NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

NYS Harmful Algae Blooms

Lewis McCaffrey, PhD
Senior Research Scientist, Finger Lakes Water Hub,
Bureau of Water Assessment and Management, Division of Water

Onondaga County Planning Federation
Annual Planning Symposium
March 7th 2019

Contents

Acronym time: HABs

H: **Harmful** (toxins, economic aesthetics, ecological)

A: **Algal** (freshwater HABs refer to cyanobacteria, not truly algae)

B: **Blooms** (proliferation of cells, dense concentrations)

Cyanobacteria – Blue-green Algae – HABs

- Highly specialized and competitive
- Best in high temps, high light, high nutrients
- Causes not fully understood
- Hard to predict

5

Seasonal Changes in Algae

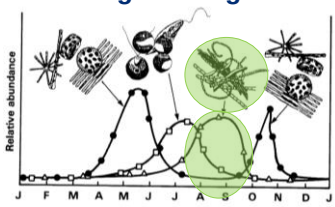


Figure 5. Seasonal Succession of Phytoplankton (Olem and Flock, 1990)
Diatoms tend to dominate in spring and fall, with greens and blue-greens dominant during summer, but many variations are possible.

Department of Environmental Conservation

6

Algae need Nutrients and Light to Thrive

- Lakes that have higher nutrients (are eutrophic) are more likely to have HABs
- However, present in low nutrient waterbodies too (Finger Lakes, Lake Placid)
- Climate change, mussels, development all play a role

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

7

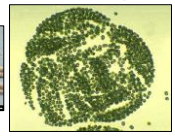
Common types of Cyanobacteria

Dolichospermum

- Fixes Nitrogen
- Produces anatoxin ("VFDF", nerve toxin) and others

Aphanizomenon

Microcystis

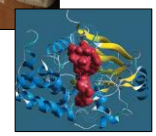


- Adjusts buoyancy
- Produces microcystin (liver toxin)

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

8

Cyanotoxins



Microcystins (liver toxins)
- Most common toxin in New York

Anatoxins (nerve toxins)
- Potentially fatal to dogs

Lipopolysaccharides (endotoxins)
- Skin irritants and allergens
- Produced by most cyanobacteria

Other Toxins (Cylindrospermopsin, Saxitoxin, BMAA, and more)

No visual cues that toxins are present

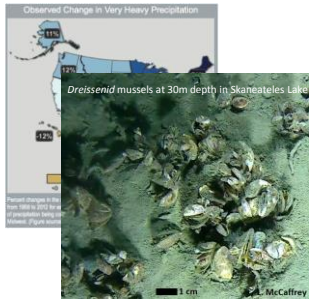
Sample collection is warranted

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

9

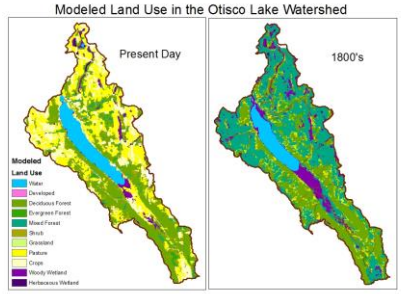
What's Changing?

- Climate change, precipitation patterns?
- Farming practices?
- Population (human, animal) dynamics?
- Invasive species? →
- Land use changes? ↓
- Aging infrastructure? ↓



10

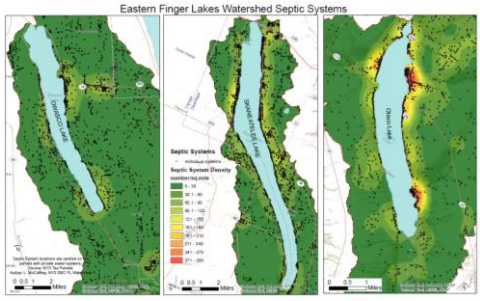
Modeled Land Use in the Otisco Lake Watershed



Department of Environmental Conservation

11

Eastern Finger Lakes Watershed Septic Systems



Department of Environmental Conservation

12

Not just NY!

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION | Department of Environmental Conservation

13

NY statewide approach to HABs

- Collaborative effort between DEC and DOH
- Goal: Track, document, protect the public and communicate about HABs
- “Avoid contact” is our mantra
- #, duration, and intensity of blooms seems to be increasing
- Toxic blooms in large low nutrient lakes

14

The DEC HABs Program

Surveillance/sampling

- DEC coordinates several HABs and lake monitoring programs (DEC lake monitoring programs, NYC Parks, Suffolk County, individual lakes); >400 lakes/year
- Sampling conducted mostly by trained volunteers or DEC staff
- Drinking water and most regulated swimming areas (beaches) are the jurisdiction of DOH & State Parks

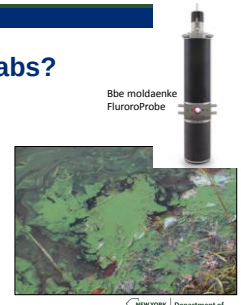
15

2018 NY HABs Partnerships

- CSLAP: **>150 lakes**; 8x/summer
- LCI: ~**100 lakes**; 1-4x/summer
- Enhanced volunteer HABs monitoring: ~**10 lakes**; weekly
- ESF and Stony Brook researchers: **>20 lakes**; weekly
- VT DEC, USACE, NYC Parks, NYC DEP and others: **>30 lakes**; variable frequency
- Regulated swimming areas; **>1400 locations**; daily inspection

What is measured by the labs?

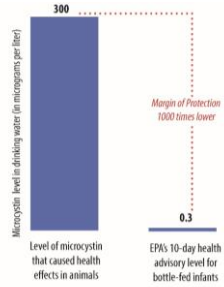
- **FluoroProbe Chlorophyll** – Measures chlorophyll (total, blue green, diatoms, green algae)
- **Microscopy** – Quick scan, check for most common taxa
- **Toxins** – ELISA for Microcystins; LC-MSMS for Anatoxin-a, Cylindrospermopsin, BMAA



17

US EPA Drinking Water Health Advisory

- Addresses exposure to unregulated contaminants
- Build in a large margin of protection between observed health effects and level
- An exceedance used to take actions to reduce exposure because the margin of protection is reduced



18

NYS Microcystin Advisory Thresholds

EPA Method 546 (ELISA) at a NY ELAP Certified Lab

- **>20 µg/L**: Shoreline water ambient water sample; DEC Confirmed with High Toxins Bloom
- **>10 µg/L**: Open water ambient water; DEC Confirmed with High Toxins Bloom
- **<4 µg/L:** Regulated swimming area can re-open; shoreline ambient water sample from a facility that has been clear of HAB for at least 24 hours
- **>0.3 µg/L:** Finished drinking water sample: Do Not Drink Advisory

19

For all blooms….

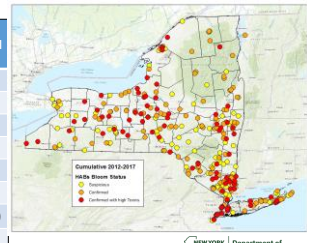
- **Avoid exposure.** Keep children and pets away from scums or discolored water
- **Seek immediate medical assistance** for symptoms consistent with exposure
- **Report any symptoms** to local/state Health Department
- **Report additional and on-going blooms to DEC** through digital photos, suspicious bloom form, or email drop box (HABsInfo@dec.ny.gov)

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

20

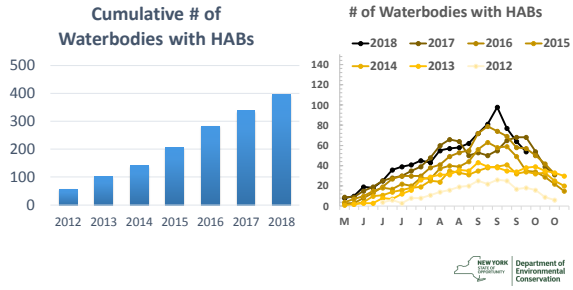
HABS in New York 2012-2018

Year	Suspicious	Confirmed	High Toxins	Total
2012	20	29	9	58
2013	17	37	22	76
2014	19	51	23	93
2015	40	62	35	137
2016	41	95	38	174
2017	45	84	36	165
2018	57	83	40	180
12-18	**122**	**171**	**101**	**394**



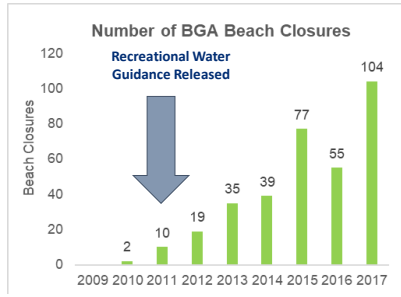
NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

21



22

NYS HABs Impact at Beaches



23

High Profile Events

- Finished DW detection Owasco Lake, October 2016
- Detections in raw water of unfiltered DW supply for Syracuse. Skaneateles Lake, 2017 & 2018
- HABs in all 11 lakes in 2017
- Finished DW detection, Canandaigua Lake, October 2018

24

High Profile Events (continued)

- Wallkill River: HABs detected over 30 miles in small river during drought conditions in 2016
- Continuing illness reported
- Beach closures continue to rise
- Record 98 waterbodies with HABs on 9/14/18

25

Combatting HABs in NYS

Late 2017: Governor Cuomo announced a 4-point initiative

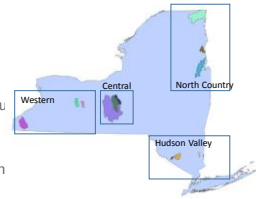
1. Selection of priority lakes
2. Regional HABs summits
3. Completion of Action Plans
4. Implementation of treatment and monitoring

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

26

Selection of Priority Lakes

- There are 16,000 lakes in NYS, so a difficult task
- Wide variety of types, locations, sizes and vulnerabilities
- All Priority Lakes are water supplies or critical tourism drivers
  - **Western Group:** Conesus; Honeoye; Chautauqu Lakes
  - **Central Group:** Owasco; Skaneateles; Cayuga Lakes
  - **North Country Group:** Parts of Lake Champlain Lake George
  - **Greater Hudson Valley Group:** Lake Carmel; Palmer Lake; Putnam Lake; Monhagen Brook watershed (five reservoirs)



NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

27

HABs Summits

Open to the Public
12 lakes divided into 4 regions
Took place in Feb/March 2018
Presentations and discussions on:

- Sources of nutrients
- Nutrient Reduction Strategies
- Algal ecology
- HABs treatment
- Other

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

28

National and Local Expertise at HABs Summits

Experts from:

- Michigan, North Carolina, Ohio & Vermont
- SUNY ESF & Stony Brook, Cornell
- Jefferson Project on Lake George
- Soil & Water Conservation Committees
- Agriculture, Industry
- State, County, Town officials

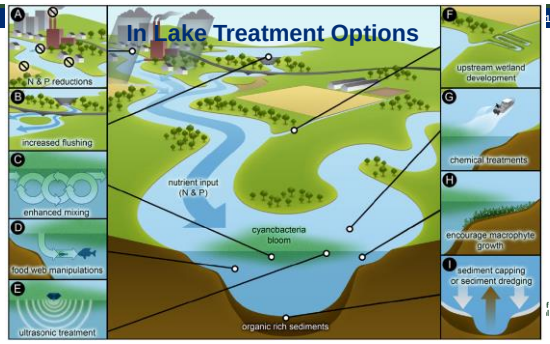
HABs Summits Take Home Messages

- "Its complicated"
- Long Haul
- Improvement is possible
- Control both nitrogen *and* phosphorus
- Expand collaborative partnerships and research

HABs Advanced Monitoring Pilot

DEC and USGS piloting use of advanced monitoring platforms

- Innovative HAB sensors
- Meteorological stations
- Real time reporting
- Webpage: https://ny.water.usgs.gov/maps/habs/



HABs Mitigation Pilots

Evaluation of innovative HABs mitigation actions

- Nutrient inactivants
- Hydrogen peroxide
- Ultrasonic devices

Fieldwork completed

Environmental review under way

33

NEW YORK STATE OF OPPORTUNITY. Department of Health

ESF

Stony Brook University

NEW YORK STATE OF OPPORTUNITY. Parks, Recreation and Historic Preservation

seneca lake

NYSFOLA New York State Federation Of Lake Associations

US Army Corps of Engineers

FINGER LAKES INSTITUTE

NYC Parks

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

34

Thank You

Lewis McCaffrey, Ph.D.
Research Scientist,
Finger Lakes Water Hub,
Bureau of Water Assessment & Management
Division of Water

315 426 7514

HABsInfo@dec.ny.gov

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

35

2018 News

- April: Environmental Lab Approval Program (ELAP) developed for Microcystin by ELISA method
- Expanded sampling in rivers and streams
- 1,397 Open water samples through CSLAP
- 1,166 shoreline HAB samples
- 1,175 Reports (visual surveillance)
- 57 New Waterbodies
- HABsiest Counties: Suffolk (24); NYC (15), Putnam(13),

The DEC HABs Program

Bloom Status

- Determine bloom status (**Suspicious**, **Confirmed**, or **Confirmed with High Toxins**) based on surveillance (visual evidence) and sampling data

Education

- Maintain website with HABs primer, FAQs, photo gallery and more (**on.ny.gov/hab**)
- Publish articles in DEC publications, respond to press inquiries, lake association newsletters, etc.
- Public presentations and training workshops

Outreach

- Daily notifications sent via email to agency and county staff
- Weekly updates to website (map), social media, etc.

37

Funding options

Governor Cuomo has made available nearly $60 million in implementation funding this year to begin projects.

Sources include:

- Water Quality Improvement Project Program
- Wastewater Infrastructure Engineering Planning Grant
- Clean Water Infrastructure Act (CWIA) Septic Program
- Green Innovation Grant Program

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

38

Mitigation Pilot - Overview

Initiated in summer 2018 on 5 waterbodies

Piloted strategies:

- Hydrogen Peroxide – 3 waterbodies
- Ultrasonic Device – 1 waterbody

Evaluated strategies:

- Nutrient Inactivants – 2 waterbodies

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

39

Mitigation Pilot – Future Outcomes

How effective were these strategies in deterring HABs or lessening their impact?

What additional work is needed to assess these and other innovative strategies?

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation