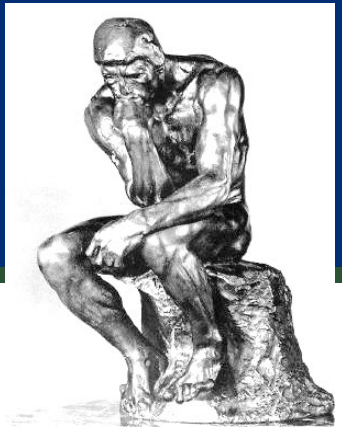
NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

What we've learned about HABs in New York



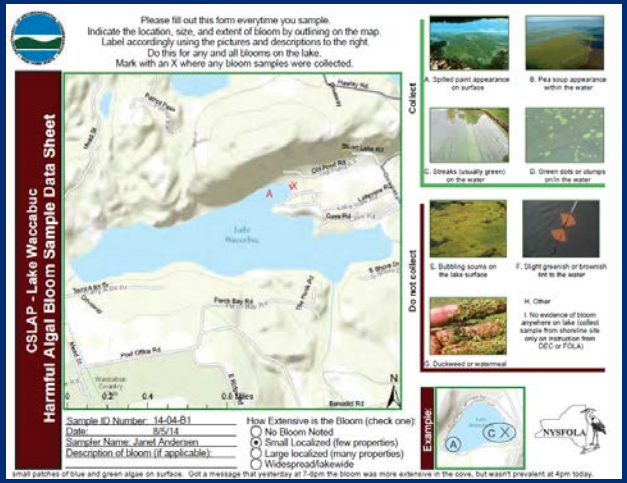
Scott Kishbaugh

CSLAP Director, NYSDEC

So what do they actually do?

Every other week CSLAP volunteers

- Collect open water HAB samples
- Filter in field and send raw water and filter to labs
- Complete field form showing extent, type, spatial coverage



CSLAP - Lake Waccabuc
Harmful Algal Bloom Sample Data Sheet

Please fill out this form everytime you sample.
Indicate the location, size, and extent of bloom by outlining on the map.
Label accordingly using the pictures and descriptions to the right.
Do this for any and all blooms on the lake.
Mark with an X where any bloom samples were collected.

Sample ID Number: 14-04-B1
Date: 8/5/14
Sampler Name: Janet Andersen
Description of bloom (if applicable):

How Extensive is the Bloom (check one):
- ○ No Bloom Noted
- ● Small Localized (few properties)
- ○ Large localized (many properties)
- ○ Widespread/lakewide

small patches of blue and green algae on surface. Got a message that yesterday at 7-8pm the bloom was more extensive in the cove, but wasn't prevalent at 4pm today.

Collect
A. Spilled paint appearance on surface
B. Pea soup appearance within the water
C. Streaks (usually green) on the water
D. Green dots or clumps on/in the water

Do not collect
E. Bubbling scums on the lake surface
F. Slight greenish or brownish tint to the water
G. Duckweed or watermeal
H. Other
I. No evidence of bloom anywhere on lake (collect sample from shoreline site only on instruction from DEC or FOLA)

Example

When blooms are observed

- Collect shoreline scum sample
- Send raw water directly to ESF
- Complete field form
- Send periodic updates to DEC

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

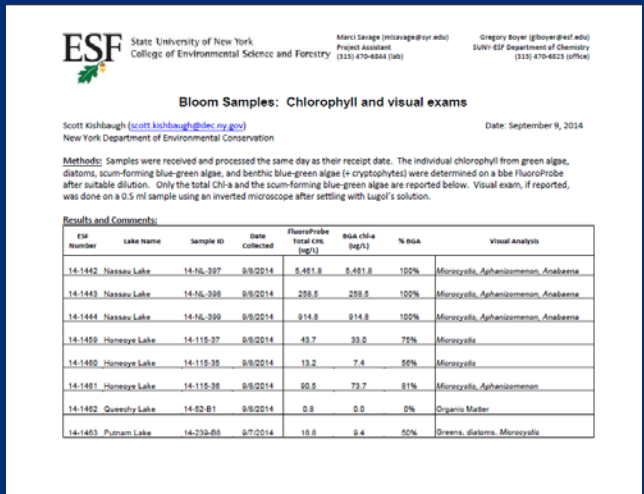
And what about ESF and UFI?

Samples received almost every day by ESF and UFI

- ESF: raw open water and filters, and shoreline bloom samples
- ESF: analyzes Total and BG chlorophyll (fluoroprobe)
- ESF: analyzes for several toxins and microscopies (high chl)
- UFI: analyzes phycocyanin and total fluorometric chlorophyll

Reports to DEC

- Fluoroprobe results daily
- Toxin results in batches
- Fluorometric results Fridays



ESF State University of New York College of Environmental Science and Forestry

Marci Savage (mlsavage@syr.edu) Project Assistant (315) 470-6564 (lab)

Gregory Boyer (gjboyer@esf.edu) SUNY-ESF Department of Chemistry (315) 470-6825 (office)

Bloom Samples: Chlorophyll and visual exams

Scott Kishbaugh (scott.kishbaugh@dec.ny.gov)
New York Department of Environmental Conservation

Date: September 9, 2014

Methods: Samples were received and processed the same day as their receipt date. The individual chlorophyll from green algae, diatoms, scum-forming blue-green algae, and benthic blue-green algae (+ cryptophytes) were determined on a bbe FluoroProbe after suitable dilution. Only the total Chl-a and the scum-forming blue-green algae are reported below. Visual exam, if reported, was done on a 0.5 ml sample using an inverted microscope after settling with Lugol's solution.

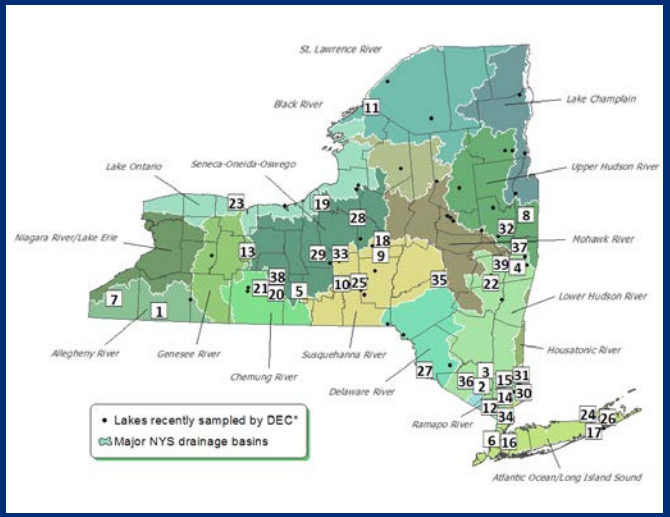
Results and Comments:

ESF Number	Lake Name	Sample ID	Date Collected	FluoroProbe Total Chl. (ug/L)	BGA chl-a (ug/L)	% BGA	Visual Analysis
14-1442	Nassau Lake	14-NL-397	9/8/2014	5,461.8	5,461.8	100%	Microcystis, Aphanizomenon, Anabaena
14-1443	Nassau Lake	14-NL-398	9/8/2014	258.5	258.5	100%	Microcystis, Aphanizomenon, Anabaena
14-1444	Nassau Lake	14-NL-399	9/8/2014	914.8	914.8	100%	Microcystis, Aphanizomenon, Anabaena
14-1459	Honeoye Lake	14-115-37	9/8/2014	43.7	33.0	75%	Microcystis
14-1460	Honeoye Lake	14-115-35	9/8/2014	13.2	7.4	56%	Microcystis
14-1461	Honeoye Lake	14-115-36	9/8/2014	90.5	73.7	81%	Microcystis, Aphanizomenon
14-1462	Queechy Lake	14-82-B1	9/8/2014	0.0	0.0	0%	Organic Matter
14-1463	Putnam Lake	14-239-B8	9/7/2014	18.8	9.4	50%	Greens, diatoms, Microcystis

And then what does DEC do…..?

Waterbodies with Blue-Green Algae Notices

Map Number	Waterbody Name	County	Status	Extent of bloom	Status Date	Type of Sample	Change in Status
1	Allegheny Reservoir+	Cattaraugus	**Confirmed**	Large localized	10/7/2013	Lab sample	Updated listing
2	Beaver Dam Lake	Orange	**Confirmed**	Small localized	10/7/2013	Lab sample	Updated listing
3	Browns Pond	Orange	Suspicious	**Widespread**	10/3/2013	Visual	No change
4	Burden Lake	Rensselaer	**Confirmed**	Small localized	9/29/2013	Lab sample	No change



All ESF/UFI reports forwarded to DEC and DOH regions and lake assn (sampler) within 12 hours of receipt

Weekly webpage update of all credible HAB reports from CSLAP, ESF, Stonybrook, public

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

How we make the call

DEC HAB website characterizes conditions

“Suspicious”

- Visual evidence of BGA bloom
- No lab sample to verify

“Confirmed”

- Visual evidence of BGA bloom AND
- BG chlorophyll (FP) > 30 OR
- Microscopics = BGA dominance

“Confirmed with high toxins”

- Confirmed BGA bloom AND
- MC-LR shore sample > 20 OR
- MC-LR open water > 10

Updated weekly with new information

All sampled waterbodies cited on page

So what have we learned

Where? (in the state)

What? (kind of algae)

How? (much has it changed?)

When? (are they occurring)

Why?

Where?
A short (but very long) history of HABs in NYS

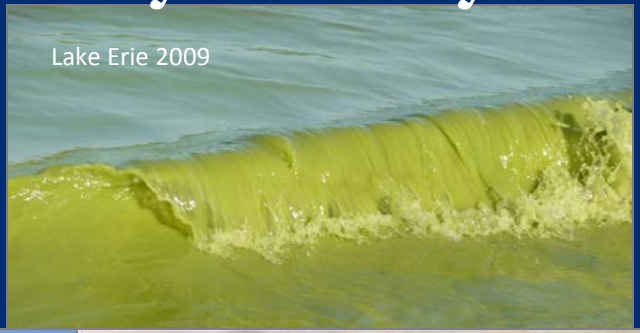
3.5 billion years ago they were captured in the fossil record

400 years ago, Samuel Champlain's description of Oneida Lake suggested algae blooms were common on the lake

200 years later, James Fenimore Cooper observed "lake blossoms" on the lake, now described as "blooms"

Similar blooms were documented on a number of the lakes by biologists during the New York Conservation Department Biological Surveys from 1924-1938

Fast forward to "yesterday"



Lake algae may be killing animals, birds

Authorities: Don't fish or touch the water. Water samples to be tested.

By Delen Goldberg
Staff writer

A dog climbed out of Lake Neatahwanta in Fulton after a short swim Tuesday night, broke into convulsions and began vomiting.

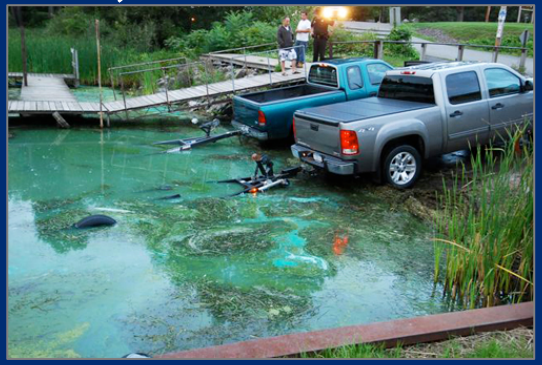
Within minutes, the Labrador

While the toxin is unlikely to be fatal to humans, officials said high levels of the poison can cause liver and nervous system damage.

"Until we find out for sure what is going on, it's better that people stay away," said Evan Walsh, associate public health sanitarian for the county Health Department.

Authorities posted signs Thursday on parts of the lake's

Sodus Bay (August 2010)

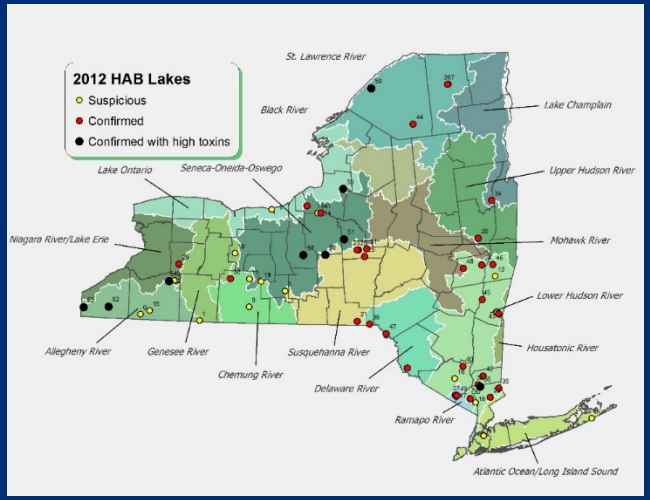


Honeoye Lake (September 2010)

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation


Lime Lake
2008
Song
Lake
2009
Hedges
Lake
2010
Cuba Lake
2010
Mill Pond
2008

The Where
(have blooms been found…?)



2011 Bloom Locations

2012 Bloom Locations

2013 HAB "Season"

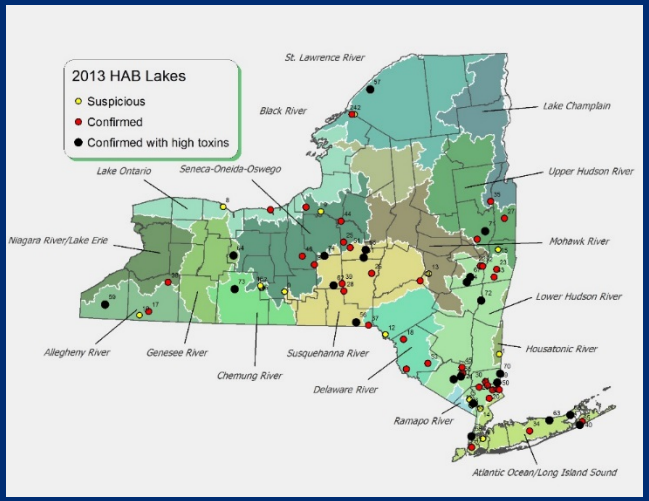
Season = June thru October

77 waterbodies reported blooms

- 62 "confirmed" (out of 170 sampled waterbodies)
- 15 "suspicious"

57 lakes identified through DEC or other baseline monitoring programs

20 lakes identified by public reporting outside of baseline monitoring programs



NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

2013: New York is a HABsy state…

10 **New York** had 50 laboratory confirmed toxic algae warnings, an indication of how a strong monitoring system can reveal the true depth of the problem.

best management practices on their farms that protect water quality.

8 For the first time, **Kentucky** officials found toxic algae this summer at four lakes which collectively draw more than 5 million people a year. Visitors to the lakes have complained of rashes and stomach problems.

9 Toxic algae has become a regular occurrence in **Lake Erie**, due primarily to agricultural runoff. Thick mats of algae have closed beaches, darkened fishing, and diminished outdoor recreation opportunities.

system can reveal the true depth of the problem.

11 In southeast **Florida**, a massive toxic algae outbreak covered St. Lucie River and Indian River Lagoon with fluorescent green slime this summer, prompting warnings from health officials to not touch the water. Scores of dolphins, manatees, birds and fish have died, and thousands of residents have protested, calling for a statewide emergency management plan to stop the toxic slime.

12 A new USGS-funded project in **Alabama** is tracking toxic algae in 350-400 freshwater sites around the southeastern U.S. Most states in the region do not currently monitor HABs.

Toxic Algae: Coming Soon to A Lake Near You? :: 3

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

2014 HAB "Season"

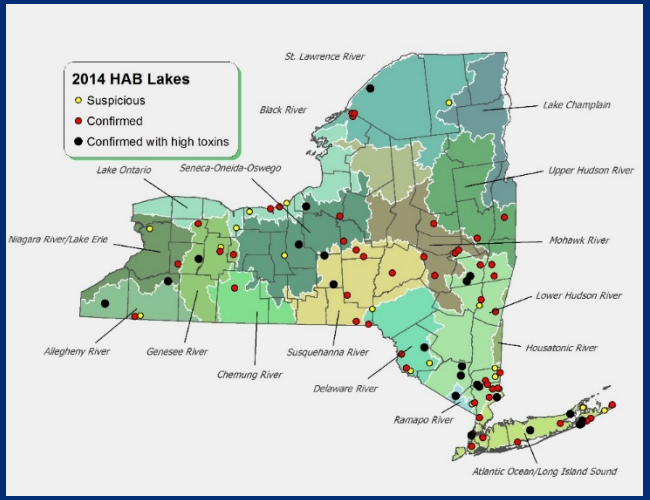
Season = June thru October

93 waterbodies reported blooms

- 74 "confirmed" (out of 195 sampled waterbodies)
- 19 "suspicious"

75 lakes identified through DEC or other baseline monitoring programs

18 lakes identified by public reporting outside of baseline monitoring programs



Where they are: 2013-14 results

Western NY and Finger Lakes

(PA border to eastern edge of Finger Lakes)

44 lakes sampled by DEC and partners in 2013 or 2014

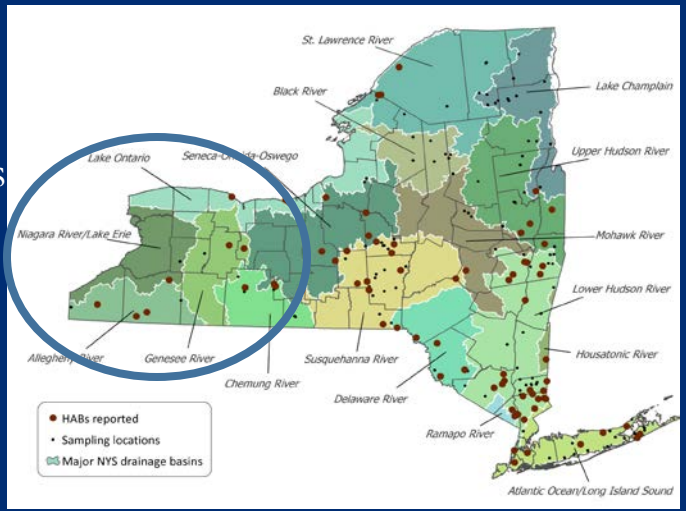
29 lakes reported HABs in 2013 or 2014

2014 TP in HAB lakes =46 ug/l

2014 TP in non-HAB lakes =18 ug/l

7 waterbodies cited as having "high toxins"

Large Finger Lakes generally do not exhibit regular HABs



Where they are- 2013-14 results

Downstate Region

(Capital District to NYC and LI)

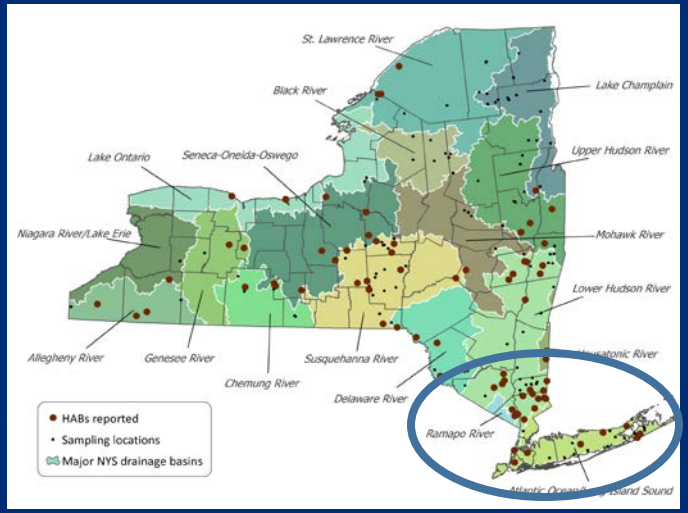
95 lakes sampled by DEC and partners in 2013 or 2014

66 lakes reported HABs in 2013 or 2014

Avg TP in HAB lakes =45 ug/l

Avg TP in non HAB lakes = 21 ug/l

27 waterbodies cited as having "high toxins"



Where they sometimes are: 2013-14

Central Region

(between FL, Adk, Downstate)

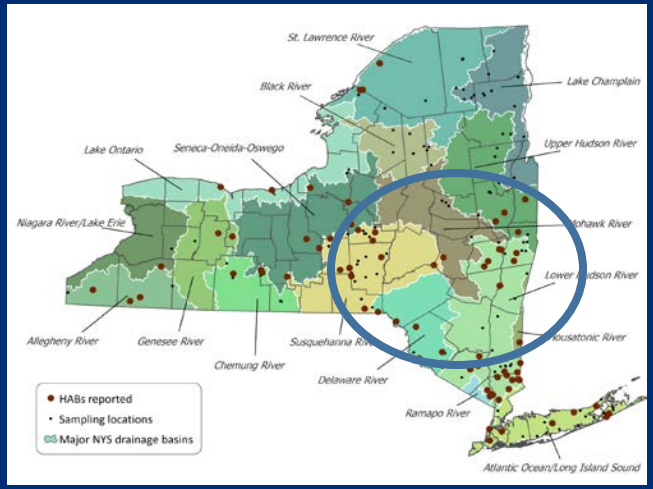
113 lakes sampled by DEC and partners in 2013 and 2014

51 lakes reported HABs in 2013 and 2014

Avg TP in HAB lakes =43 ug/l)

Avg TP in non HAB lakes = 16 ug/l

15 waterbodies cited as having "high toxins"



NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Where they aren't (definitely): 2013-14

Adirondacks

(includes E, N, W boundaries)

86 lakes sampled by DEC and partners in 2013 and 2014

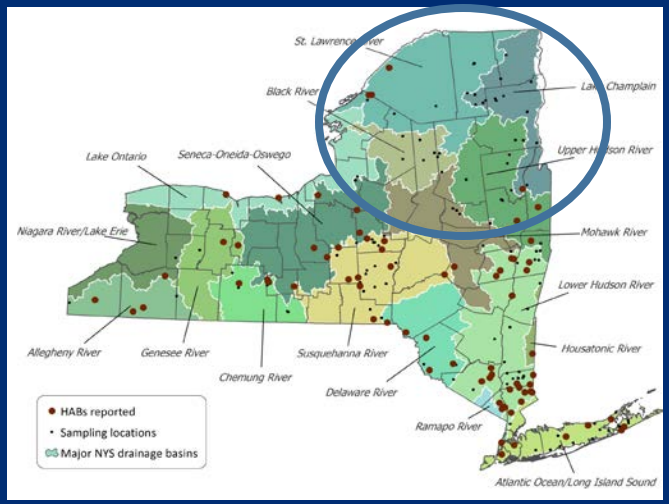
10 lakes reported HABs in 2013 and 2014

Avg TP in HAB lakes =24 ug/l

Avg TP in non HAB lakes =9 ug/l

2 waterbody cited as having "high toxins"

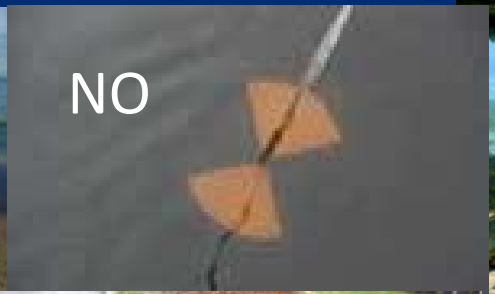
All HABs lakes in boundary (SE and NW of Blue Line)

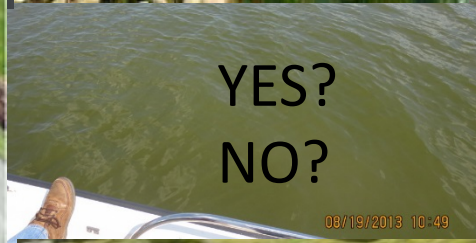


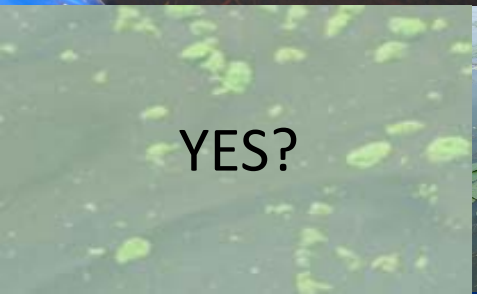
Come again, but not in so many colors?

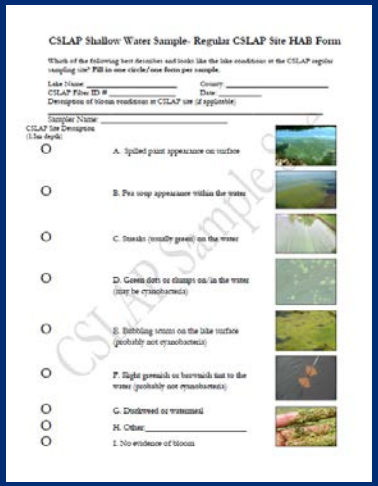
Region	# 13-14 Sampled Lakes	# 13-14 HAB Lakes	2014 avg TP HABs Lakes	2014 avg TP non - HABs Lakes	# Lakes w/ High Toxins
Western and Finger Lakes	37	24	46 ug/l	18 ug/l	7
Downstate and Long Island	95	66	45 ug/l	21 ug/l	27
Central	113	51	44 ug/l	16 ug/l	15
Adirondacks (region)	86	10	24 ug/l	9 ug/l	2

What do they (BGA) look like?








CSLAP Shallow Water Sample- Regular CSLAP Site HAB Form

Which of the following best describes what looks like the lake conditions at the CSLAP regular sampling site? Fill in one circle/one form per sample.

Lake Name: _____ County: _____
CSLAP Filter ID #: _____ Date: _____
Description of bloom conditions at CSLAP site (if applicable):

Sampler Name: _____
CSLAP Site Description
(1.5m depth)

- O A. Spilled paint appearance on surface
- O B. Pea soup appearance within the water
- O C. Streaks (usually green) on the water
- O D. Green dots or clumps on/in the water (may be cyanobacteria)
- O E. Bubbling seams on the lake surface (probably not cyanobacteria)
- O F. Slight greenish or brownish tint to the water (probably not cyanobacteria)
- O G. Discolored or watermelt
- O H. Other: _____
- O I. No evidence of bloom

Reporting on blooms….

Year	2014	2013	2012
# Open Forms	864	777	581
% Open Forms	92%	80%	83%
# Shore Forms	736	570	0
% Shore Forms	78%	59%	0%

Samplers asked to report on open water algae since 2011

Samplers asked to report on shoreline algae since 2013

2014 reporting is most complete

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Let's go to the data (2012-14, open water)

Type	N	FP_TChl	FP_BGChl	MC	Zsd	FLChl	TP	TN:TP
Spilled Paint	22	23	16	0.9	1.3	42	79	37
Pea Soup	52	23	17	0.8	1.6	36	63	47
Green Streaks	27	24	16	0.9	1.4	33	67	43
Green Dots	69	19	13	1.4	2.0	25	48	50
Any of last 4	136	20	14	1.1	1.8	30	56	47
Bubbling Scums	26	160	3	0.2	2.1	17	38	50
Discolored	194	10	5	0.3	2.4	18	34	55
Duckweed	15	6	3	0.3	2.0	15	34	39
Other	22	10	6	2.2	2.8	21	30	64
Any of last 4	263	27	5	0.5	2.4	18	35	55
No blooms	750	4	2	0.2	3.5	9	20	104

"Classic" image samples show higher BGA, TP, MC; lower N:P and clarity

Some "non" BGA image samples show higher total algae (bubbling scums), higher toxins ("other")

But sometimes a few samples skew results

Type	N	%FP TChl >50	%FP BG >30	%FP BG >20	%FP BG>15	%MC>4	%MC>20	Zsd<1.2	FlChl >30	TP>20
Spilled Paint	22	5%	14%	36%	45%	9%	0%	45%	45%	73%
Pea Soup	52	10%	21%	37%	40%	4%	2%	40%	40%	69%
Green Streaks	27	4%	19%	33%	41%	7%	0%	48%	33%	74%
Green Dots	69	4%	14%	23%	29%	4%	1%	29%	26%	52%
Any of last 4	136	7%	15%	26%	32%	4%	1%	33%	30%	58%
Bubbling Scums	26	4%	4%	4%	8%	0%	0%	38%	19%	0%
Discolored	194	3%	2%	6%	7%	1%	0%	25%	18%	0%
Duckweed	15	0%	0%	0%	0%	0%	0%	7%	7%	0%
Other	22	5%	9%	9%	9%	5%	5%	23%	18%	0%
Any of last 4	263	3%	4%	8%	9%	1%	0%	26%	17%	0%
No blooms	750	0%	1%	2%	2%	0%	0%	10%	6%	29%

”BGA” blooms more likely to present “moderate” to “high” risk for toxins and blue green algae

Big three appear to be “spilled paint”, “pea soup” and “green streaks”

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

What about where people swim?

Type	N	FP_TChl	FP_BGChl	MC
Spilled Paint	72	22824	22604	381.1
Pea Soup	67	19379	19076	165.9
Green Streaks	62	3177	3055	131.1
Green Dots	95	1635	1460	66.3
Any of last 4	224	8875	8676	129.3
Bubbling Scums	15	1580	1306	1.7
Discolored	5	228	207	48.7
Duckweed	3	210	59	185.3
Other	9	392	139	2.0
Any of last 4	51	600	459	19.9
No blooms	12	65	42	23.1

Wow! HUGE numbers!

(and these)

?

Must be mis ID

Apparent very high total and BGA levels and toxins in all samples

Some “non” BGA image samples show higher total algae (bubbling scums), higher toxins (“other”)

But sometimes a few samples skew results

Type	N	%FP TChl >50	%FP BG >30	%FP BG >20	%FP BG>15	%MC>4	%MC>20
Spilled Paint	72	83%	83%	83%	83%	57%	46%
Pea Soup	67	93%	87%	90%	90%	46%	30%
Green Streaks	62	71%	74%	76%	77%	40%	27%
Green Dots	95	46%	43%	44%	45%	22%	12%
Any of last 4	224	64%	62%	64%	65%	34%	22%
Bubbling Scums	15	40%	20%	27%	40%	7%	0%
Discolored	5	40%	40%	40%	40%	40%	20%
Duckweed	3	100%	67%	67%	67%	67%	33%
Other	9	44%	33%	33%	44%	11%	0%
Any of last 4	51	47%	35%	39%	45%	20%	8%
No blooms	12	17%	8%	8%	8%	42%	33%

”Spilled paint blooms are most toxic; pea soup have highest BGA

Some “non BGA” blooms might still have BGA and toxins

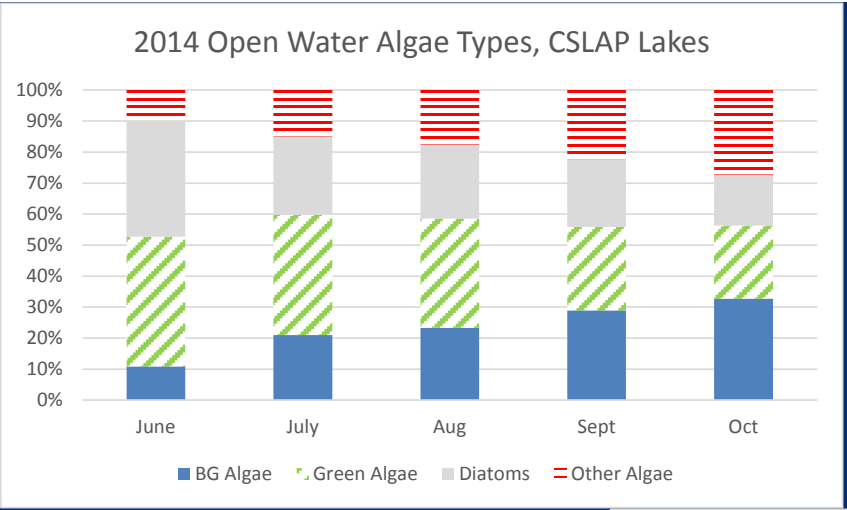
Open Water

Change from month to month

Month	FP_TChl	FP_BGChl	%FP TChl >50	%FP BG >30	%FP BG >20	%FP BG>15	%MC>4	%MC>20	N
May	9	3	0%	4%	8%	12%	0%	0%	26
June	4	1	1%	1%	2%	3%	0%	0%	414
July	10	5	3%	4%	6%	8%	1%	0%	661
Aug	14	4	3%	4%	8%	9%	2%	1%	688
Sept	18	10	3%	4%	6%	7%	2%	0%	575
Oct	35	31	3%	4%	8%	10%	1%	0%	107

Month	FP_TChl	FP_BGChl	%FP TChl >50	%FP BG >30	%FP BG >20	%FP BG>15	%MC>4	%MC>20	N
May	21	15	4%	4%	4%	4%	6%	6%	57
June	1259	1190	31%	28%	30%	31%	9%	6%	137
July	1974	1724	44%	37%	39%	43%	21%	13%	234
Aug	4199	4016	54%	55%	60%	62%	28%	16%	299
Sept	10480	10317	56%	59%	64%	68%	39%	28%	197
Oct	6538	6189	48%	46%	48%	49%	40%	21%	71

Shoreline bloom



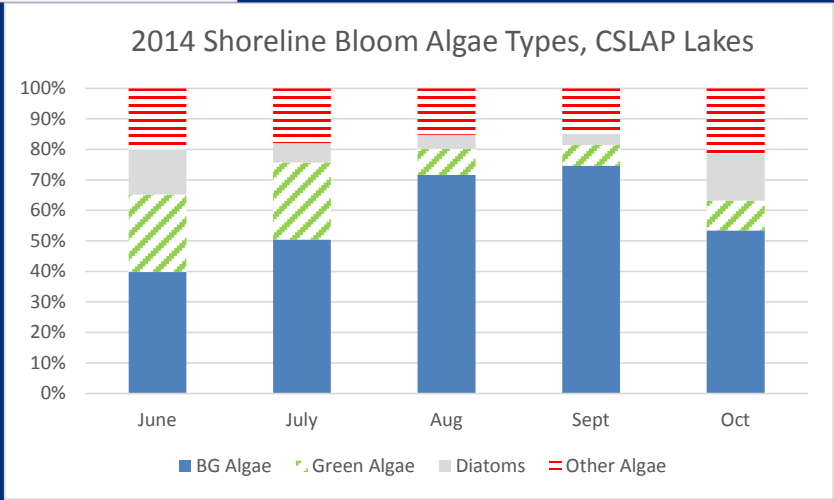
Open water:

Early: Green algae and diatoms

Late: Blue green algae and other species

Shoreline blooms:

Increasing BGA levels into late summer with decreasing green algae and diatoms



Change from year to year- all CSLAP lakes

Less Algae and Fewer blooms in 2014?

Year	Open N	AvgTChl Open	%TChl>50 Open	AvgBG Open	%BG>30 Open	AvgMC Open	%MC>4 Open
2014	902	7.8	2%	3.7	3%	0.2	0%
2013	905	16.9	3%	7.4	5%	0.5	2%
2012	650	15.1	2%	9.4	2%	0.5	2%

Year	Shore N	AvgTChl Shore	%TChl>50 Shore	AvgBG Shore	%BG>30 Shore	AvgMC Shore	%MC>4 Shore
2014	460	5492	45%	5370	44%	35	13%
2013	473	3471	43%	3166	43%	144	29%
2012	79	3482	72%	3378	59%	96	35%

Change from year to year- index lakes

Year	Open N	AvgTChl Open	%TChl>50 Open	AvgBG Open	%BG>30 Open	AvgMC Open	%MC>4 Open
2014	151	6.2	1%	4.0	3%	0.2	0%
2013	177	7.0	3%	3.3	4%	0.6	3%
2012	137	6.6	1%	4.9	5%	0.6	4%

Year	Shore N	AvgTChlShore	%TChl>50 Shore	AvgBG Shore	%BG>30 Shore	AvgMC Shore	%MC>4 Shore
2014	168	5167	35%	5146.101	39%	2.5	4%
2013	134	1553	45%	1457.901	45%	59.5	47%
2012	14	2812	57%	2662.114	50%	458.6	43%

Which toxins? (2014)

Hepatotoxins

Microcystin-LR	N	% Detectable	% > 4ug/l	% > 20ug/l
Open	966	6%	3%	1%
Shore	453	17%	13%	9%

Cylindrospermopsin	N	% Detectable	% > 6ug/l
Open	923	0%	0%
Shore	447	0%	0%

d-Cylindrospermopsin	N	% Detectable	% > 6ug/l
Open	923	0%	0%
Shore	447	0%	0%

Neurotoxins

Anatoxin-a	N	% Detectable	% > 1ug/l	% > 4ug/l
Open	924	1%	0%	0%
Shore	447	6%	1%	0%

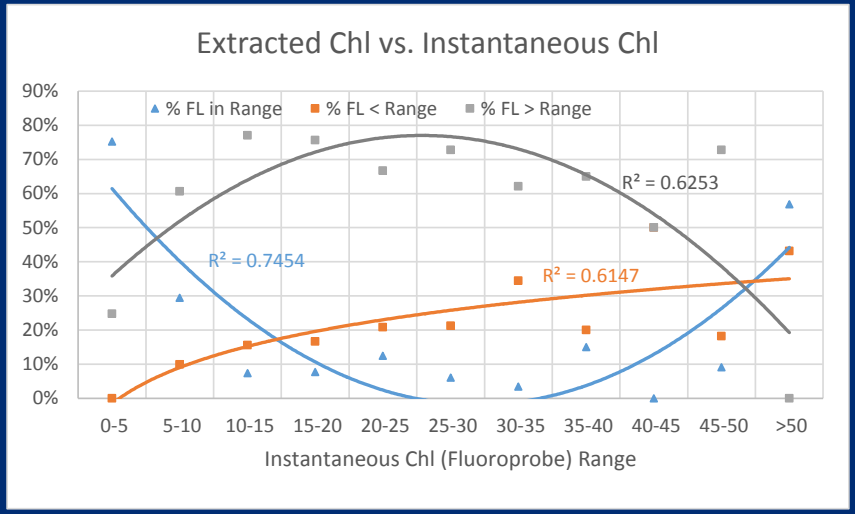
Can we detect HABs early?

Fluoroprobe used to identify appx. algal density

Data received by DEC within 24hrs receipt

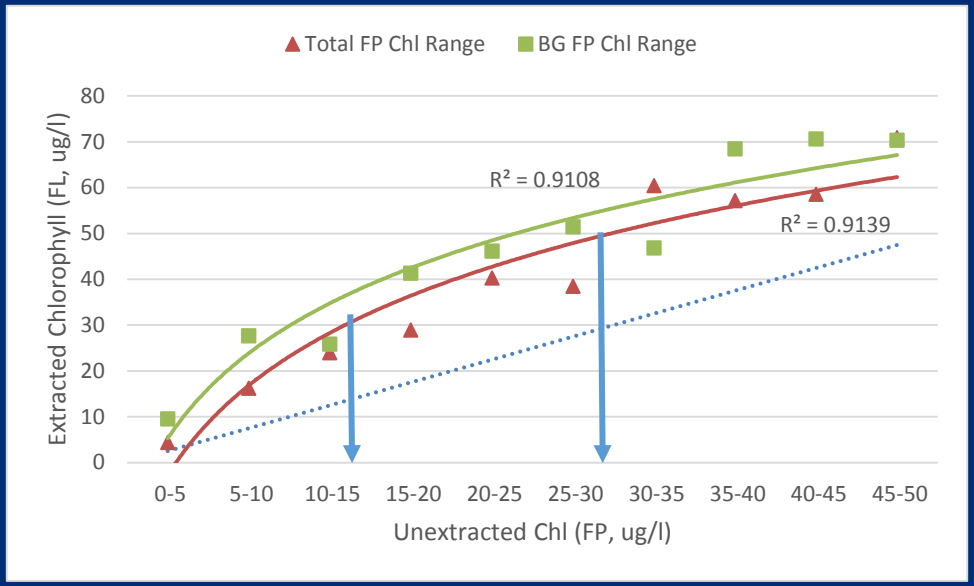
Fluoroprobe underestimates algae density near “bloom” range

FP of 30 ug/l in open water may underestimate “blooms”



NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

What might be better….



10-15 ug/l BG chlorophyll and 30 ug/l total chlorophyll measured thru fluoroprobe might be better measure of extracted chlorophyll = 30 ug/l BG chlorophyll and 50 ug/l total chlorophyll, respectively

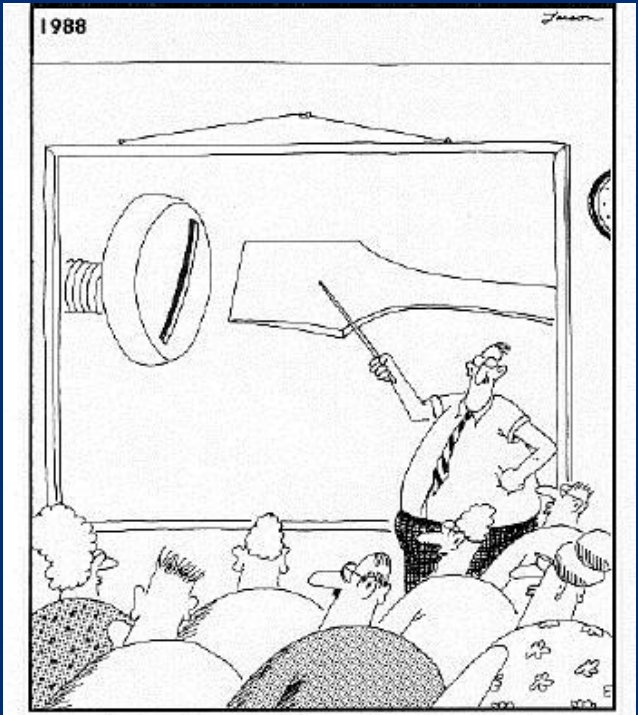
What do we still have to learn?

Why?

What (numerically, visually, etc.) is a bloom?

What about benthic algae?

Do we need to be concerned about other toxins?



School for the Mechanically Declined

Why why?

Open water blooms with “moderate” toxin risk generally limited to chlorophyll > 15

Likelihood of shoreline blooms increases 5x as chlorophyll increases from 5 to 20 ug/l

Why are blooms occurring in this (0-15 ug/l) range?