

# When a nuisance becomes a possible health hazard

Vermont's experience developing cyanobacteria monitoring and communication strategies

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# the 'Good Ole Days'



Problem: algae blooms

Cause: too much P

Solution: Reduce nutrients

Response:

- point source reduction
- some algae control
- non-point reduction

Champlain TMDL effective

2002

# A wake-up call for Lake Champlain



1999 - Two dogs die after drinking or eating algae from Lake Champlain

2000 – microcystin is commonly found in net plankton samples

# Development of the Champlain Monitoring Protocol *(Watzin et. al, UVM)*

- Primary focus is recreation
- Must be rapid
- Recognition that population build up provides early warning signal
  - useful for water facilities
- Based on the Chorus and Bartram (1999) drinking water protocol



3m tow w/63 $\mu$ m net or  
surface grab  
Rapid count protocol

# Rapid count protocol

(Watzin *et. al*, 2009)

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

# The Champlain Protocol (2002 – 2010)

Qualitative samples (2x/month)

if potential toxin producers occur, begin Quantitative



Quantitative samples (2x/month)

If >2000 cells/mL, begin Vigilance



Vigilance samples (weekly)

if >4000 cells/mL, go to Alert 1



Alert 1 (weekly, toxin analysis)

if microcystin >6µg/L, go to Alert 2  
analyze for anatoxin when potential producers present  
Advisories and warnings posted if warranted



# Responding to a Bloom

2 countries

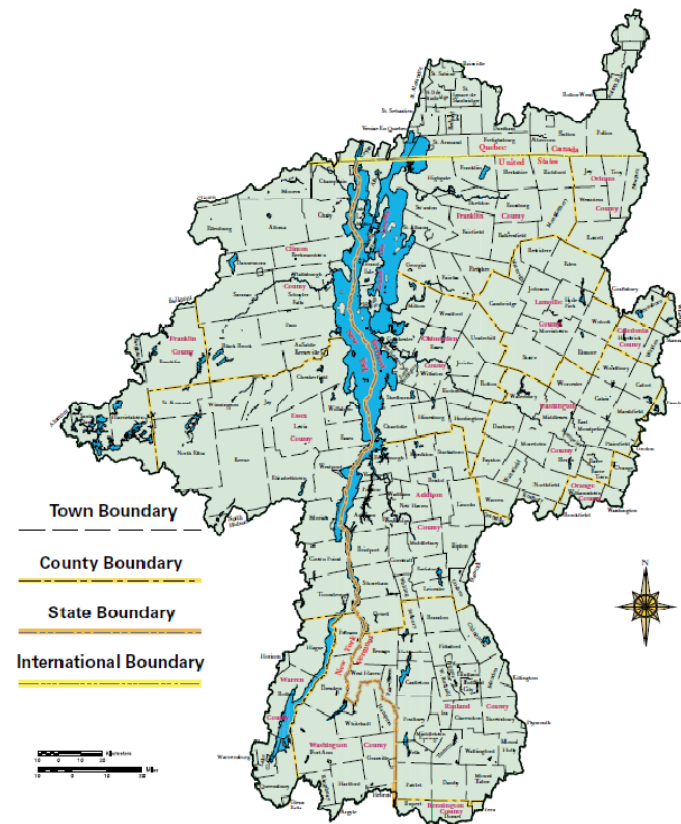
2 states, 1 province

Many towns

- An email group keeps decision-makers informed of lake conditions and data
- The DOH web page is updated weekly for the public

THE LAKE CHAMPLAIN BASIN ATLAS

## Political Boundaries



Map by Northern Cartographic

# Champlain is a Collaborative Effort

- **University of Vermont** – sample collection, algal counts, microcystin analysis
- **VT DEC** – sample collection, bloom spotting, algal ID, source water
- **Lake Champlain Committee** – recruitment and coordination of volunteer monitors, sample pick-up and delivery
- **VT DOH** – microcystin and anatoxin analysis, health advisories and guidance to lake-users and beach managers, webpage updates.



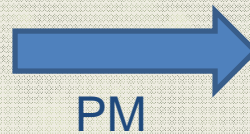
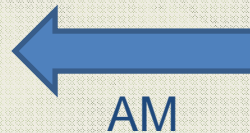
# Lessons from Monitoring

## Sampling location should reflect data needs

- Off shore: provides general info
- Near shore: good recreational indicator

## Algal conditions can change rapidly

- Data can be outdated before it's even reported



# Lessons from Monitoring

Cell density is a good recreational indicator

- Low cell densities rarely have toxins above the recreational guidelines.



We used Champlain data to develop statewide public health guidelines and educational products for cyanobacteria.

# Health Concerns



Ingestion



Dermal



Inhalation

# Recommended Beach Protocol

Close and post a public beach if **any** of the following conditions are met:

- Visible cyanobacteria bloom/scum or potential cyanobacteria bloom/scum
- Microcystin-LR (equivalents)  $\geq 6\mu\text{g/L}$
- Anatoxin-a  $\geq 10\mu\text{g/L}$

Re-open only when **all three** conditions are met:

- No visible cyanobacteria bloom/scum
- Microcystin  $\leq 6\mu\text{g/L}$
- Anatoxin  $\leq 10\mu\text{g/L}$

The Health Department evaluates exceptions to re-opening guidance based on field data.

**ATTENTION**  
**SWIMMING AREA CLOSED**

as of \_\_\_\_\_

The \_\_\_\_\_ local health officer has determined that swimming in this area presents a public health risk because of water contaminated by \_\_\_\_\_  
It will be retested on \_\_\_\_\_

For more information contact \_\_\_\_\_  
Phone: \_\_\_\_\_  
Signed: \_\_\_\_\_  
Local Town Health Officer

**HEALTH ALERT**

**Keep children and pets away from ALGAE**

Water may be green, blue, brown, red or appear cloudy. A thick foam or mat may be on the shoreline. Some algae may cause illness.

To report algae or for more information call  
**1-800-439-8550**  
or visit [healthvermont.gov](http://healthvermont.gov)

# Drinking Water Guidance

VT DEC Water Supply, the DOH and the Lake Champlain Coalition of Water Suppliers worked to develop “Practice” :

VERMONT ENVIRONMENTAL CONSERVATION		PRACTICE
Water Supply Division		
<b>Title:</b>	<b>PROCESS FOR MANAGING ANATOXIN and MICROCYSTIN DETECTIONS IN FINISHED WATER SAMPLES FOR PUBLIC WATER SYSTEMS</b>	
<b>Serial Number:</b>	2007-02	
<b>Original Issue Date:</b>	June 15, 2007	
<b>WSR Reference:</b>	Subchapter 21-6	
<b>Expires on:</b>	January 1, 2015	
<b>Supersedes:</b>	July 3, 2007 Version	
<b>Purpose:</b>	To establish a process between the Department of Environmental Conservation (DEC), Department of Health (DOH), University of Vermont (UVM), and the Lake Champlain Coalition of Municipal Water Suppliers for managing detections of microcystin and anatoxin-a in raw and finished water samples from public water systems. These compounds are not regulated by USEPA and the Water Supply Rule, but detections in finished water would pose sufficient public health risk to warrant special planning and preparedness. This Practice is a direct outcome of ongoing work by the Lake Champlain Coalition of Municipal Water Suppliers to ensure appropriate management and protection of public drinking water sources on Lake Champlain. This process is also appropriate for other public water systems that use surface water sources which have blue-green algae blooms.	
<b>Keyword(s):</b>	Blue-green algae, algal toxins, microcystin, anatoxin, source water monitoring, unregulated contaminants, public notice requirements	
<b>I. General Policies and Procedures</b>		
<b>Encouragement of Voluntary Monitoring.</b> Lake Champlain public water systems participate in visual and analytical source water monitoring for blue-green algae blooms and toxins throughout the summer and fall. Sampling of source water is conducted under the umbrella of a Lake-wide blue-green algae monitoring program performed by UVM in cooperation with the DEC Water Quality Division, DOH, and the Lake Champlain Committee. Public water systems evaluate Lake-wide data published in UVM email alerts. Source water samples are collected and analyzed when algae bloom conditions warrant sampling at a particular drinking water intake. Water systems provide finished water samples for analysis to complement raw water analyses. It is the policy of the Water Supply Division (WSD) to encourage such monitoring and to assist water systems to take appropriate public notification and operational actions should toxins be detected in finished water at concentrations at or above health advisories established by the State Toxicologist.		
<b>Toxins Addressed by this Practice.</b> Throughout this Practice, "anatoxin" refers to Anatoxin-a (CAS: 64285-06-9) and "microcystin" refers to Microcystin-LR (CAS: 101043-37-2) and is reported as microcystin-LR equivalents.		
<b>Testing Methods.</b> This Practice assumes that public water systems participating in blue-green algae toxin sampling will use test kits available from the Vermont Department of Health (DOH) to test for microcystin using the ELISA assay method. Anatoxin will be tested using LC/MS/MS methods.		
<b>Confirmation Sample.</b> If two initial samples were submitted and analyzed in duplicate, this duplicate will be considered the confirmation sample. Of the two initial samples, if one exceeds or equals 0.5 ug/L (method detection limit), and duplicate does not, then a third sample must be taken as soon as possible.		
<b>Data Reporting.</b> Participating public water systems will report all raw and finished water monitoring results for microcystin and anatoxin to the WSD Blue-Green Algae Coordinator, Heather Young at 241-3717 (See Blue Green Algae Contact Information Sheet). The WSD Blue-Green Algae Coordinator will review the results upon receipt.		
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13 municipal water suppliers:  
approximately  
150,000 people

[http://www.vermontdrinkingwater.org/forms/AlgalToxinDetections\\_2009.pdf](http://www.vermontdrinkingwater.org/forms/AlgalToxinDetections_2009.pdf)

# Drinking Water Guidance

Initiates sampling based on lake conditions around intakes.

Detections of toxins in *finished* water trigger further actions:

- increased testing
- notification Consumer Confidence Report
- DO NOT DRINK /DO NOT USE



Guidance allows for the Toxicologist to make risk assessment on data and environmental conditions.

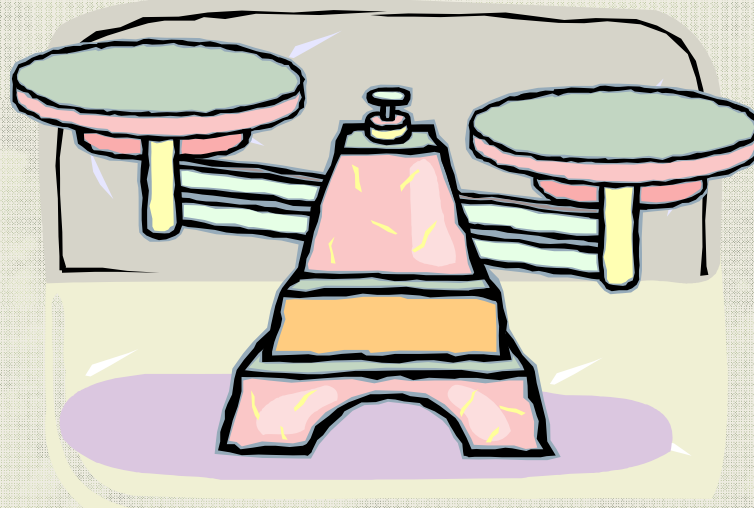
# Balance

Business

Recreation

Tourism

Public health:  
acute, chronic



October 20, 2010 11:22 AM Eastern Daylight Time

**Ohio Businesses Affected by Toxic Algae Bloom Can Apply for SBA Disaster Loans**

# Emphasis on Education and Outreach

Goal: Recognize cyanobacteria and assess risk

Individuals thru the webpage

Town Health officers through webcasts



**VERMONT Department of Health**  
Agency of Human Services

### Status of Blue Green Algae on Lake Champlain

- Weekly Status
- Lake Status Map
- Alert Level Descriptions
- Blue-Green Algae homepage
- Tips for Lake Users

#### Weekly Status

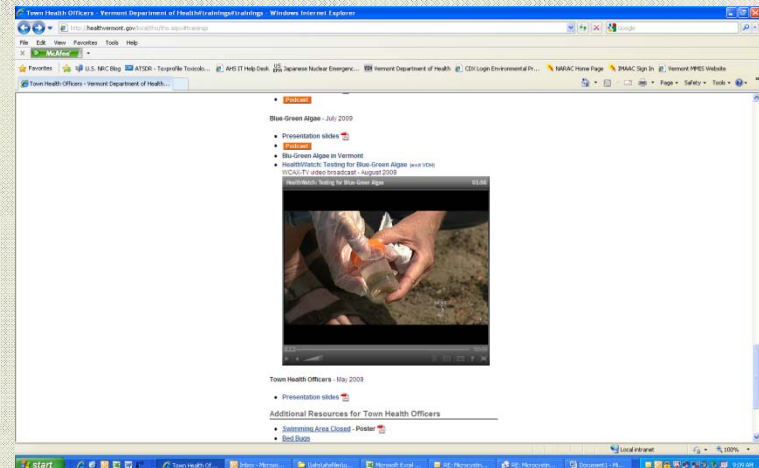
October 8, 2010

All areas of Lake Champlain are generally safe, including the South Lake, Main Lake, Inland Sea, Malletts Bay, St. Albans Bay, and Missisquoi Bay.

As the growing season winds down, any remaining areas algae accumulation will be moving around with changing winds and weather. Those recreating on the lake should watch for any remaining accumulations of algae and avoid these locations.

[Lake Champlain Status Map](#)

Updates courtesy of Rubenstein School of Environment and Natural Resources, University of Vermont



Town Health Officers - Vermont Department of Health | Lake Champlain

Blue Green Algae - July 2009

- Presentation slides
- Blue Green Algae in Vermont
- HealthWatch: Testing for Blue Green Algae (June 2008)
- NOAA TV video broadcast - August 2009

Presentations being for interested parties

Town Health Officers - May 2009

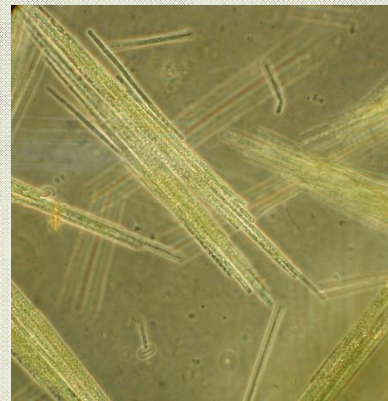
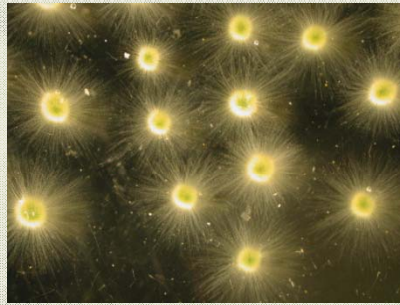
- Presentation slides

Additional Resources for Town Health Officers

- Swimming Areas Closed - Poster
- Red Buoys



# Taking the Experience Statewide



Vermont has ~800 named lakes

3 have TMDL Plans for P Reduction

14 inland lakes reported blooms in 2010

# Champlain Program Not Easily Transferred to Inland Lakes

Resource intensive

Taxonomic skills required

Blooms are not as common on most of our lakes

Most towns could not implement this program nor should they



Lake Hortonia, July 2010, Gary Ulrich

# Monitoring Strategy for Towns

Step 1 - Assess how often do cyanobacteria occur

Never occurs  Common and extensive

Step 2 - Identify implementers and stakeholders

Town and Health Officials  Homeowners

Step 3 - Develop local monitoring and response

solely visual  toxin analysis and counts

# The Visual System

Category 1 – low risk

Visible material is not likely  
cyanobacteria or water is generally  
clear



# The Visual System

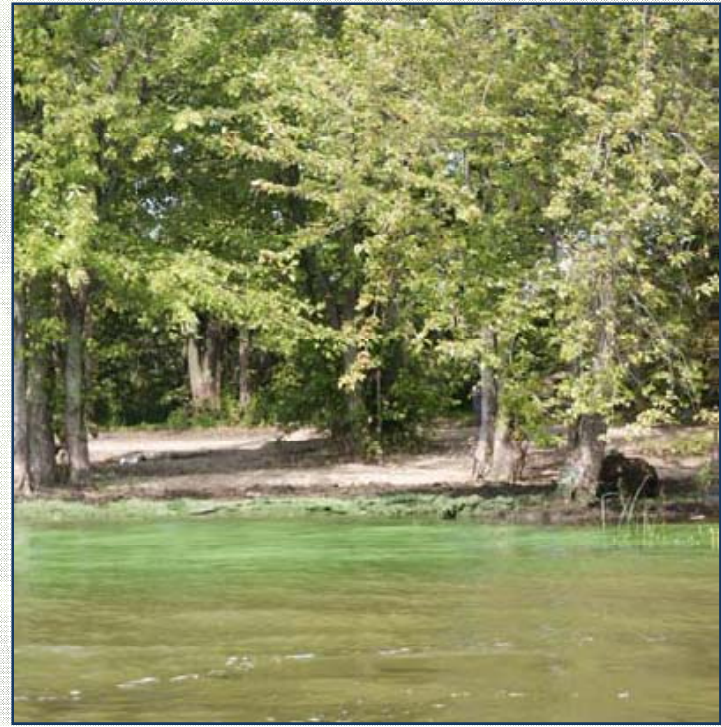
Category 2 – cyanobacteria present in low numbers.  
There are visible small accumulations but water is  
generally clear.



Photo courtesy of Mel Efron, Colchester VT

# The Visual System

Category 3 – Cyanobacteria present in high numbers. Scums may or may not be present. Water is discolored throughout. Large areas affected. Color assists to rule out sediment and other algae.

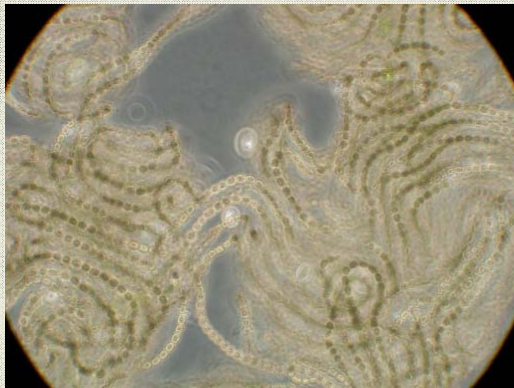


# DOH and DEC Assistance

- Training workshops
- Confirmation of suspected cyanobacteria
  - Photographic evidence
  - Physical samples
- Toxin analysis available at reasonable cost
  - Microcystin and anatoxin only
- Signs and educational material
- Guidance regarding beaches, water supplies and public health



# The Transition Ahead



The Champlain Program is moving from the research phase to a sustainable long-term effort.



# Stakeholder Goals for Transition

- Sustainable system to protect public health
- State-wide consistency
  - Monitoring
  - Communication
  - Response
- Increased education and outreach
- Opportunity for citizen volunteers
- More information from inland lakes



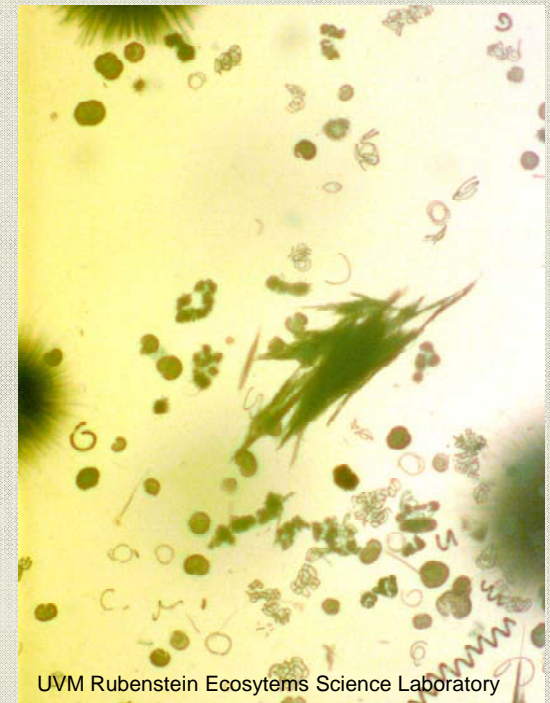
# Obstacles to Overcome

- Data Quality

- Is a visual system enough?
- Don't want to lose important quantitative information
- Nearshore vs. offshore sites

- Identifying Thresholds for toxins

- When MUST we test for toxins?
- What about the 'other' toxins?



# Obstacles to Overcome

- Communication Strategies
  - Enhanced educational/outreach efforts
  - Establish consistency in message and response
- Budget constraints are a serious issue



# It's a team effort

- Vermont Dept of Health
  - Bill Bress, toxicologist
  - Kirk Kimball, organics lab chief
  - \*Gail Center, water engineer
- Department of Environmental Conservation
  - \*Heather Campbell, Water System cyanobacteria program coordinator
  - \*Rodney Pingree, Water Supply Resources Section Chief
- University of Vermont
  - Dr. Mary Watzin, lead researcher
  - Susan Fuller, lead technician
- Lake Champlain Committee
  - \*Mike Winslow, volunteer recruiter and sample transporter
- Lake Champlain Coalition of Water Suppliers
- Vermont Rural Water
  - \*Liz Royer, Water protection specialist
- Funding Sources
  - Lake Champlain Basin Program
  - MERHAB

\* Here today – feel free to stop and talk with us

# Links

Vermont Department of Health (Public Health website):

[http://healthvermont.gov/enviro/bg\\_algae/bgalgae.aspx](http://healthvermont.gov/enviro/bg_algae/bgalgae.aspx)

Vermont Department of Environmental Conservation (Long-term Monitoring & Water Supply Practice):

[http://www.vtwaterquality.org/lakes/htm/lp\\_longterm.htm](http://www.vtwaterquality.org/lakes/htm/lp_longterm.htm)

<http://www.vermontdrinkingwater.org/GuidanceRules.htm>

Lake Champlain Committee (outreach and educational material):

<http://www.lakechamplaincommittee.org/>

Lake Champlain Basin Program (Information & UVM Technical Reports)

<http://www.lcbp.org/bgalgae.htm>