay.

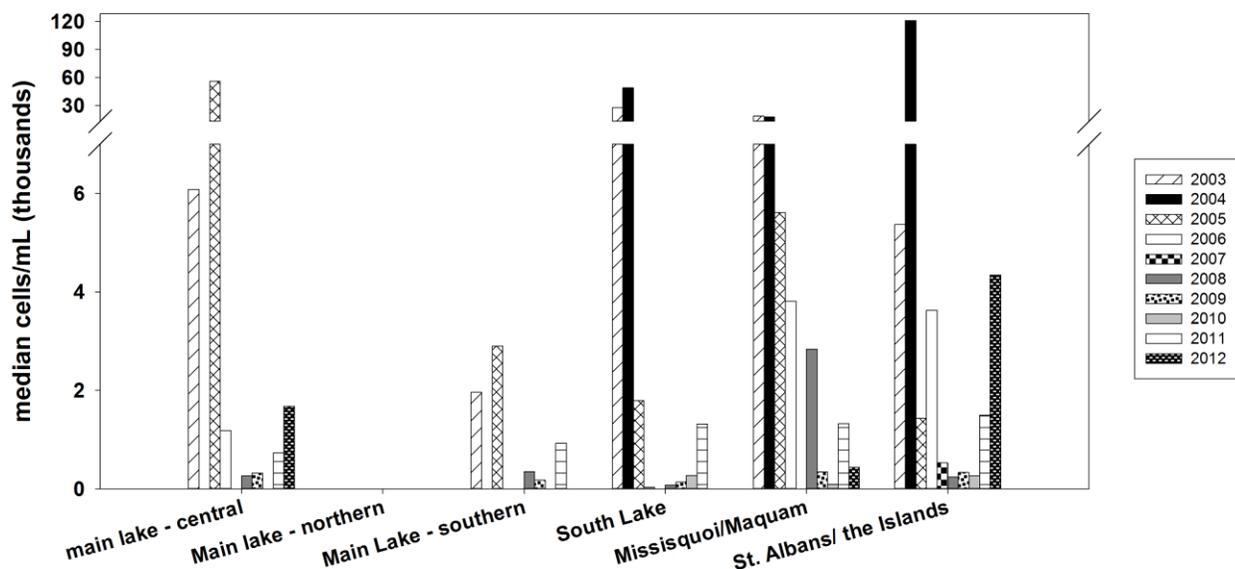


Figure 4. Median cell densities, thousands, of potentially toxic cyanobacteria in whole water samples, 2003 – 2012.

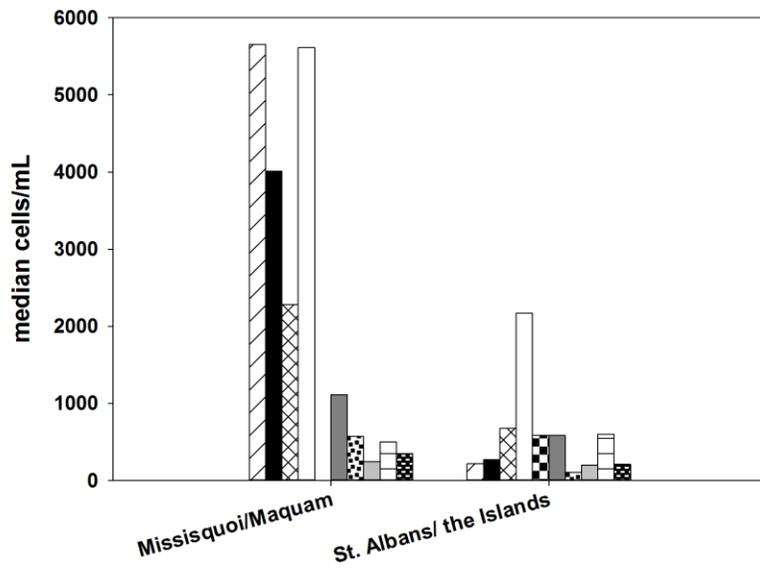
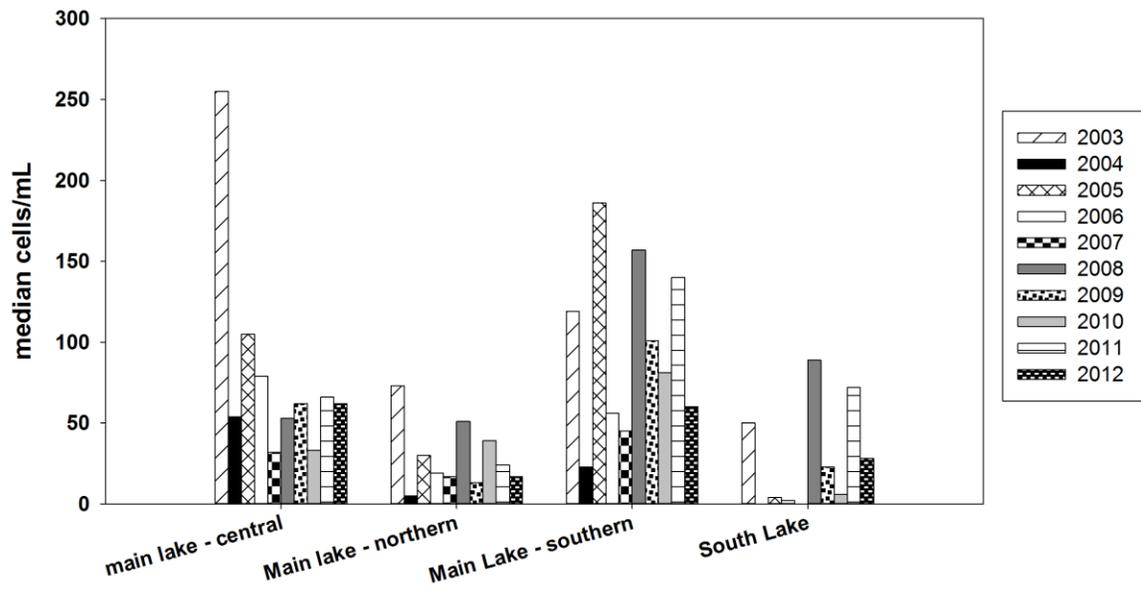


Figure 5. Median cell densities of potentially toxic cyanobacteria in net plankton samples, 2003 – 2012.

Table 16. Microcystin concentrations in major lake segments, 2003 – 2012. Numbers of stations includes those locations monitored by the tiered alert system as well as bloom events. Data do not distinguish between net plankton and whole water samples. One station in the central main lake region and in Maquam were sampled for microcystin during each weekly visit in 2012 for method validation purposes rather than bloom evaluation. ND = not detected

Lake Region		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Main Lake - northern	Median						1.56		0.03	0.01	
	Range										
	#samples	0	0	0	0	0	1	0	1	1	0
	#stations	3	3	6	7	6	7	5	5	6	3
Main Lake - central	Median	0.05		7.42	0.04	2.82	0.47	0.03	0.08	0.02	0.13
	Range	0.01 – 0.12		6.04 – 8.80	0.04 – 3.47	0.02 – 5.61	0.03 – 1.49	0.03 – 23.36	0.02 – 0.14	0.01 – 0.04	ND – 0.64
	#samples	19	0	2	8	2	3	6	7	6	23
	#stations	10	9	10	15	13	9	11	10	10	7
Main Lake - southern	Median	0.07		0.04					0.13	0.01	
	Range			<0.01 – 0.07							
	#samples	1	0	2	0	0	0	0	1	1	0
	#stations	3	3	7	4	3	4	3	7	4	2
South Lake	Median	0.96		0.01						0.02	
	Range	0.53 – 1.38									
	#samples	2	0	1	0	0	0	0	0	1	0
	#stations	3	5	5	3	3	3	3	3	3	2
St. Albans Bay/the islands	Median	0.05	0.05	0.13	0.08	0.05	0.04	0.03	0.09	0.04	0.03
	Range	0.01 – 0.41	<0.01 – 22.48	0.01 – 0.82	0.01 – 42.14	0.02 – 0.54	0.02 – 22.50	0.01 – 0.17	0.01 – 0.80	0.02 – 0.82	0.03 – 0.04
	#samples	32	30	23	46	23	11	7	11	18	3
	#stations	5	5	8	11	12	11	10	9	10	3
Missisquoi Bay/Maquam	Median	0.09	0.77	0.64	0.50	0.05	2.26	0.54	0.03	0.52	0.99
	Range	<0.01 – 23.91	0.01 – 6490.06	<0.01 – 22.11	0.01 – 21.29		0.03 – 94.58	0.03 – 54.16	0.01 – 0.12	0.01 – 180.82	ND – 54.76
	#samples	348	237	149	159	1	91	29	12	64	51
	#stations	17	15	16	17	14	15	14	13	13	9

Overall Assessment of Cyanobacteria on Lake Champlain

Cyanobacteria are routinely documented in phytoplankton samples collected around Lake Champlain by this program and others, including taxa that are known to produce a variety of cyanotoxins. They are a natural component of the ecosystem, one that has the potential to affect human and animal health. The goal of this monitoring effort is to provide public health officials and the general public with information they need to make decisions regarding recreational activities on the lake and the condition of raw drinking water sources, in a fiscally sustainable program. Feedback from stakeholders indicates that the information generated over the summer is being used in these decision-making processes.

It is not possible to ‘know’ the conditions occurring around the lake at every location and point in time. Nor can the program test for every possible cyanotoxin that might be present in a particular algal

population. It can, however, document trends each summer in the number of cyanobacteria and the concentration of microcystin, the most commonly observed cyanotoxin in the lake (Watzin et al., 2006), and use these to predict a likely condition at a particular location and time. Historical data from Missisquoi Bay, for example, have shown cyanobacteria are likely to be present in large numbers each summer and also that microcystin is routinely present around the Bay. Scums here are more likely than any other region in the lake to have microcystin concentrations above recreational guidelines, an understanding that will help formulate the public health response whenever scums are reported in the area. The assistance received in 2012 from the LCC's team of volunteers has allowed the program to expand the number of monitoring stations around Champlain, providing a better lens through which to make public health decisions. It also informs a better overall awareness of cyanobacteria conditions around the lake.

During 2012, 90% of the reports generated by the monitoring program indicated that conditions were generally safe, e.g. no or few cyanobacteria noted along the shoreline or enumerated during phytoplankton counts (Table 17). Less than 10% of the reports indicated that cyanobacteria were present at levels above recreational health guidelines, e.g. observed scums, high algal densities or detectable microcystin. Extensive scums and high cell densities did occur in the main lake and Missisquoi Bay, which also had elevated microcystin concentrations, but no reports of illness in people or animals were received during 2012.

Table 17. Summary of status conditions reported via the VDH website, including bloom reports from areas not routinely monitored.

Lake Section	# Reports	Generally Safe	Low alert	High alert
Main Lake - northern	95	89	3	3
Main Lake - central	183	169	13	1
Main Lake - southern	81	75	4	2
St. Albans/the Islands	128	120	6	2
Missisquoi/Maquam	132	103	21	8
South Lake	36	36	0	0
Totals	655	592 (90%)	47 (7%)	16 (2%)

Cyanobacteria in most locations around the lake were not of concern during much of summer 2012. Potentially toxic taxa were present throughout the lake and each region, with the exception of the South Lake, had at least one report of scum or high cell densities. The extensive bloom in the main lake provided opportunity to reach out to lake users, reminding them of the potential health risks associated with exposure to these organisms and pointing them to available resources. With the release of the on-line status map, information is now available to users at the water's edge. Future outreach efforts will continue to educate the public on how best to use these resources when visiting Lake Champlain and actions individuals can take to protect Champlain's water quality.

The Evolving Champlain Cyanobacteria Monitoring Program

Summer 2012 marked the 10th year that the quantitative tiered alert protocol developed by Dr. Mary Watzin and others at the University of Vermont was used to track cyanobacteria populations on Lake Champlain. It also marked the transition of the program management responsibilities from UVM to the VT DEC and an expansion of the public health surveillance system around the lake.

Fall 2012 marked another transition as Dr. Watzin accepted a position as Dean of the North Carolina State University's College of Natural Resources in Raleigh. Her many years of experience and insight regarding the Lake Champlain ecosystem will be missed. Susan Fuller, senior UVM research staff member and long-time monitoring program member, has also taken a new position. We wish them all the best.

Acknowledgements

Project funding was provided by the Lake Champlain Basin Program and the State of Vermont. This project is very much a collaborative effort and we'd like to thank all those who have contributed - Pete Stangel (VT DEC Watershed Management); Gail Center and Truman Bennett (VDH); Kirk Kimball and Marie Sawyer (VDH Laboratory); Pete Young and Jan Leja (VDH developers of the on-line status map); Heather Campbell (VT DEC Drinking Water Protection); Lesley Schuster and others at UVM and especially our volunteer monitors who took time from their busy lives to collect monitoring data.

Literature Cited

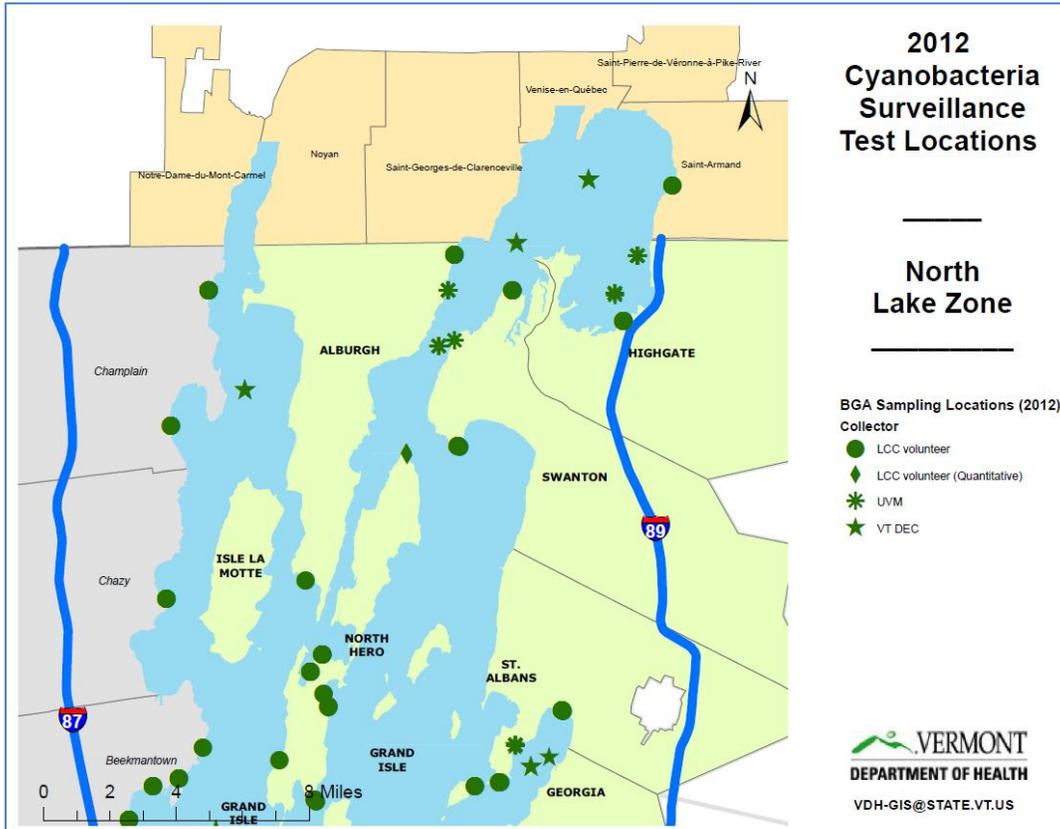
- Ballot, A., J. Fastner, and C. Wiedner. 2010. Paralytic Shellfish Poisoning Toxin-producing Cyanobacterium *Aphanizomenon gracile* in Northeast Germany. *Appl. Environ. Microbiol.* 76(4):1173-1180.
- Burns, J. 2008. Toxic Cyanobacteria in Florida Waters. In Cyanobacterial Harmful Algal Blooms: the state of the Science and Research Needs. H. K. Hudnell, ed. *Advances in Experimental Medicine and Biology*. Vol. 619: 127-137. ISBN 978-0-387-75865-7. 950 pp.
- Carmichael, W., W.R. Evans, Q.Q. Yin, P. Bell, and E. Moczydlowski. 1997. Evidence for Paralytic Shellfish Poisons in the Freshwater Cyanobacterium *Lyngbya wollei* (Farlow ex Gomont) comb. nov. *Appl. Environ. Microbiol.* 63(8):3104-3110.
- Chorus, I. and J. Bartram. 1999. Toxic Cyanobacteria in Water: a Guide to Their Public Health Consequences, Monitoring and Management. E & FN Spon, London and NY. 416 pp.
- Graham, J., K. Loftin, A. Ziegler, and M. Meyer. 2008. Cyanobacteria in Lakes and Reservoirs: Toxin and Taste-and-Odor Sampling Guidelines (ver. 1.0). US Geological Survey Techniques of Water-Resources Investigations, Book 9, Chapter A7, section 7.5. Available online at <http://pubs.water.usgs.gov/twri9A/>.
- Rogalus, M. and M. Watzin. 2008. Evaluation of Sampling and Screening Techniques for Tiered Monitoring of Toxic Cyanobacteria in Lakes. *Harmful Algae* 7(4):504-514.

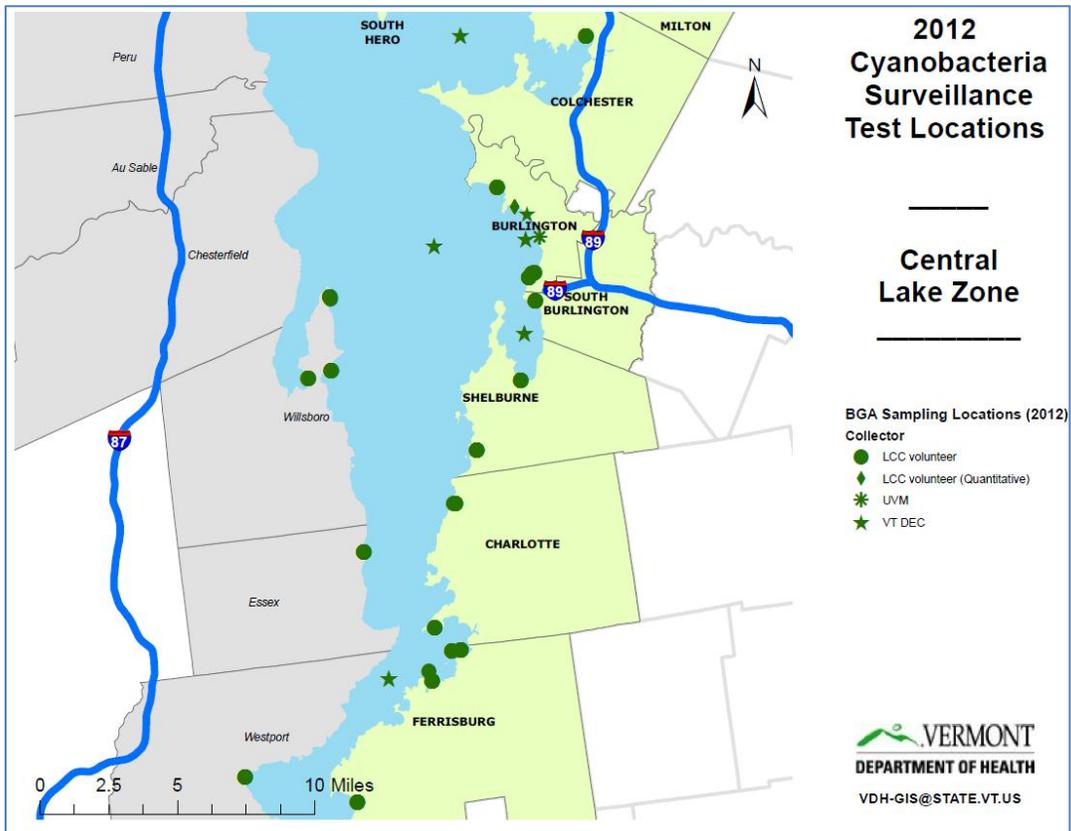
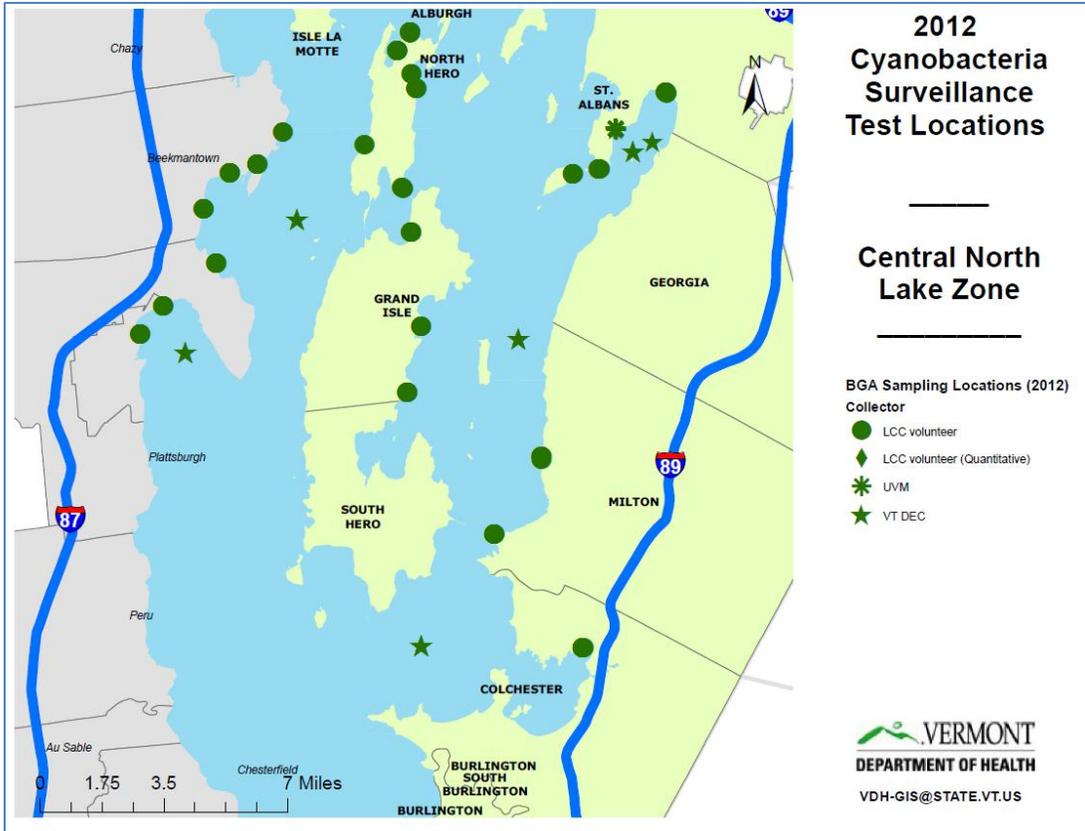
Smith, F., S. Wood, T. Wilks, D. Kelly, P. Broady, W. Williamson, and S. Gaw. 2012. Survey of *Scytonema* (Cyanobacteria) and associated saxitoxins in the littoral zone of recreational lakes in Canterbury, New Zealand. *Phycologia* 51(5):542-551.

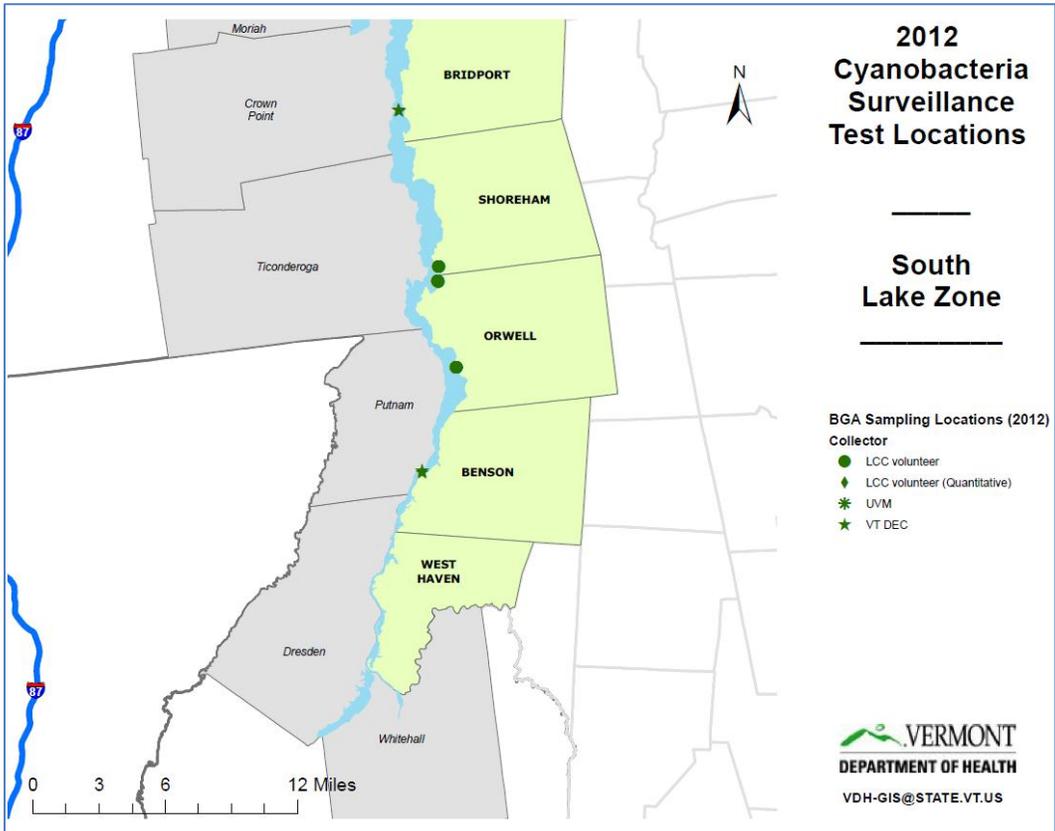
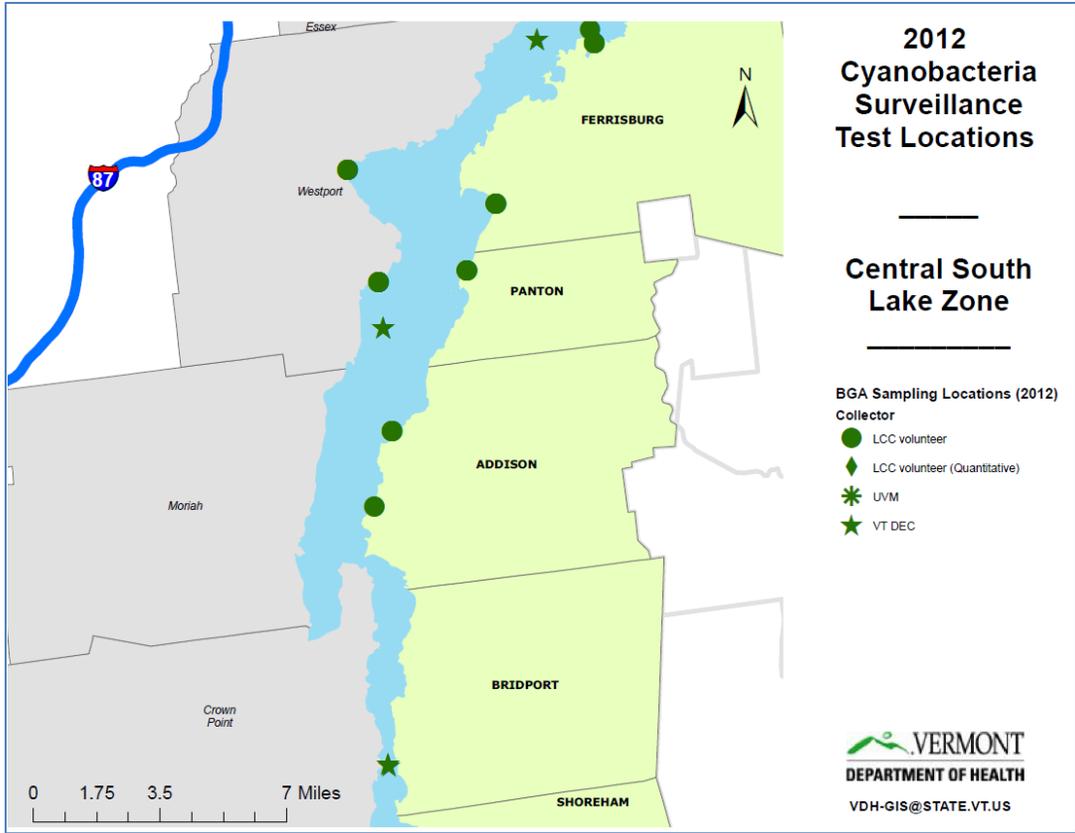
Vieira, J., M., M. Azevedo, S. Azevedo, R. Honda, and B. Correa. 2005. Toxic Cyanobacteria and Microcystin Concentrations in a Public Water Supply Reservoir in the Brazilian Amazonia Region. *Toxicon* 45:901-909.

Watzin, M., E. Miller, A. Shambaugh, and M. Kreider. 2006. Application of the WHO Alert Level Framework to Cyanobacterial Monitoring of Lake Champlain, Vermont. *Environmental Toxicology* 21(3):278-288.

Appendix A - 2012 Sampling locations







Region	Location	Assessment Method	Collector	Latitude	Longitude
Main Lake - central	Beggs Park Beach, Essex NY	Visual	LCC volunteer	44.3084	-73.3487
Main Lake - central	Boat Launch, Willsboro Bay NY	Visual	LCC volunteer	44.4003	-73.3903
Main Lake - central	Bueno Vista Park, Willsboro NY	Visual	LCC volunteer	44.4042	-73.3748
Main Lake - central	LaPlatte River mouth, Shelburne Bay VT	Visual	LCC volunteer	44.3999	-73.2349
Main Lake - central	Leddy Park, Burlington VT	Visual	LCC volunteer	44.5018	-73.2527
Main Lake - central	LTM 16	Tiered Alert	VTDEC	44.4258	-73.2320
Main Lake - central	LTM 19	Tiered Alert	VTDEC	44.4710	-73.2992
Main Lake - central	LTM 21	Tiered Alert	VTDEC	44.4748	-73.2317
Main Lake - central	LTM 25	Tiered Alert	VTDEC	44.5820	-73.2812
Main Lake - central	Niquette Bay State Park VT	Visual	LCC volunteer	44.5820	-73.1886
Main Lake - central	North Beach, Burlington VT	Visual	LCC volunteer	44.4920	-73.2398
Main Lake - central	Oakledge Park (Blanchard Beach), Burlington VT	Visual	LCC volunteer	44.4567	-73.2249
Main Lake - central	Oakledge Park (Oakledge Cove), Burlington VT	Visual	LCC volunteer	44.4542	-73.2289
Main Lake - central	Oakledge Park (rocky shoreline), Burlington VT	Visual	LCC volunteer	44.4562	-73.2269
Main Lake - central	Red Rocks Beach, S. Burlington VT	Visual	LCC volunteer	44.4427	-73.2244
Main Lake - central	Teddy Bear Point Cove, Willsboro NY	Visual	LCC volunteer	44.4428	-73.3758
Main Lake - central	Thompsons Point, Charlotte VT	Visual	LCC volunteer	44.2692	-73.2960
Main Lake - central	Town Beach, Charlotte VT	Visual	LCC volunteer	44.3343	-73.2816
Main Lake - central	Town Beach, Shelburne VT	Visual	LCC volunteer	44.3629	-73.2663
Main Lake - central	Town Boat Launch, Willsboro NY	Visual	LCC volunteer	44.4003	-73.3903
Main Lake - northern	Beekmantown, NY	Visual	LCC volunteer	44.7920	-73.3649
Main Lake - northern	Boat Launch, Chazy NY	Visual	LCC volunteer	44.9322	73.3862
Main Lake - northern	City Beach, Plattsburgh NY	Visual	LCC volunteer	44.7208	-73.4316
Main Lake - northern	Eagle Acres Rd, Chazy NY	Visual	LCC volunteer	44.8566	-73.3875
Main Lake - northern	LTM 33	Tiered Alert	VTDEC	44.7012	-73.4182
Main Lake - northern	LTM 36	Tiered Alert	VTDEC	44.7562	-73.3550
Main Lake - northern	LTM 46	Tiered Alert	VTDEC	44.9483	-73.3400
Main Lake - northern	Oliver Bay, Plattsburgh NY	Visual	LCC volunteer	44.7355	-73.4030
Main Lake - northern	Oliver Bay, Plattsburgh NY	Visual	LCC volunteer	44.7357	-73.4033

Region	Location	Assessment Method	Collector	Latitude	Longitude
Main Lake - northern	Pt Au Roche State Park, NY (beach)	Visual	LCC volunteer	44.7751	-73.3952
Main Lake - northern	Pt Au Roche State Park, NY (Deep Bay)	visual	LCC volunteer	44.7787	-73.3781
Main Lake - northern	Rouses Pt, NY	Visual	LCC volunteer	44.9915	-73.3635
Main Lake - northern	Town Boat Launch, Chazy NY	Visual	LCC volunteer	44.9322	-73.3862
Main Lake - northern	Treadswell Bay, Beekmantown NY	Visual	LCC volunteer	44.7601	-73.4095
Main Lake - northern	Wilcox Dock, Plattsburgh NY	Visual	LCC volunteer	44.7082	-73.4439
Main Lake - southern	Arnold Bay, VT	Visual	LCC volunteer	44.1492	-73.3671
Main Lake - southern	Boat launch, Button Bay State Park VT	Visual	LCC volunteer	44.1769	-73.3511
Main Lake - southern	Camp Dudley, Westport NY	Visual	LCC volunteer	44.1449	-73.4164
Main Lake - southern	DAR State Park VT	Visual	LCC volunteer	44.0544	-73.4168
Main Lake - southern	Kingsland Bay State Park VT	Visual	LCC volunteer	44.2407	-73.2975
Main Lake - southern	Long Point, VT	Visual	LCC volunteer	44.2566	-73.2831
Main Lake - southern	Long Point, VT	Visual	LCC volunteer	44.2570	-73.2760
Main Lake - southern	LTM 07	Tiered Alert	VTDEC	44.1260	-73.4128
Main Lake - southern	LTM 09	Tiered Alert	VTDEC	44.2422	-73.3292
Main Lake - southern	West Addison, VT	visual	LCC volunteer	44.0845	-73.4074
Main Lake - southern	Westport Boat Launch NY	Visual	LCC volunteer	44.1891	-73.4340
Missisquoi Bay/Maquam	Alburgh, VT	Tiered Alert	UVM	44.9926	-73.2140
Missisquoi Bay/Maquam	Alburgh, VT - shoreline	Tiered alert	UVM	44.9922	-73.2174
Missisquoi Bay/Maquam	Chapman Bay, VT	Visual	LCC volunteer	45.0083	-73.2124
Missisquoi Bay/Maquam	Donaldson Pt, VT	Visual	LCC volunteer	44.9925	-73.1762
Missisquoi Bay/Maquam	Highgate Cliffs, Highgate VT	Tiered Alert	UVM	45.0082	-73.0996
Missisquoi Bay/Maquam	Highgate Springs, Highgate VT	Tiered Alert	UVM	44.9918	-73.1134
Missisquoi Bay/Maquam	Larry Greene Fish and Wildlife Access - shoreline, Swanton VT	Tiered Alert	UVM	44.9708	-73.2116
Missisquoi Bay/Maquam	Larry Greene Fish and Wildlife Access, Swanton VT	Tiered Alert	UVM	44.9680	-73.2211
Missisquoi Bay/Maquam	LTM 50	Tiered Alert	VTDEC	45.0133	-73.1738
Missisquoi Bay/Maquam	LTM 51	Tiered Alert	VTDEC	45.0417	-73.1297
Missisquoi Bay/Maquam	Maquam Bay, Swanton VT	Visual	LCC volunteer	44.9245	-73.2090
Missisquoi Bay/Maquam	North Hero State Park VT	Visual	LCC volunteer	44.9208	-73.2402

Region	Location	Assessment Method	Collector	Latitude	Longitude
Missisquoi Bay/Maquam	Phillipsburg, QE	Visual	LCC volunteer	45.0389	-73.0782
Missisquoi Bay/Maquam	Shipyard, Highgate Springs VT	Visual	LCC volunteer	44.9797	-73.1077
South Lake	Allen Bay, Orwell VT	Visual	LCC volunteer	43.7828	-73.3530
South Lake	Beadles Cove, Shoreham VT	Visual	LCC volunteer	43.8490	-73.3695
South Lake	Larabees Point, VT	Visual	LCC volunteer	43.8554	-73.3766
South Lake	LTM 02	Tiered Alert	VTDEC	43.7148	-73.3830
South Lake	LTM 04	Tiered Alert	VTDEC	43.9517	-73.4078
South Lake	Marlena Bay, Shoreham VT	Visual	LCC volunteer	43.8397	-73.3707
St. Albans/the islands	Alburgh Dunes State Park, VT	Visual	LCC volunteer	44.8657	-73.3013
St. Albans/the islands	Boat Launch, St. Albans VT	Tiered Alert	UVM	44.7942	-73.1723
St. Albans/the islands	Burton Island State Park, VT	Visual	LCC volunteer	44.7760	-73.1966
St. Albans/the islands	Carry Bay, VT	Visual	LCC volunteer	44.8331	-73.2910
St. Albans/the islands	City Bay, North Hero VT	Visual	LCC volunteer	44.8104	-73.2870
St. Albans/the islands	Folsom Harbor, Grand Isle VT	Visual	LCC volunteer	44.7135	-73.2831
St. Albans/the islands	Grand Isle State Park VT	Visual	LCC volunteer	44.6859	-73.2910
St. Albans/the islands	Kill Kare State Park VT	Visual	LCC volunteer	44.7781	-73.1817
St. Albans/the islands	Knight Point State Park VT	Visual	LCC volunteer	44.7699	-73.2948
St. Albans/the islands	LTM 34	Tiered Alert	VTDEC	44.7082	-73.2268
St. Albans/the islands	LTM 40	Tiered Alert	VTDEC	44.7853	-73.1622
St. Albans/the islands	Milton VT	Visual	LCC volunteer	44.6600	-73.2131
St. Albans/the islands	Pelots Bay, VT	Visual	LCC volunteer	44.8255	-73.2976
St. Albans/the islands	Rt 2 - City Bay, North Hero VT	Visual	LCC volunteer	44.8166	-73.2902
St. Albans/the islands	Sand Bar State Park VT	Visual	LCC volunteer	44.6282	-73.2398
St. Albans/the islands	St. Albans Bay Park, St. Albans VT	Visual	LCC volunteer	44.8095	-73.1435
St. Albans/the islands	The Gut	Visual	LCC volunteer	44.7514	-73.2892
St. Albans/the islands	West Shore Rd., North Hero VT	Visual	LCC volunteer	44.7867	-73.3166

Appendix B. Visual Assessment Protocols Developed by the LCC

B.1. On-line reporting form

[-http://www.lakechamplaincommittee.org/get-involved/volunteers/bga-monitors/bga-report/](http://www.lakechamplaincommittee.org/get-involved/volunteers/bga-monitors/bga-report/)

Reporting Blue-Green Algae on Lake Champlain

Please use this form to report on water quality conditions with regard to algae on Lake Champlain.

Blue-green algae blooms can be easily confused with other natural phenomena. Please consult our guide to [Recognizing Blue Green Algae in Lake Champlain](#) before reporting a bloom.

Also, our [guide to categories of algae bloom intensity](#) and our [instructions for photographing algae blooms](#) will be helpful in filling out the form below.

The first five items in the form (up to 'Please choose the category') and your contact information (bottom of form) are the most important items. Other questions provide details for our information but are less critical.

Algae Report Form

Water body or section of Lake Champlain

Municipality of observation

Date of observation

Time of observation

Please choose the category (see links above) that best describes the intensity of any bloom present Please choose the category (see links above) that best describes the intensity of any bloom present 1a - Little or no blue-green algae present - clear water

1b - Little or no blue-green algae present - brown or turbid water

1c - Little or no blue-green algae present - other material present

2 - Blue-green algae present -less than bloom levels (include photos)

- 3 - Blue-green algae bloom in process (include photos)

Photo - water surface close-up

Photo - water surface broad view

Photo - water sample in clear container

Extent of algae bloom on open water (Evaluate the area within 100 yards of where you are).

- Coverage greater than 75%
- Between 50 and 75% cover
- <50% cover
- Very limited
- No bloom
- Unknown

Algae Color

- Green
- Turquoise
- Reddish
- Yellow
- None
- Other (add details below)

Has the bloom disappeared since the observation noted above? Has the bloom disappeared since the observation noted above?

- Yes
- No
- I don't know

If known, date of disappearance

Other details

Please provide the most accurate location information you can - e.g. GPS coordinates,

precise street address, name of the bay, etc.

Water temperature

Water Surface

Name

Email

Address

Telephone

B.2. Determining Algae Bloom Intensity

- <http://www.lakechamplaincommittee.org/get-involved/volunteers/bga-monitors/algaebloomintensity/>

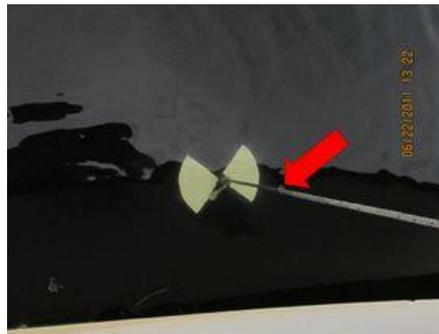
General Instructions

Observations should be made at the same location once per week. Observations must be made between 10:00 AM and 2:00 PM. At that time the algae have had a chance to rise from lower in the water column, but cells are not yet likely to have ruptured from the heat of mid-day. Anyone providing reports should include information on the extent and type of algae and plant growth, the color of the water, and rate the algae intensity. The rating scale runs from one (a, b, or c) to three, with one being clear water with little to no blue-green algae present and three being a blue-green algae bloom in progress.

For [category 2](#) and [3](#) conditions, three digital photographs should be submitted via the [online form](#).

Category 1a: Little to no blue-green algae present - clear water

Any organisms floating in water column are clear (e.g. insect 'skins') rather than green. Leafy or grass-like plants (including duckweed) may be present. Foam may be present.



Objects sitting lower in the water column are clearly visible (red arrow indicates water surface)



Overall appearance of water is clear

Category 1b - Little to no blue-green algae present - brown and turbid

Brown turbid low visibility through water column



Brown and cloudy does not indicate presence of blue-green algae

Category 1c - Little to no blue-green algae present - other material

Other material that doesn't count as blue-green algae might include:

- Long strands that tangle around paddles or boat hooks
- Small bright mustard yellow (pollen) or grass green (duckweed) particles
- Algae attached to rocks or the lake bottom.



Green dots are duckweed; stringy algae are not blue-green algae



From a distance duckweed can look like algae



Stringy algae attached to the bottom are not blue-greens



Duckweed up close

Category 2: Blue-green algae present, but at less than 'bloom' levels

Numerous green balls (pinhead size or larger) floating in water column, but not accumulated at water surface. Possible small (smaller than a softball) patches of algae

accumulation. Open water color **not** green. Possible narrow band of algae accumulation at shoreline.



Some algae in water but not a uniform layer



Open water not green.

Category 3: Blue-green algae bloom in progress

Extensive surface scum on water – color may range from green to electric blue (not yellow/pollen). Usually accompanied by a thick accumulation at shoreline. Open water appears green.



Continuous layer of algae at the surface - not stringy



Thick surface scum present



Open water surface green to turquoise

Main navigation:

B.3. Guidelines for Photographic Documentation -

<http://www.lakechamplaincommittee.org/get-involved/volunteers/bga-monitors/bga-photos/>

Instructions for Photographing Algae Blooms

Please take digital photographs of the water when [category 2 or 3 bloom conditions](#) are observed.

We need three photographs:

1. A close-up of the water surface,
2. A broad view of water in the vicinity, and
3. A close-up of a water sample in a clear container and placed against a background that provides contrast such as a sheet of paper or a light-colored wall. Darker colors provide more contrast.



1. Use your camera's date stamp, or hold up a card in the photo with time, date, and location.



2. Photograph both a close-up and a broad view.



3. For close-ups, take a sample of water in a clear container and photograph against a white or light-colored background.

All photographs should include the time, date, and location. This information can be added by using the date stamp in your camera or by holding a piece of paper with the relevant information in the picture. Name the photograph file using the year, month, day-photographer's name-location-photo type.

Example file name: 2012-07-15_MWinslow_DonaldsonPt_Closeup

Appendix C. 2012 monitoring report summary

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
6/6/2012	Missisquoi Bay/Maquam	Alburgh VT	Tiered Alert	quantitative	17	Microcystis	not tested	not tested
6/6/2012	Missisquoi Bay/Maquam	Highgate cliffs	Tiered Alert	quantitative	2	Microcystis	not tested	not tested
6/6/2012	Missisquoi Bay/Maquam	Highgate Springs	Tiered Alert	quantitative	3	Microcystis	not tested	not tested
6/6/2012	Main Lake - central	LTM 25	Tiered Alert	qualitative	Not counted	Anabaena, Aphanizomenon	not tested	not tested
6/6/2012	Missisquoi Bay/Maquam	Rt 78 Access	Tiered Alert	quantitative	0	Microcystis	not tested	not tested
6/6/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	quantitative	4	Microcystis	not tested	not tested
6/7/2012	St. Albans/the islands	LTM 34	Tiered Alert	qualitative	0		not tested	not tested
6/7/2012	St. Albans/the islands	LTM 40	Tiered Alert	qualitative	0		not tested	not tested
6/8/2012	Main Lake - southern	LTM 07	Tiered Alert	quantitative	3	Aphanizomenon	not tested	not tested
6/8/2012	Main Lake - southern	LTM 09	Tiered Alert	quantitative	17	Aphanizomenon	not tested	not tested
6/11/2012	Main Lake - northern	LTM 46	Tiered Alert	quantitative	<1	Aphanizomenon	not tested	not tested
6/11/2012	Missisquoi Bay/Maquam	LTM 50	Tiered Alert	quantitative	9	Microcystis	not tested	not tested
6/11/2012	Missisquoi Bay/Maquam	LTM 51	Tiered Alert	quantitative	<1	Microcystis	not tested	not tested
6/15/2012	South Lake	LTM 02	Tiered Alert	quantitative	<1	Anabaena	not tested	not tested
6/15/2012	South Lake	LTM 04	Tiered Alert	quantitative	<1	Aphanizomenon	not tested	not tested
6/18/2012	Missisquoi Bay/Maquam	Alburgh VT	Tiered Alert	quantitative	0		not tested	not tested
6/18/2012	Missisquoi Bay/Maquam	Rt 78 Access	Tiered Alert	quantitative	0		not tested	not tested
6/18/2012	Missisquoi Bay/Maquam	Shipyard - Highgate Springs	Tiered Alert	quantitative	0		not tested	not tested
6/18/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	quantitative	4	Aphanizomenon, Microcystis	not tested	not tested
6/20/2012	Main Lake - central	LTM 16	Tiered Alert	quantitative	2	Anabaena, Aphanizomenon	not tested	not tested
6/20/2012	Main Lake - central	LTM 19	Tiered Alert	quantitative	6	Anabaena, Aphanizomenon	not tested	not tested
6/20/2012	Main Lake - central	LTM 21	Tiered Alert	quantitative	20	Anabaena, Woronichinia/Coelosphaerium	not tested	not tested
6/21/2012	Main Lake - central	LTM 25	Tiered Alert	quantitative	34	Anabaena, Woronichinia/Coelosphaerium	not tested	not tested
6/21/2012	Main Lake - central	UVM boat slip, Burlington VT	Tiered Alert	Alert Level 1	422000	Anabaena	Not detected	not detected

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
6/22/2012	Main Lake - northern	LTM 33	Tiered Alert	quantitative	18	Anabaena	not tested	not tested
6/22/2012	Main Lake - northern	LTM 36	Tiered Alert	quantitative	8	Anabaena, Aphanizomenon	not tested	not tested
6/25/2012	Main Lake - southern	Arnold Bay	Visual	1a				
6/26/2012	St. Albans/the islands	Grand Isle State Park	Visual	1b				
6/29/2012	Main Lake - southern	LTM 07	Tiered Alert	quantitative	43	Anabaena	not tested	not tested
6/29/2012	Main Lake - southern	LTM 09	Tiered Alert	quantitative	76	Anabaena, Aphanizomenon	not tested	not tested
7/1/2012	South Lake	Allen Bay, Orwell	Visual	1b				
7/1/2012	South Lake	Beadles Cove, Shoreham	Visual	1b				
7/1/2012	St. Albans/the islands	Carry Bay - Savage Point	Visual	1a				
7/1/2012	Missisquoi Bay/Maquam	Chapman Bay, Alburgh	Visual	1a				
7/1/2012	Missisquoi Bay/Maquam	Donaldson Point	Visual	1c				
7/1/2012	St. Albans/the islands	Kill Kare State Park	Visual	1a				
7/1/2012	Main Lake - central	LaPlatte R. at Shelburne Bay	Visual	1b				
7/1/2012	Main Lake - central	Leddy Park, Burlington	Visual	1a				
7/1/2012	St. Albans/the islands	Sand Bar State Park	Visual	1a				
7/1/2012	Missisquoi Bay/Maquam	Shipyard - Highgate Springs	Visual	1b				
7/1/2012	St. Albans/the islands	St. Albans Bay Park	Visual	1a				
7/1/2012	Main Lake - central	Teddy Bear Point Cove, Willsboro NY	Visual	1b				
7/1/2012	Main Lake - northern	Treadswell Bay, Beekmantown NY	Visual	1c				
7/2/2012	Missisquoi Bay/Maquam	Alburgh VT	Tiered Alert	quantitative	14	Aphanizomenon, Microcystis	not tested	not tested
7/2/2012	Missisquoi Bay/Maquam	Highgate cliffs	Tiered Alert	quantitative	8	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
7/2/2012	Missisquoi Bay/Maquam	Highgate Springs	Tiered Alert	quantitative	71	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
7/2/2012	St. Albans/the islands	LTM 34	Tiered Alert	quantitative	8	Anabaena	not tested	not tested

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/2/2012	St. Albans/the islands	LTM 40	Tiered Alert	quantitative	1	Anabaena, Oscillatoria	not tested	not tested
7/2/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Tiered Alert	quantitative	0		Not detected	not tested
7/2/2012	Missisquoi Bay/Maquam	Rt 78 Access	Tiered Alert	quantitative	42	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
7/2/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	quantitative	9	Anabaena, Microcystis	not tested	not tested
7/2/2012	St. Albans/the islands	City Bay	Visual	1c				
7/2/2012	Main Lake - northern	Eagle Acres Rd, Chazy NY	Visual	1a				
7/2/2012	Main Lake - central	Essex, NY	Visual	2				
7/2/2012	Main Lake - southern	Kingsland Bay State Park	Visual	3				
7/2/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	2				
7/2/2012	Missisquoi Bay/Maquam	Maquam Bay, Swanton	Visual	1c				
7/2/2012	Missisquoi Bay/Maquam	Phillipsburg, QE	Visual	2				
7/2/2012	Main Lake - northern	Pt Au Roche State Park	Visual	1a				
7/2/2012	Main Lake - central	Red Rocks, South Burlington	Visual	3				
7/2/2012	Main Lake - northern	Rouses Point, NY	Visual	1a				
7/2/2012	Main Lake - northern	Town Boat Launch, Chazy NY	Visual	1c				
7/2/2012	Main Lake - southern	Westport Boat Launch	Visual	2				
7/2/2012	Main Lake - central	Willsboro Bay	Visual	2				
7/3/2012	Main Lake - northern	LTM 46	Tiered Alert	quantitative	1	Anabaena	not tested	not tested
7/3/2012	Missisquoi Bay/Maquam	LTM 50	Tiered Alert	quantitative	133	Anabaena, Aphanizomenon, Microcystis	0.04	not tested
7/3/2012	Missisquoi Bay/Maquam	LTM 51	Tiered Alert	alert level 2	not tested		13.42	not detected
7/3/2012	Missisquoi Bay/Maquam	LTM 51	Tiered Alert	quantitative	658	Anabaena, Aphanizomenon, Microcystis	Not tested	Not tested
7/3/2012	Main Lake - central	North Beach, Burlington VT	Tiered Alert	Alert Level 1	59700	Anabaena	Not detected	not tested

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/3/2012	Main Lake - central	UVM boat slip, Burlington VT	Tiered Alert	Alert Level 1	163680	Anabaena	0.13	not detected
7/3/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	2				
7/3/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	2				
7/3/2012	Main Lake - central	Niquette Bay State Park	Visual	1a				
7/3/2012	Main Lake - central	Town Boat Launch, Willsboro NY	Visual	1b				
7/5/2012	South Lake	LTM 02	Tiered Alert	quantitative	1	Anabaena	not tested	not tested
7/5/2012	South Lake	LTM 04	Tiered Alert	quantitative	47	Anabaena	not tested	not tested
7/7/2012	Main Lake - southern	Kingsland Bay State Park	Visual	2				
7/8/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Tiered Alert	quantitative	0		Not detected	not tested
7/8/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	1a				
7/8/2012	St. Albans/the islands	Carry Bay - Savage Point	Visual	1a				
7/8/2012	Missisquoi Bay/Maquam	Chapman Bay, Alburgh	Visual	1a				
7/8/2012	Missisquoi Bay/Maquam	Donaldson Point	Visual	1b				
7/8/2012	St. Albans/the islands	Folsom Harbor	Visual	1c				
7/8/2012	St. Albans/the islands	Kill Kare State Park	Visual	1a				
7/8/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1a				
7/8/2012	St. Albans/the islands	Milton	Visual	1a				
7/8/2012	Main Lake - central	Niquette Bay State Park	Visual	1a				
7/8/2012	St. Albans/the islands	St. Albans Bay Park	Visual	1a				
7/8/2012	Main Lake - southern	Town Beach, Charlotte	Visual	1b				
7/8/2012	Main Lake - central	Town Boat Launch, Willsboro NY	Visual	1a				
7/9/2012	Main Lake - southern	Arnold Bay	Visual	1a				
7/9/2012	Main Lake - southern	Button Bay Boat Launch	Visual	1a				
7/9/2012	St. Albans/the islands	City Bay	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/9/2012	Missisquoi Bay/Maquam	Maquam Bay, Swanton	Visual	1a				
7/9/2012	Main Lake - northern	Oliver Bay, Plattsburgh NY	Visual	1a				
7/9/2012	Main Lake - northern	Pt Au Roche State Park	Visual	1a				
7/9/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1a				
7/9/2012	Main Lake - northern	Rouses Point, NY	Visual	1a				
7/9/2012	St. Albans/the islands	Sand Bar State Park	Visual	1c				
7/10/2012	Missisquoi Bay/Maquam	Alburgh VT	Tiered Alert	quantitative	79	Anabaena, Microcystis	not tested	not tested
7/10/2012	Missisquoi Bay/Maquam	Highgate cliffs	Tiered Alert	quantitative	1270	Anabaena, Microcystis, Aphanizomenon	not tested	not tested
7/10/2012	Missisquoi Bay/Maquam	Highgate Springs	Tiered Alert	quantitative	13	Microcystis, Aphanizomenon	not tested	not tested
7/10/2012	Main Lake - central	LTM 16	Tiered Alert	quantitative	85	Anabaena, Aphanizomenon	not tested	not tested
7/10/2012	Main Lake - central	LTM 16 - surface scum	Tiered Alert	quantitative	52900	Anabaena	0.03	not detected
7/10/2012	Main Lake - central	LTM 19	Tiered Alert	quantitative	86	Anabaena, Aphanizomenon	not tested	not tested
7/10/2012	Main Lake - central	LTM 21	Tiered Alert	quantitative	15	Anabaena, Aphanizomenon	not tested	not tested
7/10/2012	Main Lake - central	North Beach, Burlington VT	Tiered Alert	quantitative	1760		Not detected	not tested
7/10/2012	Missisquoi Bay/Maquam	Rt 78 Access	Tiered Alert	quantitative	133		not tested	not tested
7/10/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	quantitative	275	Anabaena	not tested	not tested
7/10/2012	South Lake	Allen Bay, Orwell	Visual	1a				
7/10/2012	Main Lake - southern	Camp Dudley - Westport	Visual	1a				
7/10/2012	St. Albans/the islands	City Bay, Rt. 2	Visual	1a				
7/10/2012	St. Albans/the islands	Knight Point State Park	Visual	1a				
7/10/2012	South Lake	Marlena Bay	Visual	1a				
7/10/2012	Main Lake - northern	Oliver Bay, Plattsburgh NY	Visual	1c				
7/10/2012	Main Lake - southern	Westport Boat Launch	Visual	1b				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/11/2012	Main Lake - central	Texaco Beach, Burlington VT - bloom	Tiered Alert	Alert Level 1	1360000	Anabaena	Not detected	not detected
7/11/2012	Main Lake - central	UVM boat slip, Burlington VT	Tiered Alert	Alert Level 1	1800000	Anabaena	0.64	not detected
7/12/2012	Main Lake - central	LTM 25	Tiered Alert	quantitative	12	Anabaena, Microcystis	not tested	not tested
7/13/2012	Main Lake - northern	LTM 33	Tiered Alert	quantitative	5	Anabaena, Aphanizomenon	not tested	not tested
7/13/2012	Main Lake - northern	LTM 36	Tiered Alert	quantitative	23	Anabaena	not tested	not tested
7/15/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Tiered Alert	quantitative	0		Not detected	not tested
7/15/2012	South Lake	Allen Bay, Orwell	Visual	1b				
7/15/2012	South Lake	Beadles Cove, Shoreham	Visual	1b				
7/15/2012	Missisquoi Bay/Maquam	Chapman Bay, Alburgh	Visual	1c				
7/15/2012	Main Lake - central	Charlotte Beach	Visual	1a				
7/15/2012	Missisquoi Bay/Maquam	Donaldson Point	Visual	1c				
7/15/2012	Main Lake - central	LaPlatte R. at Shelburne Bay	Visual	1b				
7/15/2012	Main Lake - central	Leddy Park, Burlington	Visual	1a				
7/15/2012	South Lake	Marlena Bay	Visual	1a				
7/15/2012	St. Albans/the islands	Milton	Visual	1c				
7/15/2012	Main Lake - central	Niquette Bay State Park	Visual	1a				
7/15/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Visual	1c				
7/15/2012	Main Lake - central	Oakledge Park Blanchard Beach	Visual	2				
7/15/2012	Main Lake - central	Oakledge Park Oakledge Cove	Visual	1c				
7/15/2012	Main Lake - central	Oakledge Park rocky shoreline	Visual	1c				
7/15/2012	Main Lake - northern	Plattsburgh City Beach	Visual	1a				
7/15/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Visual	1b				
7/15/2012	St. Albans/the islands	St. Albans Bay Park	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/15/2012	Main Lake - central	Teddy Bear Point Cove, Willsboro, NY	Visual	1a				
7/15/2012	St. Albans/the islands	The Gut	Visual	1a				
7/15/2012	Main Lake - northern	Wilcox Dock, Plattsburgh	Visual	1a				
7/16/2012	Main Lake - southern	LTM 07	Tiered Alert	quantitative	3	Aphanizomenon	not tested	not tested
7/16/2012	Main Lake - southern	LTM 09	Tiered Alert	quantitative	9	Anabaena, Aphanizomenon, Woronichinia/Coelosphaerium	not tested	not tested
7/16/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	1b				
7/16/2012	St. Albans/the islands	Burton Island	Visual	1a				
7/16/2012	St. Albans/the islands	Carry Bay - Savage Point	Visual	1c				
7/16/2012	Main Lake - northern	Chazy Boat Launch	Visual	1c				
7/16/2012	St. Albans/the islands	City Bay	Visual	1a				
7/16/2012	Main Lake - southern	DAR State Park	Visual	1a				
7/16/2012	Main Lake - northern	Eagle Acres Rd, Chazy NY	Visual	1a				
7/16/2012	St. Albans/the islands	Kill Kare State Park	Visual	1a				
7/16/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1a				
7/16/2012	Missisquoi Bay/Maquam	Maquam Bay, Swanton	Visual	1a				
7/16/2012	Main Lake - northern	Oliver Bay 2, Plattsburgh	Visual	1c				
7/16/2012	St. Albans/the islands	Pelots Bay	Visual	1c				
7/16/2012	Main Lake - northern	Pt Au Roche State Park	Visual	1c				
7/16/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1c				
7/16/2012	Main Lake - northern	Rouses Point, NY	Visual	1a				
7/16/2012	Main Lake - central	Shelburne Beach	Visual	1c				
7/16/2012	Main Lake - central	Thompsons Point, Charlotte	Visual	1b				
7/16/2012	Main Lake - northern	Treadswell Bay, Beekmantown NY	Visual	1c				
7/16/2012	Main Lake - southern	Westport Boat Launch	Visual	1b				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/16/2012	Main Lake - central	Willsboro Boat Launch	Visual	1b				
7/17/2012	Missisquoi Bay/Maquam	Alburgh VT - shoreline	Tiered Alert	quantitative	0		not tested	not tested
7/17/2012	Missisquoi Bay/Maquam	Highgate Springs - shoreline	Tiered Alert	quantitative	496	Microcystis, Aphanizomenon	not tested	not tested
7/17/2012	Main Lake - central	North Beach, Burlington VT	Tiered Alert	quantitative			Not detected	not tested
7/17/2012	Missisquoi Bay/Maquam	Rt 78 Access	Tiered Alert	quantitative	3	Microcystis	not tested	not tested
7/17/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	vigilance	3204	Anabaena, Aphanizomenon	not tested	not tested
7/17/2012	Main Lake - southern	Arnold Bay	Visual	1a				
7/17/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	1a				
7/17/2012	Main Lake - southern	Button Bay Boat Launch	Visual	1b				
7/17/2012	Main Lake - southern	Camp Dudley - Westport	Visual	1b				
7/17/2012	St. Albans/the islands	City Bay, Rt. 2	Visual	1a				
7/17/2012	St. Albans/the islands	Grand Isle State Park	Visual	1a				
7/17/2012	Main Lake - southern	Long Pt, (Wood) Ferrisburgh	Visual	1a				
7/17/2012	Main Lake - central	North Beach, Burlington VT	Visual	1a				
7/17/2012	Main Lake - northern	Oliver Bay 1, Plattsburgh	Visual	1a				
7/17/2012	St. Albans/the islands	Sand Bar State Park	Visual	1b				
7/17/2012	St. Albans/the islands	West Shore Rd. North Hero	Visual	1a				
7/18/2012	St. Albans/the islands	LTM 34	Tiered Alert	quantitative	59	Anabaena	not tested	not tested
7/18/2012	St. Albans/the islands	LTM 40	Tiered Alert	quantitative	281	Anabaena	not tested	not tested
7/19/2012	Main Lake - northern	LTM 46	Tiered Alert	quantitative	4	Anabaena, Aphanizomenon	not tested	not tested
7/19/2012	Missisquoi Bay/Maquam	LTM 50	Tiered Alert	quantitative	337	Anabaena, Aphanizomenon, Microcystis	not tested	not tested

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/19/2012	Missisquoi Bay/Maquam	LTM 51	Tiered Alert	vigilance	2230	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
7/21/2012	Main Lake - central	Niquette Bay State Park	Visual	1a				
7/22/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Tiered Alert	quantitative			Not detected	not tested
7/22/2012	South Lake	Beadles Cove, Shoreham	Visual	1b				
7/22/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	1a				
7/22/2012	St. Albans/the islands	Carry Bay - Savage Point	Visual	1a				
7/22/2012	Missisquoi Bay/Maquam	Chapman Bay, Alburgh	Visual	1b				
7/22/2012	Main Lake - central	Charlotte Beach	Visual	1a				
7/22/2012	Missisquoi Bay/Maquam	Donaldson Point	Visual	1c				
7/22/2012	Main Lake - southern	Kingsland Bay State Park	Visual	1a				
7/22/2012	Main Lake - central	LaPlatte R. at Shelburne Bay	Visual	1b				
7/22/2012	St. Albans/the islands	Milton	Visual	1b				
7/22/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Visual	1a				
7/22/2012	Missisquoi Bay/Maquam	Phillipsburg, QE	Visual	2				
7/22/2012	Main Lake - northern	Plattsburgh City Beach	Visual	1b				
7/22/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Visual	1b				
7/22/2012	Main Lake - central	Teddy Bear Point Cove, Willsboro, NY	Visual	1a				
7/22/2012	St. Albans/the islands	The Gut	Visual	1a				
7/22/2012	Main Lake - central	Thompsons Point, Charlotte	Visual	1a				
7/22/2012	Main Lake - northern	Wilcox Dock, Plattsburgh	Visual	1c				
7/22/2012	Main Lake - central	Willsboro Boat Launch	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/23/2012	Main Lake - central	LTM 25	Tiered Alert	quantitative	52	Anabaena, Aphanizomenon, Microcystis, Woronichinia/Coelosphaerium	not tested	not tested
7/23/2012	Main Lake - central	North Beach, Burlington VT	Tiered Alert	quantitative			Not detected	not tested
7/23/2012	South Lake	Allen Bay, Orwell	Visual	1b				
7/23/2012	Main Lake - southern	Arnold Bay	Visual	1a				
7/23/2012	St. Albans/the islands	Burton Island	Visual	1a				
7/23/2012	St. Albans/the islands	City Bay	Visual	1a				
7/23/2012	Main Lake - northern	Eagle Acres Rd, Chazy NY	Visual	1a				
7/23/2012	St. Albans/the islands	Kill Kare State Park	Visual	1a				
7/23/2012	Missisquoi Bay/Maquam	Maquam Bay, Swanton	Visual	1a				
7/23/2012	Main Lake - central	North Beach, Burlington VT	Visual	1a				
7/23/2012	St. Albans/the islands	Pelots Bay	Visual	1c				
7/23/2012	Main Lake - northern	Pt. Au Roche S.P. beach	Visual	1a				
7/23/2012	Main Lake - northern	Pt. Au Roche S.P. Deep Bay	visual	1a				
7/23/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1b				
7/23/2012	Main Lake - northern	Rouses Point, NY	Visual	1b				
7/23/2012	St. Albans/the islands	Sand Bar State Park	Visual	1a				
7/23/2012	Main Lake - central	Shelburne Beach	Visual	1a				
7/23/2012	Main Lake - southern	Tri-Town Water	visual	1a				
7/23/2012	Main Lake - southern	Westport Boat Launch	Visual	1b				
7/24/2012	Missisquoi Bay/Maquam	Alburgh VT - shoreline	Tiered Alert	quantitative	0		not tested	not tested
7/24/2012	Missisquoi Bay/Maquam	Rt. 78 Access - shoreline	Tiered Alert	quantitative	2	Anabaena	not tested	not tested
7/24/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Tiered Alert	Alert Level 1	19733	Anabaena, Aphanizomenon, Microcystis	0.39 ug/L	not detected

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/24/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	quantitative	29	Anabaena, Aphanizomenon	not tested	not tested
7/24/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	1a				
7/24/2012	Main Lake - southern	Button Bay Boat Launch	Visual	1c				
7/24/2012	Main Lake - northern	Chazy Boat Launch	Visual	1c				
7/24/2012	St. Albans/the islands	Grand Isle State Park	Visual	1a				
7/24/2012	Main Lake - central	Leddy Park, Burlington	Visual	1a				
7/24/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1b				
7/24/2012	South Lake	Marlena Bay	Visual	1a				
7/24/2012	Main Lake - northern	Oliver Bay 1, Plattsburgh	Visual	1c				
7/24/2012	Main Lake - northern	Oliver Bay 2, Plattsburgh	Visual	1a				
7/24/2012	St. Albans/the islands	St. Albans Bay Park	Visual	1a				
7/24/2012	Main Lake - northern	Treadswell Bay, Beekmantown NY	Visual	1c				
7/27/2012	Main Lake - central	LTM 16	Tiered Alert	quantitative	25	Anabaena, Aphanizomenon	not tested	not tested
7/27/2012	Main Lake - central	LTM 19	Tiered Alert	quantitative	26	Anabaena, Aphanizomenon	not tested	not tested
7/27/2012	Main Lake - central	LTM 21	Tiered Alert	quantitative	67	Anabaena, Aphanizomenon	not tested	not tested
7/29/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Tiered Alert	quantitative	0		Not detected	not tested
7/29/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Tiered Alert	alert level 2	4506667	Anabaena, Aphanizomenon	24.95	not detected
7/29/2012	South Lake	Allen Bay, Orwell	Visual	1a				
7/29/2012	South Lake	Beadles Cove, Shoreham	Visual	1b				
7/29/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	1a				
7/29/2012	St. Albans/the islands	Carry Bay - Savage Point	Visual	1a				
7/29/2012	Missisquoi Bay/Maquam	Chapman Bay, Alburgh	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/29/2012	Main Lake - southern	Kingsland Bay State Park	Visual	1a				
7/29/2012	Main Lake - central	LaPlatte R. at Shelburne Bay	Visual	1b				
7/29/2012	Main Lake - central	Leddy Park, Burlington	Visual	1c				
7/29/2012	St. Albans/the islands	Milton	Visual	1c				
7/29/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Visual	1a				
7/29/2012	St. Albans/the islands	Pelots Bay	Visual	2				
7/29/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Visual	3				
7/29/2012	St. Albans/the islands	St. Albans Bay Park	Visual	1a				
7/29/2012	Main Lake - central	Teddy Bear Point Cove, Willsboro, NY	Visual	1b				
7/29/2012	St. Albans/the islands	The Gut	Visual	1a				
7/30/2012	Main Lake - southern	LTM 07	Tiered Alert	quantitative	82	Anabaena, Aphanizomenon	not tested	not tested
7/30/2012	Main Lake - southern	LTM 09	Tiered Alert	quantitative	157	Anabaena, Aphanizomenon, Woronichinia/Coelosphaerium	not tested	not tested
7/30/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	1c				
7/30/2012	St. Albans/the islands	Burton Island	Visual	1a				
7/30/2012	St. Albans/the islands	City Bay	Visual	1a				
7/30/2012	Missisquoi Bay/Maquam	Donaldson Point	Visual	2				
7/30/2012	Main Lake - northern	Eagle Acres Rd, Chazy NY	Visual	1a				
7/30/2012	St. Albans/the islands	Folsom Harbor	Visual	1a				
7/30/2012	St. Albans/the islands	Knight Point State Park	Visual	1b				
7/30/2012	Missisquoi Bay/Maquam	Maquam Bay, Swanton	Visual	2				
7/30/2012	South Lake	Marlena Bay	Visual	1b				
7/30/2012	Main Lake - central	Niquette Bay State Park	Visual	1a				
7/30/2012	Main Lake - central	Oakledge Park Blanchard Beach	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/30/2012	Main Lake - northern	Plattsburgh City Beach	Visual	1c				
7/30/2012	Main Lake - northern	Pt. Au Roche S.P. beach	Visual	1a				
7/30/2012	Main Lake - northern	Pt. Au Roche S.P. Deep Bay	visual	1c				
7/30/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1b				
7/30/2012	Main Lake - northern	Rouses Point, NY	Visual	1b				
7/30/2012	Main Lake - northern	Treadswell Bay, Beekmantown NY	Visual	1c				
7/30/2012	Main Lake - southern	Westport Boat Launch	Visual	1b				
7/30/2012	Main Lake - northern	Wilcox Dock, Plattsburgh	Visual	1c				
7/30/2012	Main Lake - central	Willsboro Boat Launch	Visual	1c				
7/31/2012	Missisquoi Bay/Maquam	Alburgh VT	Tiered Alert	quantitative	55	Anabaena, Microcystis, Aphanizomenon	not tested	not tested
7/31/2012	Missisquoi Bay/Maquam	Highgate cliffs	Tiered Alert	Alert Level 1	5452	Anabaena, Microcystis, Aphanizomenon	0.79	not detected
7/31/2012	Missisquoi Bay/Maquam	Highgate Springs	Tiered Alert	Alert Level 1	54107	Anabaena, Microcystis, Aphanizomenon	1.83	not detected
7/31/2012	Main Lake - central	North Beach, Burlington VT	Tiered Alert	quantitative	0		Not detected	not tested
7/31/2012	Missisquoi Bay/Maquam	Rt 78 Access	Tiered Alert	quantitative	56	Anabaena, Microcystis, Aphanizomenon	not tested	not tested
7/31/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	quantitative	356	Anabaena, Microcystis, Aphanizomenon	not tested	not tested
7/31/2012	Main Lake - southern	Arnold Bay	Visual	1a				
7/31/2012	Main Lake - southern	Button Bay Boat Launch	Visual	1c				
7/31/2012	Main Lake - southern	Camp Dudley - Westport	Visual	1a				
7/31/2012	Main Lake - central	Charlotte Beach	Visual	1a				
7/31/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1a				
7/31/2012	Main Lake - central	North Beach, Burlington VT	Visual	1a				
7/31/2012	St. Albans/the islands	Sand Bar State Park	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
7/31/2012	Main Lake - central	Shelburne Beach	Visual	1a				
7/31/2012	Main Lake - southern	Tri-Town Water	visual	1c				
8/1/2012	Main Lake - northern	LTM 33	Tiered Alert	quantitative	15	Anabaena, Aphanizomenon	not tested	not tested
8/1/2012	Main Lake - northern	LTM 36	Tiered Alert	quantitative	102	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
8/1/2012	Main Lake - northern	Oliver Bay 2, Plattsburgh	Visual	1a				
8/3/2012	St. Albans/the islands	LTM 34	Tiered Alert	quantitative	75	Anabaena, Woronichinia/Coelosphaerium	not tested	not tested
8/3/2012	St. Albans/the islands	LTM 40	Tiered Alert	quantitative	1970	Anabaena, Aphanizomenon, Gloeotrichia	not tested	not tested
8/4/2012	Missisquoi Bay/Maquam	Donaldson Point	Visual	1c				
8/5/2012	South Lake	Beadles Cove, Shoreham	Visual	1b				
8/5/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	1a				
8/5/2012	St. Albans/the islands	Carry Bay - Savage Point	Visual	1a				
8/5/2012	Main Lake - central	Leddy Park, Burlington	Visual	1a				
8/5/2012	St. Albans/the islands	Milton	Visual	1c				
8/5/2012	Main Lake - central	Niquette Bay State Park	Visual	1a				
8/5/2012	Main Lake - central	Oakledge Park Blanchard Beach	Visual	1b				
8/5/2012	Main Lake - central	Oakledge Park Oakledge Cove	Visual	1b				
8/5/2012	St. Albans/the islands	Pelots Bay	Visual	1a				
8/5/2012	Main Lake - northern	Plattsburgh City Beach	Visual	1b				
8/5/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Visual	1c				
8/5/2012	Main Lake - central	Teddy Bear Point Cove, Willsboro, NY	Visual	1c				
8/5/2012	St. Albans/the islands	The Gut	Visual	1b				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
8/5/2012	Main Lake - northern	Wilcox Dock, Plattsburgh	Visual	1b				
8/6/2012	Main Lake - northern	LTM 46	Tiered Alert	quantitative	15	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
8/6/2012	Missisquoi Bay/Maquam	LTM 50	Tiered Alert	quantitative	275	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
8/6/2012	Missisquoi Bay/Maquam	LTM 51	Tiered Alert	quantitative	2120	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
8/6/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Tiered Alert	quantitative	347	Anabaena	Not detected	not tested
8/6/2012	Missisquoi Bay/Maquam	Shipyards, Highgate Springs	Tiered Alert	Alert Level 1	146800	Aphanizomenon, Anabaena, Microcystis	5.64	not detected
8/6/2012	Main Lake - southern	Arnold Bay	Visual	1a				
8/6/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	1a				
8/6/2012	St. Albans/the islands	Burton Island	Visual	1a				
8/6/2012	Main Lake - southern	Button Bay Boat Launch	Visual	1a				
8/6/2012	Missisquoi Bay/Maquam	Chapman Bay, Alburgh	Visual	1b				
8/6/2012	Main Lake - central	Charlotte Beach	Visual	1a				
8/6/2012	St. Albans/the islands	City Bay	Visual	1a				
8/6/2012	St. Albans/the islands	Grand Isle State Park	Visual	1a				
8/6/2012	Main Lake - central	LaPlatte R. at Shelburne Bay	Visual	1b				
8/6/2012	Missisquoi Bay/Maquam	Maquam Bay, Swanton	Visual	1a				
8/6/2012	Main Lake - northern	Pt. Au Roche S.P. beach	Visual	1a				
8/6/2012	Main Lake - northern	Pt. Au Roche S.P. Deep Bay	visual	1a				
8/6/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1a				
8/6/2012	Main Lake - northern	Rouses Point, NY	Visual	1a				
8/6/2012	St. Albans/the islands	St. Albans Bay Park	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
8/6/2012	Main Lake - northern	Treadswell Bay, Beekmantown NY	Visual	1c				
8/6/2012	Main Lake - southern	Westport Boat Launch	Visual	1b				
8/6/2012	Main Lake - central	Willsboro Boat Launch	Visual	1a				
8/6/2012	Main Lake - central	Willsboro Boat Launch	Visual	1a				
8/7/2012	Missisquoi Bay/Maquam	Alburgh VT	Tiered Alert	quantitative	733	Aphanizomenon, Anabaena, Microcystis	not tested	not tested
8/7/2012	Missisquoi Bay/Maquam	Highgate cliffs	Tiered Alert	Alert Level 1	10051	Aphanizomenon, Anabaena, Microcystis	0.51	not detected
8/7/2012	Missisquoi Bay/Maquam	Highgate Springs	Tiered Alert	Alert Level 1	7240	Aphanizomenon, Anabaena, Microcystis	0.84	not detected
8/7/2012	South Lake	LTM 02	Tiered Alert	quantitative	37	Anabaena, Aphanizomenon, Woronichinia/Coelosphaerium	not tested	not tested
8/7/2012	South Lake	LTM 04	Tiered Alert	quantitative	58	Anabaena, Aphanizomenon	not tested	not tested
8/7/2012	Missisquoi Bay/Maquam	Rt 78 Access	Tiered Alert	quantitative	64	Aphanizomenon, Anabaena, Microcystis	not tested	not tested
8/7/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	quantitative	933	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
8/7/2012	South Lake	Allen Bay, Orwell	Visual	1b				
8/7/2012	Main Lake - southern	Camp Dudley - Westport	Visual	1a				
8/7/2012	Main Lake - northern	Eagle Acres Rd, Chazy NY	Visual	1a				
8/7/2012	St. Albans/the islands	Kill Kare State Park	Visual	1b				
8/7/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1a				
8/7/2012	South Lake	Marlena Bay	Visual	1b				
8/7/2012	Main Lake - central	Niquette Bay State Park	Visual	2				
8/7/2012	Main Lake - central	North Beach, Burlington VT	Visual	1b				
8/7/2012	St. Albans/the islands	Sand Bar State Park	Visual	1c				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
8/7/2012	Main Lake - southern	Tri-Town Water	visual	1a				
8/9/2012	Main Lake - central	LTM 25	Tiered Alert	quantitative	66	possible Radiocystis, Anabaena, Aphanizomenon, Microcystis, Woronichinia/Coelosphaerium		
8/12/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Tiered Alert	quantitative	0		Not detected	not tested
8/12/2012	South Lake	Allen Bay, Orwell	Visual	1a				
8/12/2012	South Lake	Beadles Cove, Shoreham	Visual	1a				
8/12/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	1c				
8/12/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	1c				
8/12/2012	St. Albans/the islands	Carry Bay - Savage Point	Visual	1a				
8/12/2012	Missisquoi Bay/Maquam	Chapman Bay, Alburgh	Visual	1b				
8/12/2012	Main Lake - northern	Chazy Boat Launch	Visual	1c				
8/12/2012	Main Lake - central	LaPlatte R. at Shelburne Bay	Visual	1b				
8/12/2012	Main Lake - central	Leddy Park, Burlington	Visual	1a				
8/12/2012	St. Albans/the islands	Milton	Visual	1a				
8/12/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Visual	1c				
8/12/2012	St. Albans/the islands	Pelots Bay	Visual	1c				
8/12/2012	Missisquoi Bay/Maquam	Phillipsburg, QE	Visual	3				
8/12/2012	Main Lake - central	Teddy Bear Point Cove, Willsboro, NY	Visual	1b				
8/12/2012	St. Albans/the islands	The Gut	Visual	1a				
8/12/2012	Main Lake - central	Thompsons Point, Charlotte	Visual	1b				
8/12/2012	Main Lake - northern	Treadswell Bay, Beekmantown NY	Visual	1c				
8/12/2012	Main Lake - central	Willsboro Boat Launch	Visual	1c				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
8/13/2012	Main Lake - central	LTM 16	Tiered Alert	quantitative	117	Anabaena, Aphanizomenon, Aphanothece, Microcystis, Woronichinia/Coelosphaerium		
8/13/2012	Main Lake - central	LTM 19	Tiered Alert	quantitative	218	Anabaena, Aphanizomenon, Woronichinia/Coelosphaerium		
8/13/2012	Main Lake - central	LTM 21	Tiered Alert	quantitative	175	Anabaena, Aphanizomenon		
8/13/2012	Main Lake - southern	Arnold Bay	Visual	1a				
8/13/2012	Main Lake - southern	Button Bay Boat Launch	Visual	1a				
8/13/2012	Main Lake - central	Charlotte Beach	Visual	1a				
8/13/2012	St. Albans/the islands	City Bay	Visual	1a				
8/13/2012	Missisquoi Bay/Maquam	Donaldson Point	Visual	1c				
8/13/2012	Main Lake - northern	Eagle Acres Rd, Chazy NY	Visual	1a				
8/13/2012	Main Lake - southern	Kingsland Bay State Park	Visual	1a				
8/13/2012	Missisquoi Bay/Maquam	Maquam Bay, Swanton	Visual	1b				
8/13/2012	South Lake	Marlena Bay	Visual	1b				
8/13/2012	Main Lake - central	Oakledge Park Blanchard Beach	Visual	1a				
8/13/2012	Main Lake - central	Oakledge Park Oakledge Cove	Visual	1a				
8/13/2012	Main Lake - central	Oakledge Park rocky shoreline	Visual	1a				
8/13/2012	Main Lake - northern	Pt. Au Roche S.P. beach	Visual	1a				
8/13/2012	Main Lake - northern	Pt. Au Roche S.P. Deep Bay	visual	1a				
8/13/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1b				
8/13/2012	Main Lake - northern	Rouses Point, NY	Visual	1c				
8/13/2012	Main Lake - central	Shelburne Beach	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
8/13/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Visual	1c				
8/13/2012	Main Lake - southern	Westport Boat Launch	Visual	1b				
8/14/2012	Missisquoi Bay/Maquam	Alburgh VT	Tiered Alert	quantitative	351	Anabaena	not tested	not tested
8/14/2012	Missisquoi Bay/Maquam	Highgate cliffs	Tiered Alert	Alert Level 1	64224	Aphanizomenon, Anabaena, Microcystis	0.98	not detected
8/14/2012	Missisquoi Bay/Maquam	Highgate Springs	Tiered Alert	Alert Level 1	43421	Anabaena, Microcystis	0.77	not detected
8/14/2012	Main Lake - northern	LTM 33	Tiered Alert	quantitative	52	Anabaena		
8/14/2012	Main Lake - northern	LTM 36	Tiered Alert	quantitative	65	Anabaena, Aphanizomenon		
8/14/2012	Main Lake - central	North Beach, Burlington VT	Tiered Alert	quantitative	1590	Aphanizomenon	Not detected	not tested
8/14/2012	Missisquoi Bay/Maquam	Rt 78 Access	Tiered Alert	quantitative	44	Anabaena	not tested	not tested
8/14/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	Alert Level 1	4342	Anabaena, Microcystis	0.04	present (<0.001)
8/14/2012	Main Lake - southern	Camp Dudley - Westport	Visual	1a				
8/14/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1a				
8/14/2012	Main Lake - central	North Beach, Burlington VT	Visual	1a				
8/14/2012	St. Albans/the islands	St. Albans Bay Park	Visual	1a				
8/14/2012	Main Lake - southern	Tri-Town Water	visual	1c				
8/15/2012	St. Albans/the islands	Grand Isle State Park	Visual	1a				
8/15/2012	St. Albans/the islands	Kill Kare State Park	Visual	1a				
8/15/2012	Main Lake - southern	Kingsland Bay State Park	Visual	2				
8/16/2012	Main Lake - northern	Plattsburgh City Beach	Visual	1c				
8/16/2012	Main Lake - northern	Wilcox Dock, Plattsburgh	Visual	1b				
8/17/2012	St. Albans/the islands	LTM 34	Tiered Alert	quantitative	19	Anabaena, Microcystis	not tested	not tested
8/17/2012	St. Albans/the islands	LTM 40	Tiered Alert	quantitative	869	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
8/19/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Tiered Alert	quantitative	0	No cyanobacteria observed	Not detected	not tested

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
8/19/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Tiered Alert	Alert Level 1	610667		2.32	not detected
8/19/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	1a				
8/19/2012	Missisquoi Bay/Maquam	Chapman Bay, Alburgh	Visual	1a				
8/19/2012	Main Lake - northern	Chazy Boat Launch	Visual	1c				
8/19/2012	Missisquoi Bay/Maquam	Donaldson Point	Visual	1c				
8/19/2012	Main Lake - central	LaPlatte R. at Shelburne Bay	Visual	1b				
8/19/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Visual	1a				
8/19/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Visual	2				
8/19/2012	Main Lake - central	Teddy Bear Point Cove, Willsboro, NY	Visual	1a				
8/19/2012	St. Albans/the islands	The Gut	Visual	1a				
8/19/2012	Main Lake - central	Thompsons Point, Charlotte	Visual	1c				
8/20/2012	Main Lake - southern	LTM 07	Tiered Alert	quantitative	639	Anabaena, Aphanizomenon	not tested	not tested
8/20/2012	Main Lake - southern	LTM 09	Tiered Alert	quantitative	184	Anabaena, Aphanizomenon, Woronichinia/Coelosphaerium	not tested	not tested
8/20/2012	Main Lake - southern	Arnold Bay	Visual	1a				
8/20/2012	St. Albans/the islands	Burton Island	Visual	1a				
8/20/2012	Main Lake - southern	Button Bay Boat Launch	Visual	1a				
8/20/2012	St. Albans/the islands	Carry Bay - Savage Point	Visual	1a				
8/20/2012	Main Lake - central	Charlotte Beach	Visual	1a				
8/20/2012	St. Albans/the islands	City Bay	Visual	1a				
8/20/2012	St. Albans/the islands	Knight Point State Park	Visual	1b				
8/20/2012	Missisquoi Bay/Maquam	Maquam Bay, Swanton	Visual	1a				
8/20/2012	Main Lake - central	Niquette Bay State Park	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
8/20/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1b				
8/20/2012	Main Lake - central	Shelburne Beach	Visual	1a				
8/20/2012	Main Lake - southern	Westport Boat Launch	Visual	1a				
8/21/2012	Missisquoi Bay/Maquam	Alburgh VT	Tiered Alert	quantitative	437	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
8/21/2012	Missisquoi Bay/Maquam	Highgate cliffs	Tiered Alert	Alert Level 1	94058	Aphanizomenon, Anabaena, Microcystis	0.90	not detected
8/21/2012	Missisquoi Bay/Maquam	Highgate Springs	Tiered Alert	Alert Level 1	29164	Aphanizomenon, Anabaena, Microcystis	1.45	not detected
8/21/2012	Main Lake - northern	LTM 46	Tiered Alert	quantitative	2	Anabaena		
8/21/2012	Missisquoi Bay/Maquam	LTM 50	Tiered Alert	vigilance	3810	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
8/21/2012	Missisquoi Bay/Maquam	LTM 51	Tiered Alert	Alert Level 1	13900	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
8/21/2012	Main Lake - central	North Beach, Burlington VT	Tiered Alert	Alert Level 1	4620	Anabaena, Microcystis, Woronichinia/Coelosphaerium	Not detected	not tested
8/21/2012	Missisquoi Bay/Maquam	Rt 78 Access	Tiered Alert	quantitative	130	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
8/21/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	vigilance	1632	Anabaena, Aphanizomenon	not tested	not tested
8/21/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	1a				
8/21/2012	St. Albans/the islands	City Bay, Rt. 2	Visual	1a				
8/21/2012	Main Lake - northern	Eagle Acres Rd, Chazy NY	Visual	1a				
8/21/2012	St. Albans/the islands	Grand Isle State Park	Visual	1a				
8/21/2012	St. Albans/the islands	Kill Kare State Park	Visual	1a				
8/21/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	3				
8/21/2012	Main Lake - northern	Oliver Bay 1, Plattsburgh	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
8/21/2012	Main Lake - northern	Pt. Au Roche S.P. beach	Visual	1a				
8/21/2012	Main Lake - northern	Pt. Au Roche S.P. Deep Bay	visual	1a				
8/21/2012	Main Lake - northern	Rouses Point, NY	Visual	3		Lyngbya	not tested	not tested
8/21/2012	St. Albans/the islands	Sand Bar State Park	Visual	1a				
8/21/2012	St. Albans/the islands	West Shore Rd. North Hero	Visual	1a				
8/21/2012	Main Lake - central	Willsboro Boat Launch	Visual	1a				
8/22/2012	Main Lake - central	North Beach, Burlington VT	Visual	1a				
8/22/2012	Main Lake - northern	Treadswell Bay, Beekmantown NY	Visual	1a				
8/22/2012	Main Lake - southern	Tri-Town Water	visual	1a				
8/23/2012	Main Lake - southern	Camp Dudley - Westport	Visual	1c				
8/23/2012	Main Lake - southern	Kingsland Bay State Park	Visual	1a				
8/23/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1a				
8/23/2012	South Lake	Marlena Bay	Visual	1b				
8/23/2012	Main Lake - central	Oakledge Park Blanchard Beach	Visual	1a				
8/23/2012	Main Lake - central	Oakledge Park Oakledge Cove	Visual	1a				
8/23/2012	Main Lake - central	Oakledge Park rocky shoreline	Visual	1a				
8/23/2012	St. Albans/the islands	Pelots Bay	Visual	1c				
8/23/2012	St. Albans/the islands	St. Albans Bay Park	Visual	1a				
8/24/2012	Main Lake - central	Leddy Park, Burlington	Visual	1c				
8/24/2012	Main Lake - northern	Plattsburgh City Beach	Visual	1c				
8/24/2012	Main Lake - northern	Wilcox Dock, Plattsburgh	Visual	1b				
8/25/2012	St. Albans/the islands	Alburgh Dunes State Park	Visual	2				
8/26/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Tiered Alert	quantitative	0		Not detected	not tested

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
8/26/2012	South Lake	Allen Bay, Orwell	Visual	1a				
8/26/2012	South Lake	Beadles Cove, Shoreham	Visual	1b				
8/26/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	1a				
8/26/2012	St. Albans/the islands	Carry Bay - Savage Point	Visual	1a				
8/26/2012	Missisquoi Bay/Maquam	Chapman Bay, Alburgh	Visual	1b				
8/26/2012	Missisquoi Bay/Maquam	Donaldson Point	Visual	3			not tested	not tested
8/26/2012	Main Lake - central	LaPlatte R. at Shelburne Bay	Visual	1a				
8/26/2012	Main Lake - central	Leddy Park, Burlington	Visual	1b				
8/26/2012	St. Albans/the islands	Milton	Visual	1a				
8/26/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Visual	1a				
8/26/2012	St. Albans/the islands	Pelots Bay	Visual	1c				
8/26/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Visual	1c				
8/26/2012	St. Albans/the islands	St. Albans Bay Park	Visual	3			not tested	not tested
8/26/2012	Main Lake - central	Teddy Bear Point Cove, Willsboro, NY	Visual	1a				
8/27/2012	South Lake	LTM 02	Tiered Alert	quantitative	18	Anabaena, Aphanizomenon, Oscillatoria	not tested	not tested
8/27/2012	South Lake	LTM 04	Tiered Alert	quantitative	228	Anabaena, Aphanizomenon	not tested	not tested
8/27/2012	Main Lake - southern	Arnold Bay	Visual	1a				
8/27/2012	Main Lake - northern	Beekmantown	Visual	1a				
8/27/2012	Main Lake - southern	Button Bay Boat Launch	Visual	1a				
8/27/2012	Main Lake - central	Charlotte Beach	Visual	1a				
8/27/2012	St. Albans/the islands	City Bay	Visual	1a				
8/27/2012	Main Lake - northern	Eagle Acres Rd, Chazy NY	Visual	1a				
8/27/2012	St. Albans/the islands	Folsom Harbor	Visual	1a				
8/27/2012	St. Albans/the islands	Grand Isle State Park	Visual	1b				
8/27/2012	South Lake	Marlena Bay	Visual	1b				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
8/27/2012	Main Lake - central	Niquette Bay State Park	Visual	1a				
8/27/2012	Main Lake - central	Oakledge Park Blanchard Beach	Visual	1a				
8/27/2012	Main Lake - central	Oakledge Park Oakledge Cove	Visual	1a				
8/27/2012	Main Lake - central	Oakledge Park rocky shoreline	Visual	1a				
8/27/2012	Main Lake - northern	Pt. Au Roche S.P. beach	Visual	1a				
8/27/2012	Main Lake - northern	Pt. Au Roche S.P. Deep Bay	visual	1c				
8/27/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1a				
8/27/2012	Main Lake - northern	Rouses Point, NY	Visual	3			not tested	not tested
8/27/2012	St. Albans/the islands	The Gut	Visual	1a				
8/27/2012	Main Lake - northern	Treadswell Bay, Beekmantown NY	Visual	1a				
8/28/2012	Missisquoi Bay/Maquam	Alburgh VT	Tiered Alert	quantitative	348	Anabaena, Microcystis, Aphanizomenon	not tested	not tested
8/28/2012	Missisquoi Bay/Maquam	Highgate cliffs	Tiered Alert	Alert Level 1	7454	Aphanizomenon, Anabaena, Microcystis	5.0	not detected
8/28/2012	Missisquoi Bay/Maquam	Highgate Springs	Tiered Alert	Alert Level 1	9988	Aphanizomenon, Anabaena, Microcystis	1.98	not detected
8/28/2012	Main Lake - central	LTM 25	Tiered Alert	quantitative	57	Anabaena, Aphanothece, Microcystis, Radiocystis, Woronichinia/Coelosphaerium	not tested	not tested
8/28/2012	Main Lake - central	North Beach, Burlington VT	Tiered Alert	quantitative	27	Anabaena	Not detected	not tested
8/28/2012	Missisquoi Bay/Maquam	Rt 78 Access	Tiered Alert	quantitative	1148	Aphanizomenon, Anabaena, Microcystis	not tested	not tested
8/28/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	quantitative	235	Aphanizomenon, Anabaena, Microcystis	not tested	not tested
8/28/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	1a				
8/28/2012	St. Albans/the islands	Kill Kare State Park	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
8/28/2012	St. Albans/the islands	Knight Point State Park	Visual	1b				
8/28/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1				
8/28/2012	Main Lake - central	North Beach, Burlington VT	Visual	1c				
8/28/2012	St. Albans/the islands	Sand Bar State Park	Visual	1a				
8/28/2012	Main Lake - central	Shelburne Beach	Visual	1a				
8/28/2012	Main Lake - central	Thompsons Point, Charlotte	Visual	1a				
8/28/2012	Main Lake - southern	Tri-Town Water	visual	1c				
8/28/2012	Main Lake - southern	Westport Boat Launch	Visual	1a				
8/28/2012	Main Lake - central	Willsboro Boat Launch	Visual	1a				
8/29/2012	Main Lake - southern	Camp Dudley - Westport	Visual	1a				
8/29/2012	Main Lake - southern	DAR State Park	Visual	1c				
8/29/2012	Main Lake - southern	Kingsland Bay State Park	Visual	1a				
8/29/2012	Missisquoi Bay/Maquam	Maquam Bay, Swanton	Visual	1a				
8/29/2012	Main Lake - northern	Oliver Bay 2, Plattsburgh	Visual	1a				
8/29/2012	Main Lake - northern	Plattsburgh City Beach	Visual	1c				
8/29/2012	Main Lake - northern	Wilcox Dock, Plattsburgh	Visual	1a				
8/30/2012	Main Lake - central	LTM 16	Tiered Alert	quantitative	110	Anabaena, Aphanizomenon, Aphanothece, Woronichinia/Coelosphaerium	not tested	not tested
8/30/2012	Main Lake - central	LTM 21	Tiered Alert	quantitative	194	Anabaena, Aphanizomenon, Microcystis		
8/30/2012	St. Albans/the islands	west shore, Inner St. Albans Bay	Visual	2				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
9/2/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Tiered Alert	alert level 2	1354667	Anabaena, Microcystis	54.7	lost due to lab analytical error
9/2/2012	South Lake	Allen Bay, Orwell	Visual	1a				
9/2/2012	South Lake	Beadles Cove, Shoreham	Visual	1b				
9/2/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	1a				
9/2/2012	St. Albans/the islands	Carry Bay - Savage Point	Visual	1a				
9/2/2012	Missisquoi Bay/Maquam	Chapman Bay, Alburgh	Visual	1a				
9/2/2012	Main Lake - central	Charlotte Beach	Visual	1a				
9/2/2012	St. Albans/the islands	City Bay	Visual	1a				
9/2/2012	Main Lake - southern	Kingsland Bay State Park	Visual	1a				
9/2/2012	Main Lake - central	Leddy Park, Burlington	Visual	1a				
9/2/2012	St. Albans/the islands	Milton	Visual	1a				
9/2/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Visual	3				
9/2/2012	St. Albans/the islands	St. Albans Bay Park	Visual	1c				
9/2/2012	Main Lake - central	Teddy Bear Point Cove, Willsboro, NY	Visual	1a				
9/2/2012	St. Albans/the islands	The Gut	Visual	1a				
9/2/2012	Main Lake - central	Thompsons Point, Charlotte	Visual	1a				
9/2/2012	Main Lake - northern	Treadswell Bay, Beekmantown NY	Visual	1a				
9/3/2012	St. Albans/the islands	Alburgh Dunes State Park	Visual	1a				
9/3/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	1a				
9/3/2012	Main Lake - northern	Chazy Boat Launch	Visual	1c				
9/3/2012	St. Albans/the islands	Folsom Harbor	Visual	1a				
9/3/2012	St. Albans/the islands	Kill Kare State Park	Visual	2				
9/3/2012	Main Lake - central	Niquette Bay State Park	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
9/3/2012	St. Albans/the islands	Pelots Bay	Visual	1c				
9/3/2012	Main Lake - northern	Pt. Au Roche S.P. beach	Visual	1a				
9/3/2012	Main Lake - northern	Pt. Au Roche S.P. Deep Bay	visual	1a				
9/3/2012	Main Lake - southern	Westport Boat Launch	Visual	1b				
9/3/2012	Main Lake - central	Willsboro Boat Launch	Visual	1b				
9/4/2012	Missisquoi Bay/Maquam	Alburgh VT - shoreline	Tiered Alert	quantitative	987	Aphanizomenon, Anabaena, Microcystis	not tested	not tested
9/4/2012	Main Lake - central	North Beach, Burlington VT	Tiered Alert	quantitative	0		Not detected	not tested
9/4/2012	Missisquoi Bay/Maquam	Rt. 78 Access - shoreline	Tiered Alert	quantitative	878	Microcystis	not tested	not tested
9/4/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Tiered Alert	Alert Level 1	18640	Microcystis, Anabaena	3.0	not detected
9/4/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	Alert Level 1	12418	Anabaena, Aphanizomenon, Microcystis	0.03	not detected
9/4/2012	Main Lake - northern	Beekmantown	Visual	1a				
9/4/2012	Main Lake - southern	Camp Dudley - Westport	Visual	1a				
9/4/2012	Missisquoi Bay/Maquam	Donaldson Point	Visual	1c				
9/4/2012	St. Albans/the islands	Grand Isle State Park	Visual	1a				
9/4/2012	Main Lake - central	North Beach, Burlington VT	Visual	1b				
9/4/2012	Main Lake - central	Oakledge Park Blanchard Beach	Visual	1a				
9/4/2012	Main Lake - central	Oakledge Park Oakledge Cove	Visual	1a				
9/4/2012	Main Lake - central	Oakledge Park rocky shoreline	Visual	1a				
9/4/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1c				
9/5/2012	Main Lake - central	LaPlatte R. at Shelburne Bay	Visual	1a				
9/5/2012	Main Lake - southern	Long Pt, (Wood) Ferrisburgh	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
9/5/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1a				
9/5/2012	South Lake	Marlena Bay	Visual	1b				
9/5/2012	Main Lake - northern	Oliver Bay 2, Plattsburgh	Visual	1a				
9/5/2012	Main Lake - northern	Rouses Point, NY	Visual	3				
9/5/2012	Main Lake - central	Shelburne Beach	Visual	1c				
9/5/2012	Main Lake - southern	Tri-Town Water	visual	1a				
9/6/2012	St. Albans/the islands	LTM 34	Tiered Alert	quantitative	29	Anabaena, Aphanizomenon, Microcystis, Pseudanabaena	not tested	not tested
9/6/2012	St. Albans/the islands	LTM 40	Tiered Alert	quantitative	1700	Anabaena, Aphanizomenon, Microcystis, Pseudanabaena	not tested	not tested
9/6/2012	St. Albans/the islands	Burton Island	Visual	1a				
9/6/2012	St. Albans/the islands	St. Albans Boat Launch	Visual	3				
9/7/2012	Main Lake - northern	LTM 33	Tiered Alert	quantitative	121	Anabaena, Aphanizomenon, Microcystis, Woronichinia/Coelosphaerium	not tested	not tested
9/7/2012	Main Lake - northern	LTM 36	Tiered Alert	quantitative	359	Anabaena, Aphanizomenon, Microcystis, Woronichinia/Coelosphaerium	not tested	not tested
9/9/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	1a				
9/9/2012	Missisquoi Bay/Maquam	Donaldson Point	Visual	1c				
9/9/2012	Main Lake - central	Shelburne Beach	Visual	1a				
9/9/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Visual	1b				
9/10/2012	Main Lake - central	Leddy Park, Burlington	Visual	1a				
9/10/2012	Main Lake - central	North Beach, Burlington VT	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
9/10/2012	Missisquoi Bay/Maquam	North Hero State Park VT	Visual	1b				
9/10/2012	Main Lake - central	Oakledge Park Blanchard Beach	Visual	1b				
9/10/2012	Main Lake - central	Oakledge Park Oakledge Cove	Visual	1b				
9/10/2012	Main Lake - central	Oakledge Park rocky shoreline	Visual	1b				
9/10/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1a				
9/10/2012	Main Lake - northern	Rouses Point, NY	Visual	2				
9/11/2012	Missisquoi Bay/Maquam	Alburgh VT	Tiered Alert	quantitative	402	Anabaena, Microcystis	not tested	not tested
9/11/2012	Missisquoi Bay/Maquam	Highgate cliffs	Tiered Alert	alert level 2	4328	Anabaena, Microcystis, Aphanizomenon	7.16	not detected
9/11/2012	Missisquoi Bay/Maquam	Highgate Springs	Tiered Alert	quantitative	1084	Anabaena, Microcystis	not tested	not tested
9/11/2012	Main Lake - central	LTM 25	Tiered Alert	quantitative	104	Anabaena, Aphanotheca, Microcystis, Woronichinia/Coelosphaerium	not tested	not tested
9/11/2012	Missisquoi Bay/Maquam	Rt 78 Access	Tiered Alert	vigilance	3283	Anabaena, Aphanizomenon, Microcystis	not tested	not tested
9/11/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	vigilance	3535	Aphanizomenon, Anabaena, Microcystis	not tested	not tested
9/11/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	1a				
9/11/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1a				
9/11/2012	Main Lake - central	Willsboro Boat Launch	Visual	2				
9/12/2012	Main Lake - southern	Long Pt, (Wood) Ferrisburgh	Visual	1a				
9/14/2012	Main Lake - northern	LTM 46	Tiered Alert	quantitative	53	Microcystis	not tested	not tested
9/14/2012	Missisquoi Bay/Maquam	LTM 50	Tiered Alert	quantitative	559	Anabaena, Microcystis, Pseudanabaena	not tested	not tested
9/14/2012	Missisquoi Bay/Maquam	LTM 51	Tiered Alert	quantitative	1750	Anabaena, Microcystis, Pseudanabaena	not tested	not tested
9/16/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	1a				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
9/16/2012	Main Lake - central	LaPlatte R. at Shelburne Bay	Visual	1a				
9/16/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Visual	1c				
9/17/2012	South Lake	LTM 02	Tiered Alert	quantitative	3	Aphanizomenon	not tested	not tested
9/17/2012	South Lake	LTM 04	Tiered Alert	quantitative	428	Anabaena, Aphanizomenon	not tested	not tested
9/17/2012	Main Lake - central	Buena Vista Park, Willsboro	Visual	1a				
9/17/2012	Main Lake - central	Leddy Park, Burlington	Visual	1a				
9/17/2012	Main Lake - central	North Beach, Burlington VT	Visual	1a				
9/17/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1b				
9/17/2012	Main Lake - northern	Rouses Point, NY	Visual	2				
9/17/2012	Main Lake - central	Shelburne Beach	Visual	1a				
9/17/2012	Main Lake - central	Willsboro Boat Launch	Visual	1a				
9/18/2012	Missisquoi Bay/Maquam	Alburgh VT - shoreline	Tiered Alert	quantitative	101	Aphanizomenon, Microcystis	not tested	not tested
9/18/2012	Missisquoi Bay/Maquam	Rt. 78 Access - shoreline	Tiered Alert	quantitative	1009	Anabaena, Microcystis	not tested	not tested
9/18/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Tiered Alert	Alert Level 1	5702	Anabaena, Microcystis	0.4	not detected
9/19/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1a				
9/23/2012	Main Lake - central	Beggs Park Beach, Essex	Visual	1a				
9/23/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Visual	1b				
9/24/2012	Main Lake - central	Leddy Park, Burlington	Visual	1a				
9/24/2012	Main Lake - southern	Long Pt, Ferrisburgh	Visual	1a				
9/24/2012	Main Lake - central	North Beach, Burlington VT	Visual	1a				
9/24/2012	Main Lake - central	Red Rocks, South Burlington	Visual	1a				
9/24/2012	Main Lake - northern	Rouses Point, NY	Visual	2				

SampleDate	Region	Station	Assessment method	Status	Potentially Toxic Cyanobacteria (cells/mL)	Potentially Toxic Cyanobacteria Present	Microcystin (ug/L), if tested	Anatoxin (ug/L), if tested
9/25/2012	Missisquoi Bay/Maquam	Alburgh VT - shoreline	Tiered Alert	quantitative	88	Anabaena	not tested	not tested
9/25/2012	Missisquoi Bay/Maquam	Rt. 78 Access - shoreline	Tiered Alert	quantitative	99	Anabaena, Microcystis, Aphanizomenon	not tested	not tested
9/25/2012	Missisquoi Bay/Maquam	Shipyard, Highgate Springs	Tiered Alert	quantitative	264	Anabaena, Microcystis	not tested	not tested
9/25/2012	St. Albans/the islands	St. Albans Boat Launch	Tiered Alert	quantitative	269	Anabaena, Microcystis, Aphanizomenon	not tested	not tested

Appendix D. New cyanobacteria documented in 2012

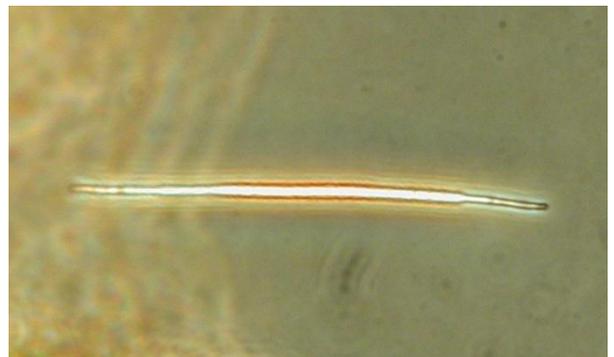
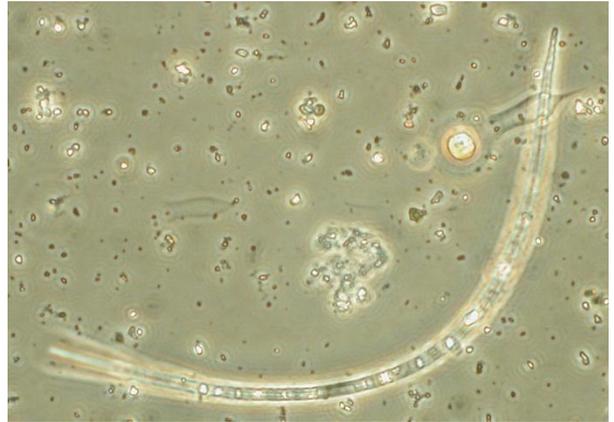
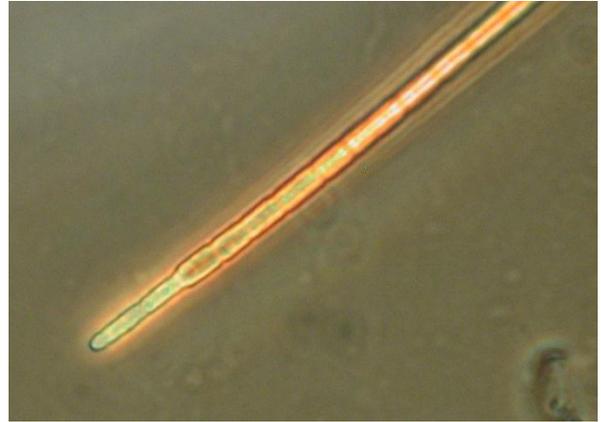
D.1. – *Aphanizomenon* spp., likely *A. gracile*

This taxon was observed in sampled collected during August and September from the following stations

- South Lake – LTM 02
- Southern Main Lake – LTM 07
- Central Main Lake – LTM 25, North Beach
- Northern Main Lake – LTM 33
- St. Albans/the Islands – LTM 34 and LTM 40

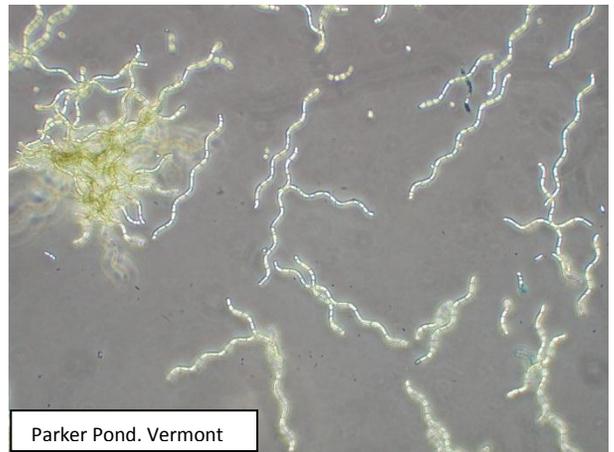
Aphanizomenon is noted as a producer of the following toxins

- Anatoxin
 - Chorus and Bartram, 1999
- Saxitoxin
 - Chorus and Bartram, 1999
- Paralytic Shellfish poison (PSP)
 - Ballot et al., 2010



D.2 – *Arthrospira* spp.

This taxon was observed in September at LTM 40 in St. Albans. This organism is not considered a likely toxin producer.

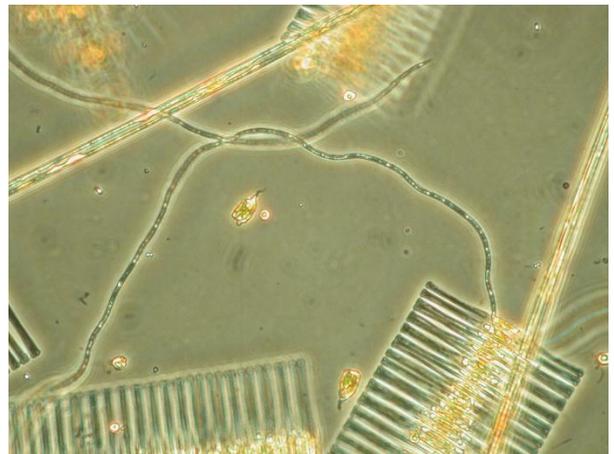


D.3 – *Limnothrix* spp.

This taxon was observed in July, August and September at the following stations

- Southern Main Lake – LTM 07, LTM 09
- Central Main Lake – LTM 16, LTM 19, LTM 21, North Beach
- Northern Main Lake – LTM 33, LTM 36
- St. Albans/the Islands – LTM 34, LTM 40

Though this taxon has been linked to toxin production, the reports come from Africa and Australia.



D.4. *Pseudanabaena* spp.

This taxon was observed in August and September at the following stations

- St. Albans/the Islands – LTM34, LTM 40
- Missisquoi/Maquam – LTM 50, LTM 51, Highgate Cliffs

Images for this taxon are not available currently from Lake Champlain but the genus can be viewed at http://www.algaebase.org/search/images/detail/?img_id=20994&sk=0

This taxon is considered a producer of

- Anatoxin
 - Graham et al., 2008
- Microcystin
 - Graham et al., 2008

D.5. *Radiocystis* spp.

This taxon was observed in August at LTM 25 in the central main lake. Images for this taxon are currently unavailable for Lake Champlain. Images can be viewed at these on-line sites -

<http://www.biolib.cz/en/taxonimage/id12375/?taxonid=128434&type=1>

http://www.greenwaterlab.com/photo_algal_5.htm

This taxon is linked with toxin production in Brazil (Vieira et al., 2005)

D.6. – *Scytonema* spp.

This taxon was observed along the shoreline of Rouses Point, NY, in the vicinity of the Gaines Marina. Initially identified as *Lyngbya* spp., samples were sent for confirmation to Dr. Barry Rosen, (USGS, Florida). Dr. Rosen identified the genus as *Lyngbya*, likely *L. cincinnatum*. This accepted name for this taxon is *Scytonema crispum*.

Marine species of *Lyngbya* are known to be toxic and a potent skin irritant, lyngbyatoxin, has been isolated from this genus. Some freshwater representatives in New Zealand, including *Scytonema crispum*, have been found to produce saxitoxins (Smith et al., 2012) and Florida considers freshwater blooms to be potentially toxic (Burns 2008). Studies in freshwater lakes and rivers of the southwestern USA have documented toxins in association with mats of these organisms (Carmichael et al., 1997).

