New York State Department of Environmental Conservation

Benthic HABs in NYS Rivers and Lakes

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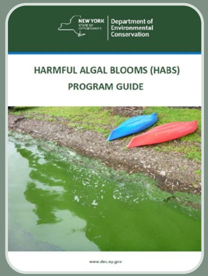
NYSFOLA 5/8/2026

Agenda: Benthic HABs in NYS



Background

- NYHABS
- Benthic HAB biology

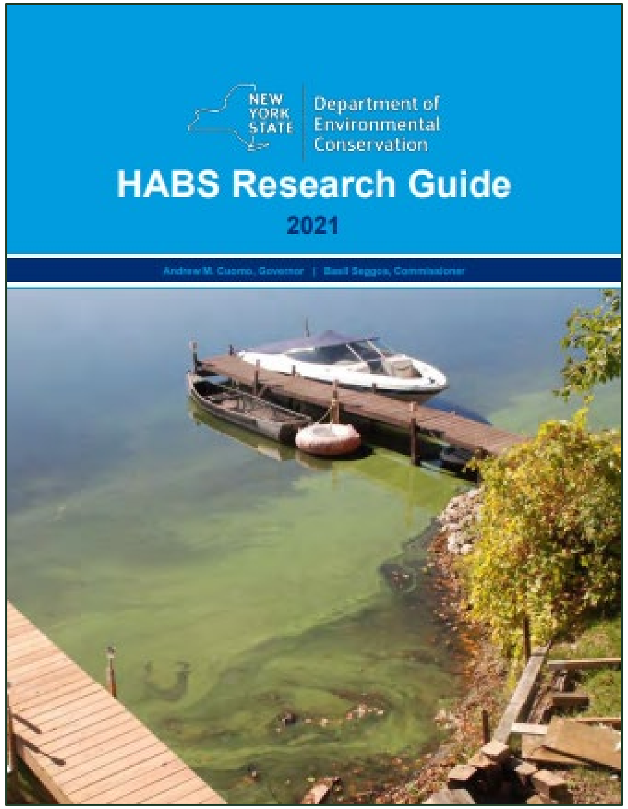
Streams

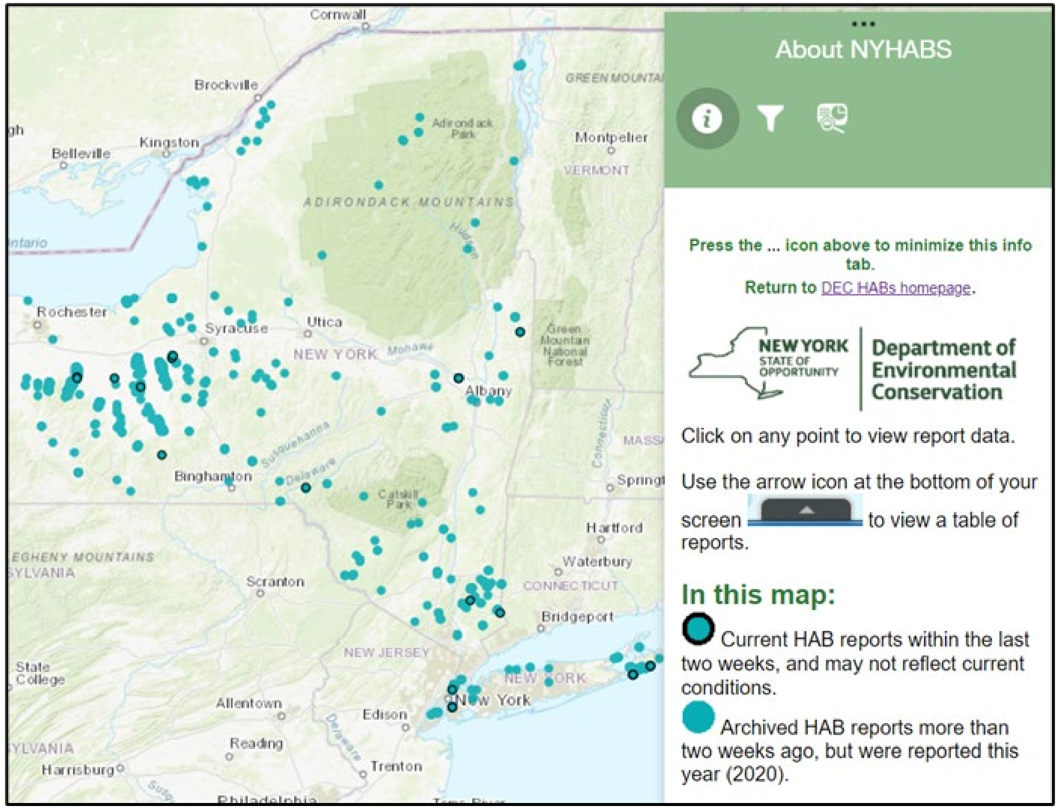
- Cyanobacteria and cyanotoxin characterization
- 2017-2021

Lakes

- Cyanobacteria and cyanotoxin characterization
- 2024-2025

The NYS DEC HABs Program



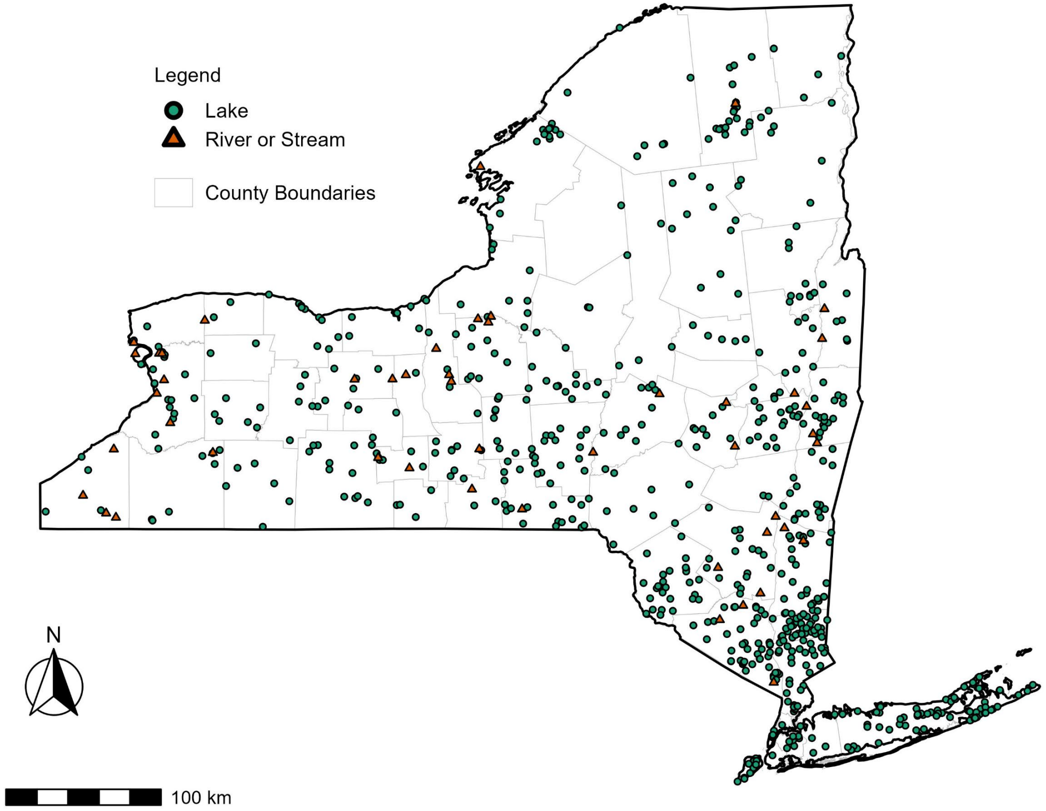


Know it, Avoid it, Report it!

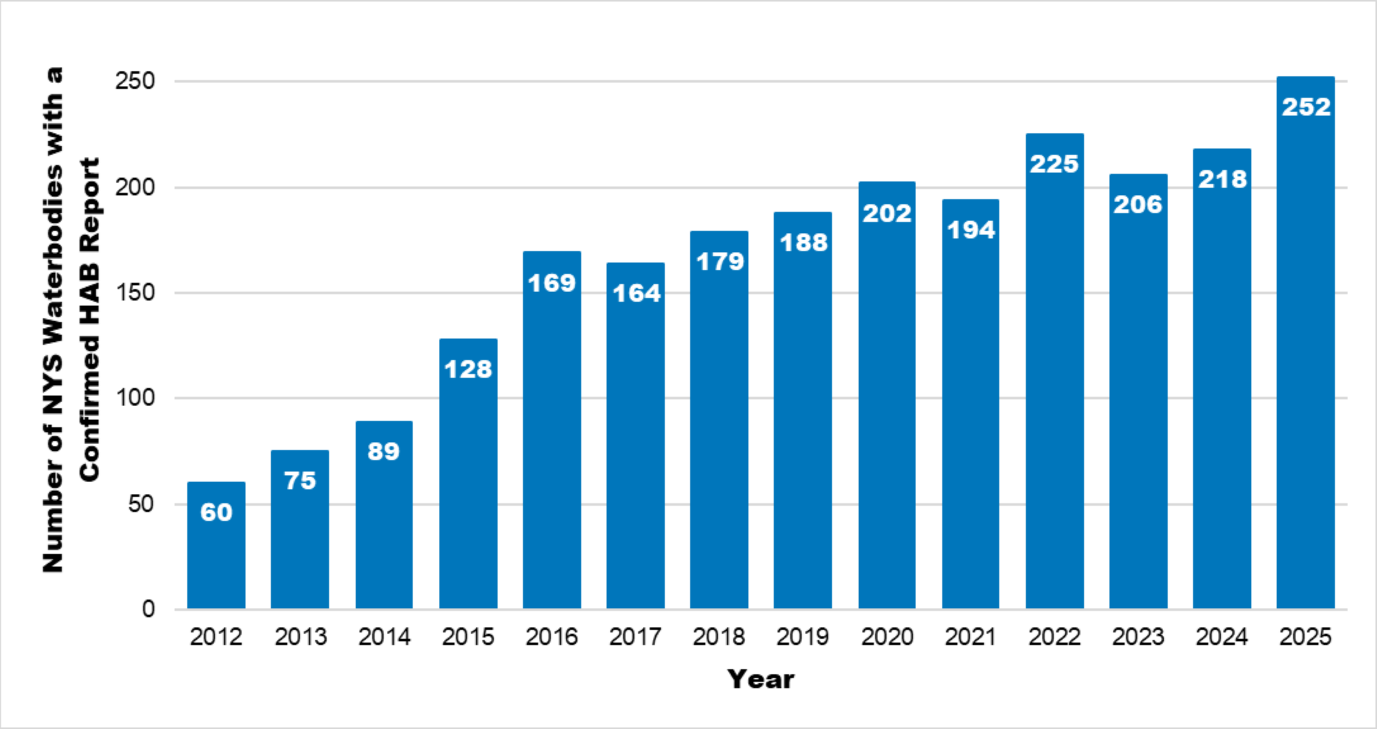
Background : Pelagic HABs in New York Lakes - NYHABS

Gorney et al. 2023 – Analysis of trends in frequency, intensity, and duration indicated increased HAB reporting likely due to increased public awareness

Waterbodies with HAB Reports 2012-2025



Waterbodies with confirmed HABs 2012-2025



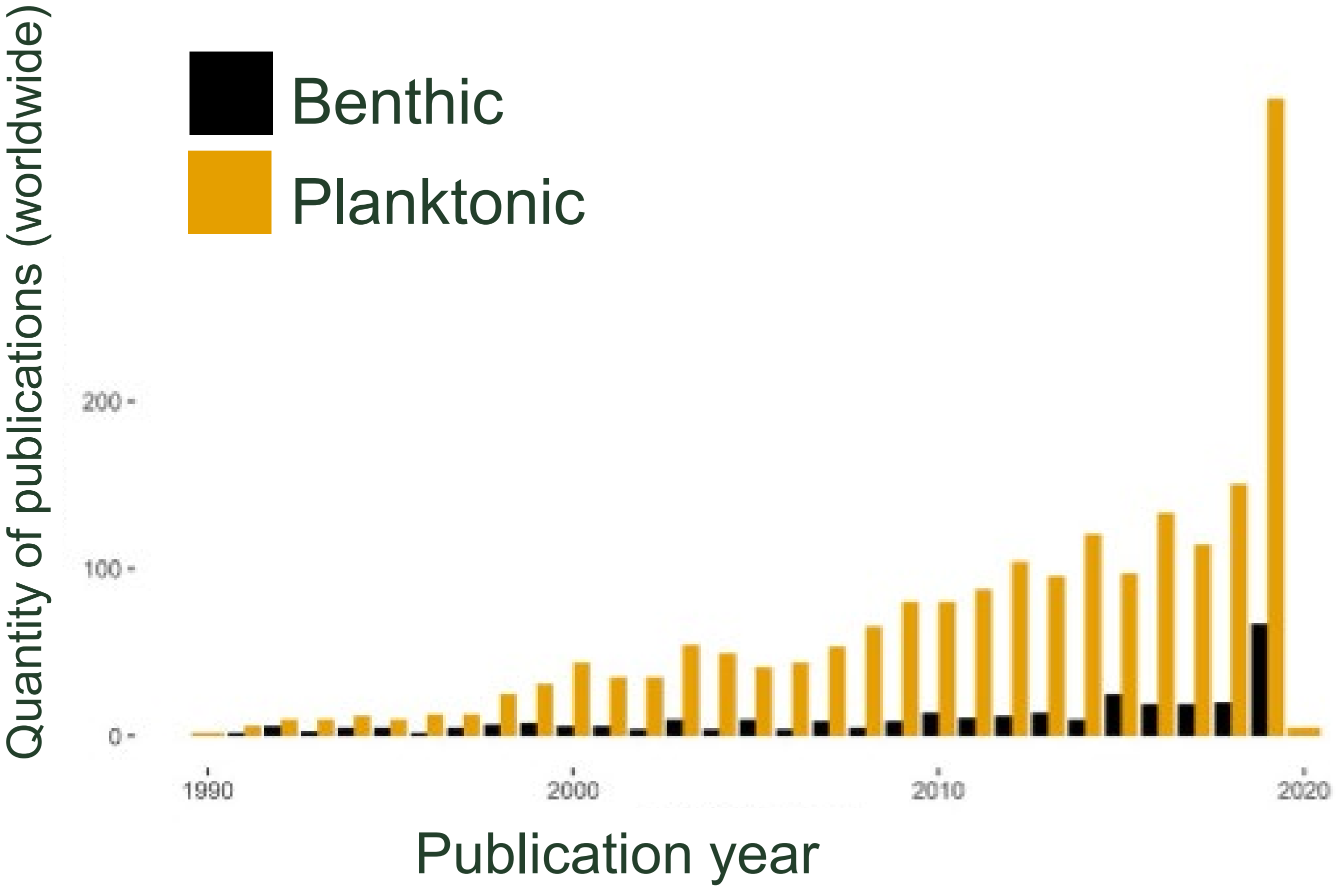
Background: Pelagic HABs in large rivers

Oswego River, 2016, 2025

Wallkill River 2016, 2025

Hudson River, 2025

Background : State of the science



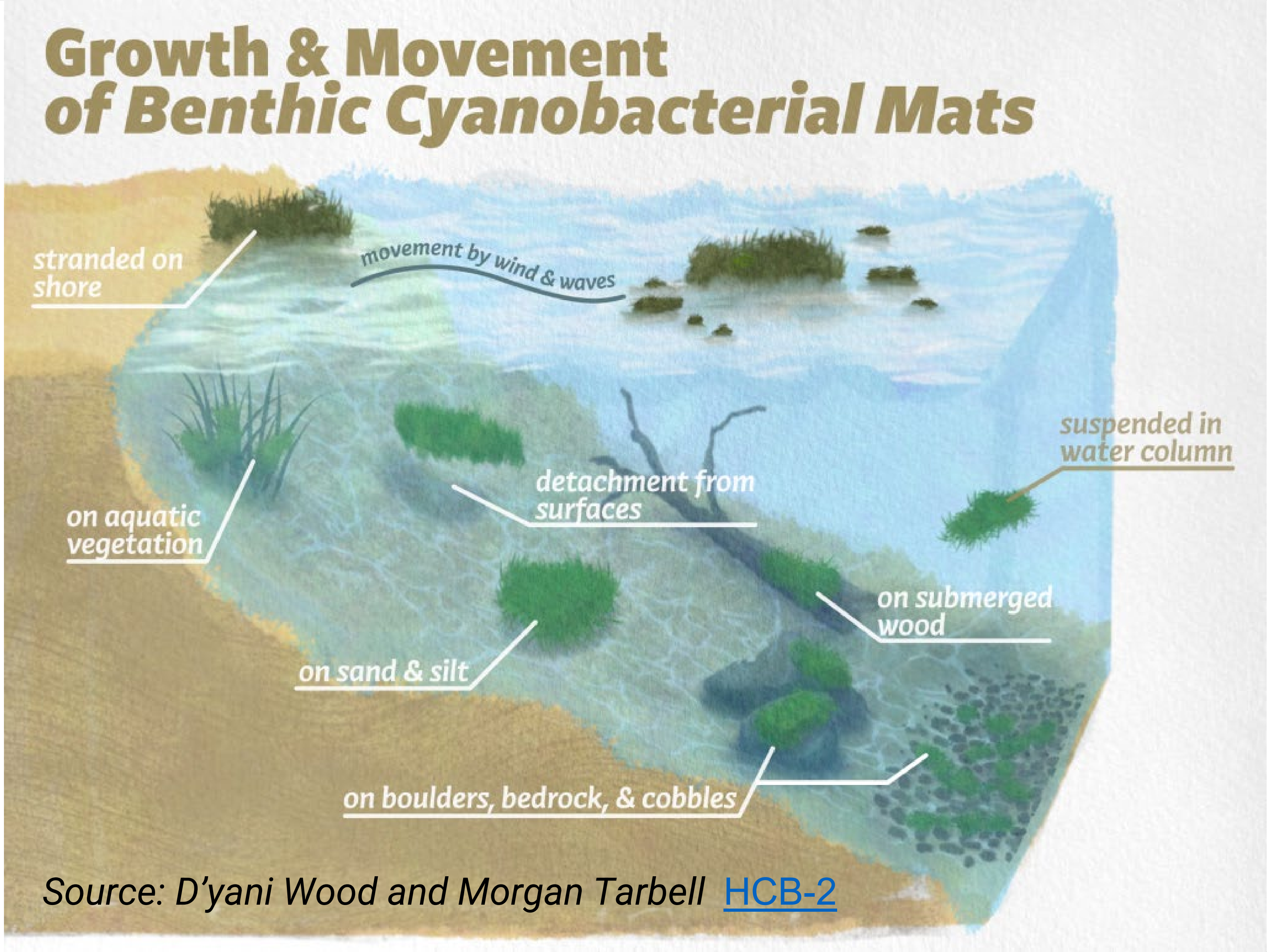
Wood, SA, Kelly, LT, Bouma-Gregson, K, et al. Toxic benthic freshwater cyanobacterial proliferations: Challenges and solutions for enhancing knowledge and improving monitoring and mitigation. Freshwater Biology. 2020; 65: 1824– 1842. https://doi.org/10.1111/fwb.13532

Specific environmental niches and local characteristics drive locally distinct cyanobacterial communities in the NE.

Schulte NO, Carlisle DM, Spaulding SA. Natural and anthropogenic influences on benthic cyanobacteria in streams of the northeastern United States. Sci Total Environ. 2022 Jun 20;826:154241. doi: 10.1016/j.scitotenv.2022.154241. Epub 2022 Mar 1. PMID: 35245560.

Its complicated!

- Rarely made up of one species
- Local ecology may drive toxin production and species assemblages
- Light, nutrients, carbon, water velocity and turbidity, temperature
- Risk is not well understood



Source: D'yani Wood and Morgan Tarbell [HCB-2]

Background : Benthic cyanotoxin exposure

Recreational exposure

Visual Inspection

Ranger holding cyanobacteria after conducting a visual inspection for the presence of cyanobacteria

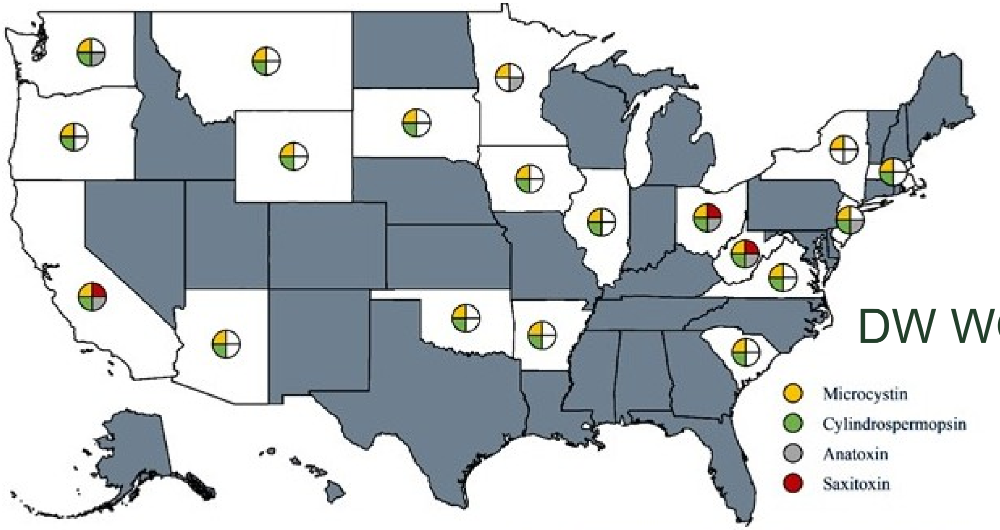
SPATT BAG

A picture of a Solid Phase Adsorption Toxin Tracking (SPATT) sample bag submerged in the water surrounded by cyanobacteria.

Benthic Disturbance Sample

A ranger walking in a cyanobacteria mat to intentionally disturb cyanobacteria on the bottom of the water (benthic disturbance) to then collect a measurement of it in the water.

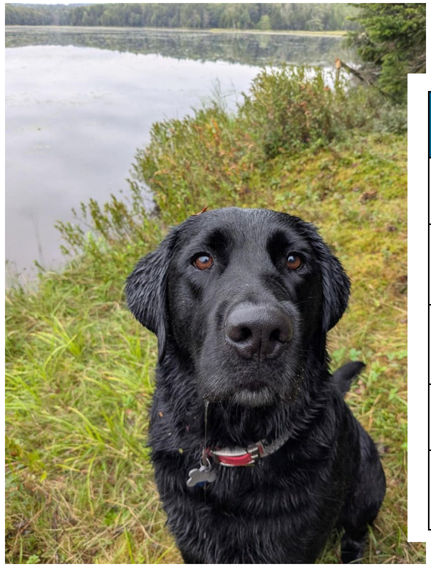
Drinking water



DW WQS

Note: Greyed out states do not have drinking water values

2. Cyanotoxins – HCB-2



Dog and livestock exposure

State	Animal and water use	Microcystin	Anatoxin-a	Saxitoxin	Cylindrospermopsin
California (OEHHA 2012 [5183])	Dog, subchronic water intake	2 µg/L	100 µg/L	–	10 µg/L
California (OEHHA 2012 [5183])	Cattle, subchronic water intake	0.9 µg/L	40 µg/L	–	5 µg/L
Indiana (IN DEM 2021 [5117])	Dog recreational	0.8 µg/L	Any detection	Any detection	1.0 µg/L
Oregon (OR HA 2019a [5189])	Dog recreational	0.2 µg/L	0.4 µg/L	0.02 µg/L	0.4 µg/L
Pennsylvania (PA DEP 2017 [5193])	Dog, non-specified	0.2 µg/L	0.6 µg/L	3 µg/L	0.2 µg/L

Background: Characterize the universe of benthic HABs in NYS

Streams

Sampled 2017-2021

- >1000 sites over 5 years
  - All screening sites over 5 years (included spatially balances and targeted sites)
- Scrape and water column samples

Lakes

Sampling 2024-2025

- 80 sites over 2 years
  - Spatially balanced site selection (Probabilistic)
- Scrape, integrated disturbance sample and floating mat samples

Stream Benthic HABs

Stream Benthic HABs : Study Design

1. Are there areas of the state that have higher occurrence of cyanobacteria/toxins?
2. Are cyanobacteria/toxins detected primarily in the periphyton or in the water column?
3. Are there specific drivers that contribute to occurrence of cyanobacteria/toxins?

Stream Benthic HABs : Study Design

Sampled 2017-2021

- >1000 sites over 5 years
  - included spatially balanced and targeted sites
- Scrape and water column samples
- Cyanotoxins, microscopy, nutrients, and physical habitat
- Macroinvertebrates
- Cyanotoxins included
  - Microcystin and congeners
  - Anatoxin A
  - Cylindrospermopsin
  - Saxitoxin (PSP)

Stream Benthic HABs : Sample Types

Scrape = 3 representative bottom type composites
Raw water = surface skim grab in “still” area

Stream Benthic HABs: Design Limitations

Study design

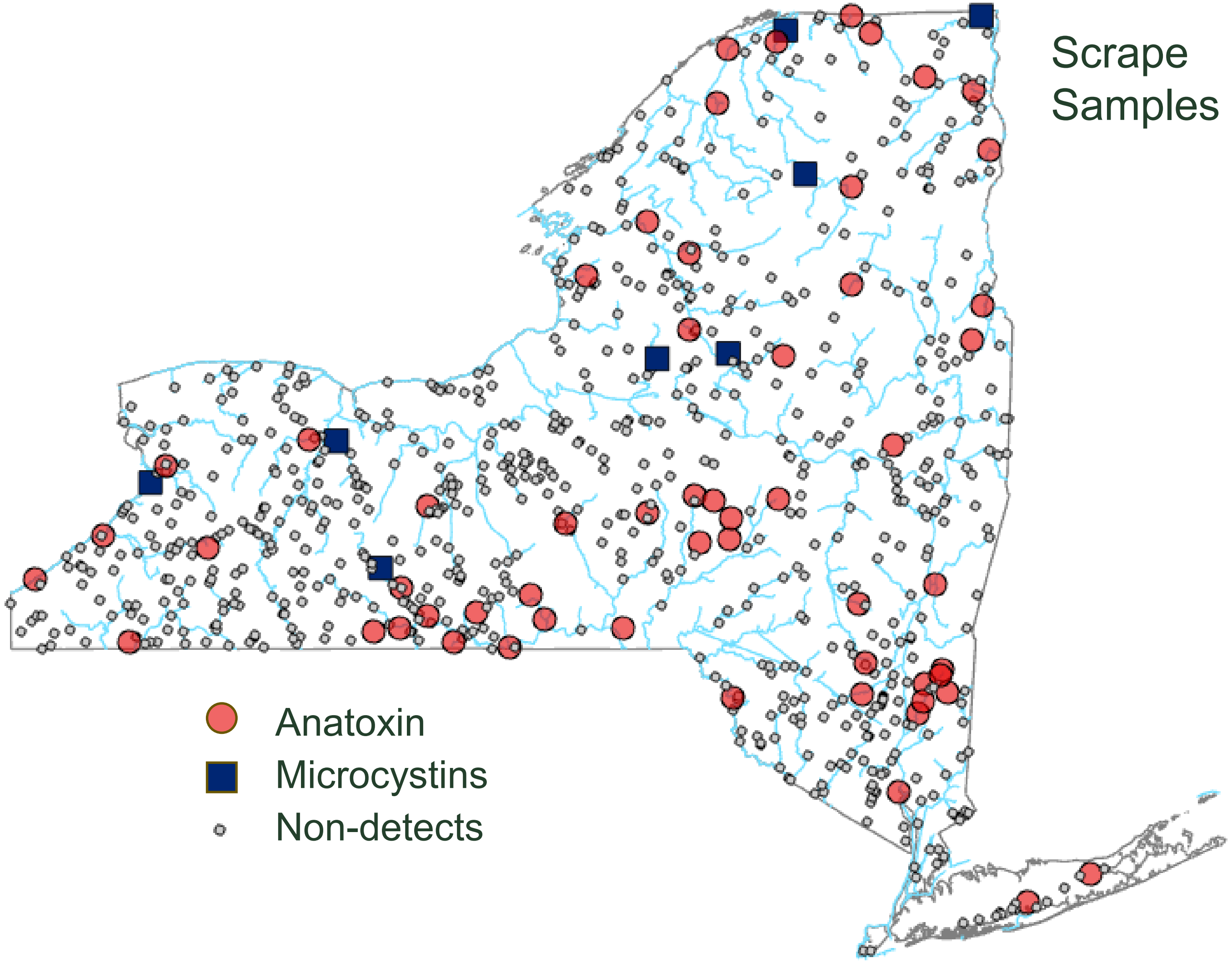
- Spatial vs. temporal elements – visited sites 1 x
  - Potential to “miss” bloom windows
  - Seasonality – community dynamics
- Composites
  - Composited “representative” substrate
  - Compositing also might “dilute” signal from potential hot spots along reaches
  - Dominant taxa vs whole community analysis (potential to be dominated by diatoms)

Stream Benthic HABs : Cyanobacteria Presence

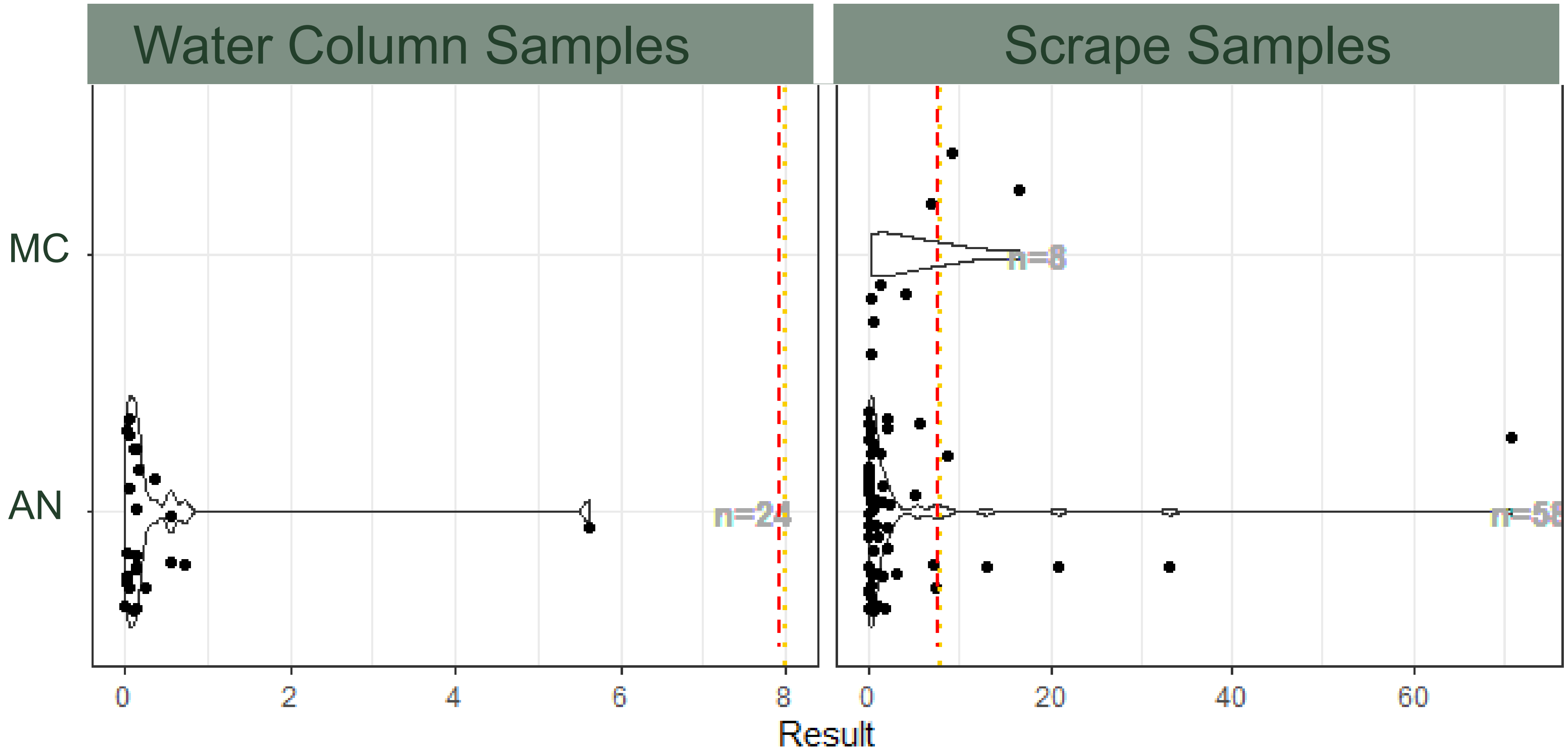
- Cyanobacteria taxa found at:
  - 18% sites in the water column samples
  - 26% sites in the scrape samples
- Dominant taxa included *Oscillatoria* and *Phormidium* in the periphyton
- Water column samples were dominated by *Microcystis* and *Oscillatoria*

Stream Benthic HABs : Cyanotoxin Detections

- Cyanotoxin detections rare
  - Water column – 3%
  - Scrape – 8%
  - anatoxin dominated, microcystin present, no cylindrospermopsin detections
- No significant differences in spatial grouping (i.e., basin or eco-region).
- Generally more common at sites with lower TP, TN, conductance, canopy, higher natural landcover



Stream Benthic HABs : Cyanotoxins



- Most detections in scrapes
- Most MC detections in scrapes samples below EPA MC recreational guidance (8 ug/L)
- DOH working off of 4 ug/L (MC)
- Anatoxin dominated scrape samples

Stream Benthic HABs : Site Differences

Several nutrient and physical habitat characteristics significantly differed in detection category (cyanotoxins present or absent)

- **Canopy cover** – detections at sites with lower canopy cover
- **Natural landcover-** detections at sites with higher natural landcover
- **Total P** – detections at sites with lower total P
- **Total N** – detections at sites with lower total N
- **Specific Conductance** – detections at sites with lower specific conductance

However ~ weak predictive power for risk assessments, less than 20% of the variability using a Principal Components Analysis (PCA).

Stream Benthic Results : Wrap Up

Benthic cyanotoxins were detected in **some streams** – but not everywhere

Detection seems linked to specific local environmental conditions

More likely where:
Lower canopy cover
Higher natural landcover
Lower nutrients

Detections ≠ widespread risk

Benthic cyanobacteria are a normal part of stream ecosystems

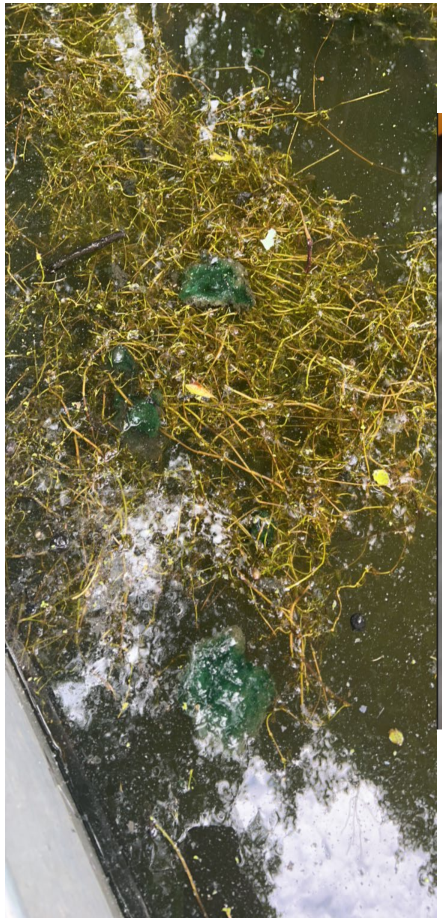
Lake Benthic HABs

NEW 2024-2025 Lake Benthic Cyanobacteria Monitoring

Characterize cyanobacteria/toxins in the littoral zone.

1. What is the potential for recreational contact?

2. What are potential drivers of benthic cyanobacteria?



Sampling 2024-2025

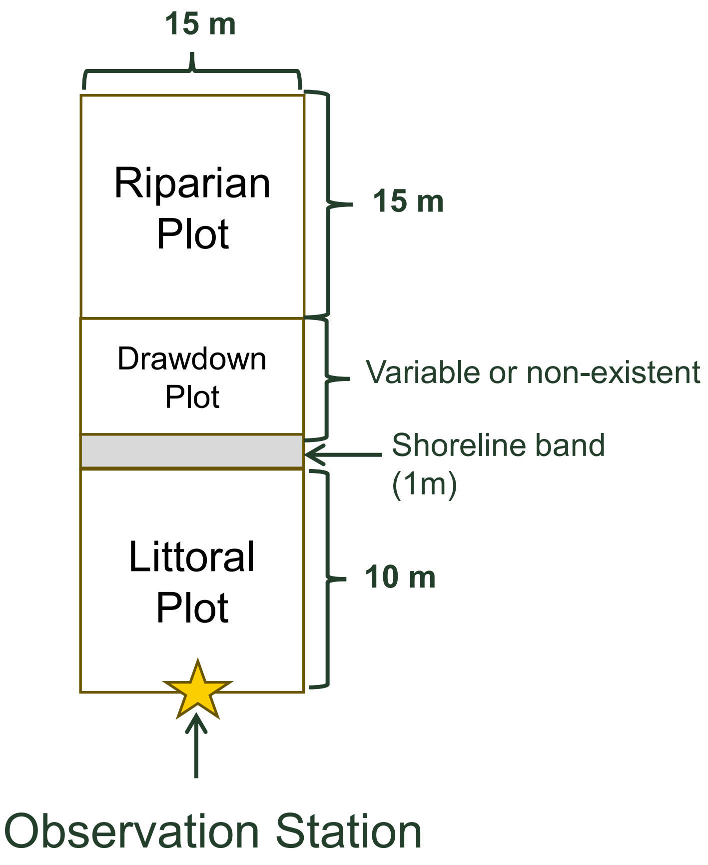
- 80 sites over 2 years (Probabilistic)
  - Microcystin and congeners, Cylindrospermopsin, Nodularin, Anatoxin A
  - Chlorophyll by Fluoroprobe
  - Microscopy for dominant taxa

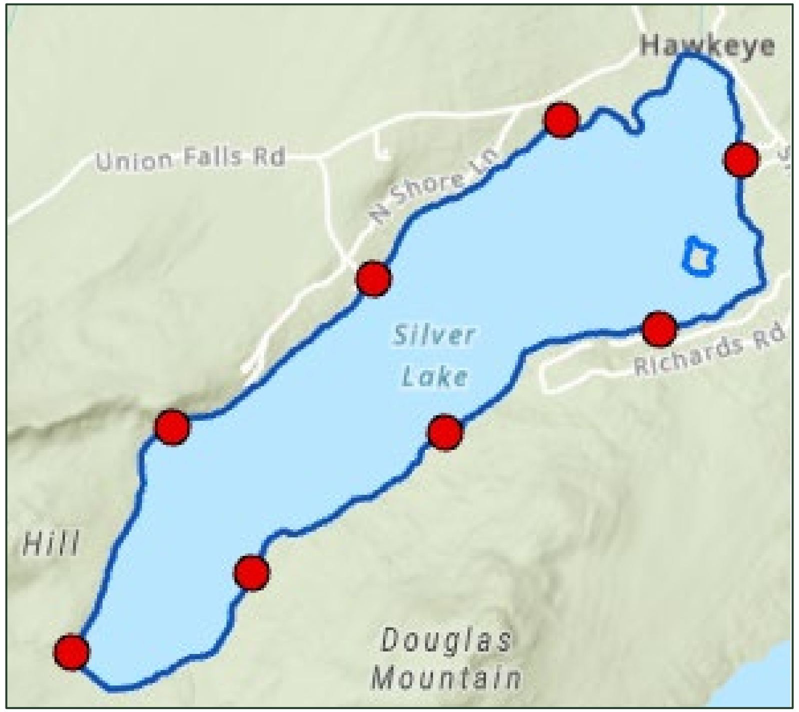
Subsampling 8 substations per Lake

- Percent cover estimates at each substation
- Composite benthic scrape (periphyton)
- Composite Integrated Disturbance Sample - recreational contact (water column)
- Presence/Absence of floating mats at each substation
- Physical Habitat Survey

Lake Benthic HABs : Study Design - Integrated Disturbance Sample

1 composite per lake





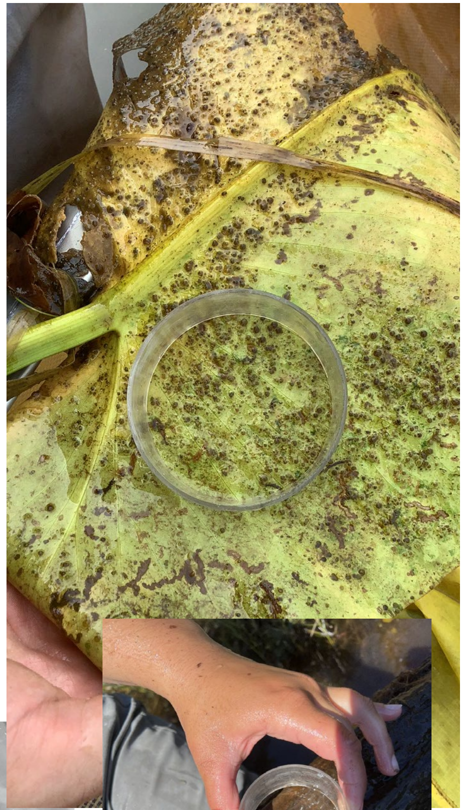
- 1 sample at knee depth at each observation station after a “typical” recreational disturbance
- 1 m^2 plot area x 8 substations for a final IDS sample (125 mls from each substation homogenized into 1L))

Lake Benthic HABs : Study Design - Composite Benthic Mat Samples

Collect representative sample from substrate at each substation using the integrated tube disk (right) to collect a known area of substrate.

- Soft bottom substrates – use sediment core
- Hard bottom substrates – use disk OR scrape from plants/rocks that can't be picked up to sample with disk as the guide

Regardless of sample type – use DI water to homogenize scrapes to a known volume per substation (125 mls per substation for final 1L composite)



Lake Benthic HABs : Study Design - Floating Mats

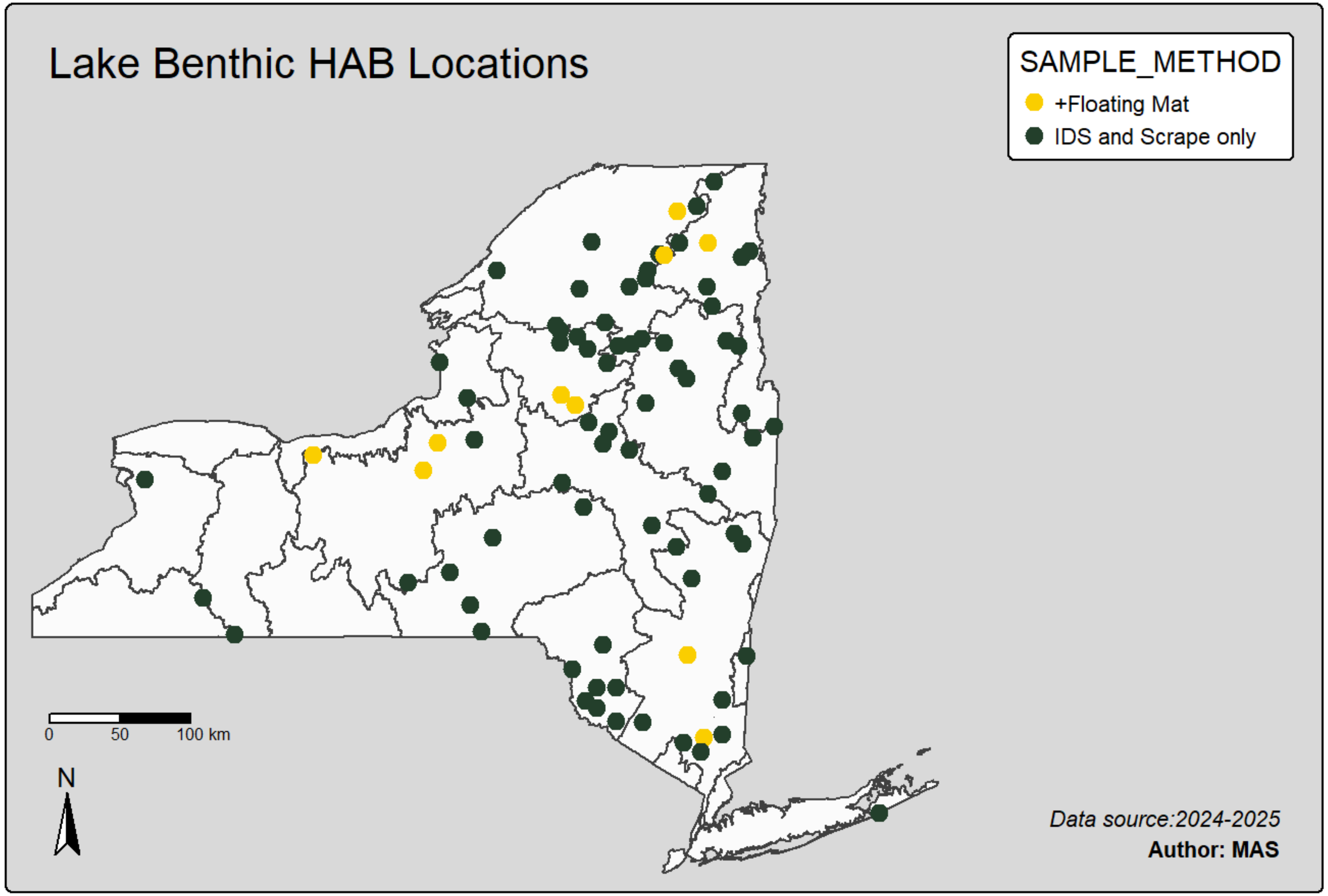
- Collect mat samples if observed in waterbody
- Only collected if observed

Lake Benthic HABs : Limitations of Study Design

Study design

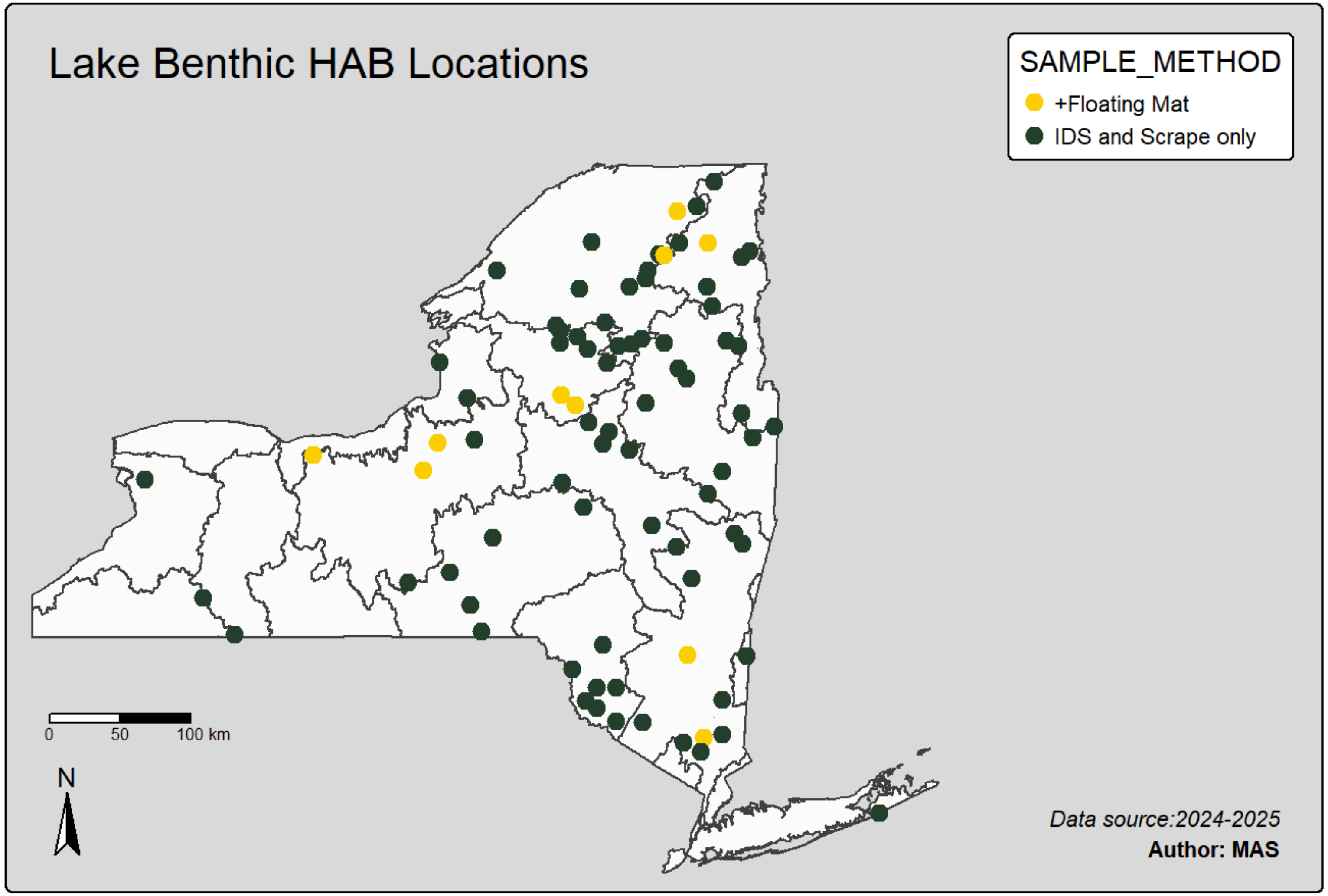
- No temporal component; this design focuses on spatial spread and not seasonality (Similar to Stream component)
    - Potential to "miss" bloom windows
- Composites
    - By compositing/aliquoting subsamples we may "miss" pockets of cyanobacteria/cyanotoxins in the biofilm
    - Compositing also might "dilute" signal from potential hot spots in lake
    - Dominant taxa vs whole community analysis (potential to be dominated by diatoms)

Lake Benthic HABs : Study Design



- 80 Lakes over 2 years
- Random, spatially balanced sampling using lake size category
- 11 floating mat samples observed and collected

Lake Benthic HABs : Results



Results coming soon!

Preliminary analysis indicates most detections at levels below the EPA recreational threshold (MC)

Most detections are in the scrapes and highest in floating mat samples

% cover not correlated with toxin detections

Range of trophic class detections

Lake Benthic HABs : Results

- Easily identifiable in the field!

Know it, Avoid it, Report it

Benthic HABs in NYS : Current Findings

Streams

Cyanotoxin detections rare, anatoxins most common

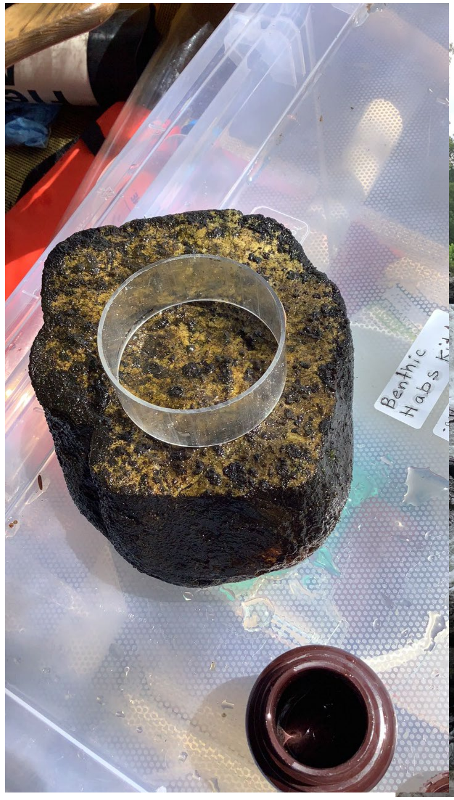
Lakes

Prelim: microcystin most common, range of waterbody classes

Cyanotoxins more common in the scraped benthic samples than paired water column or IDS samples

Current models = low predictive power

Detections ≠ widespread risk



Benthic HABs in NYS : Big Picture

Presence

Benthic cyanos are out there and normal in surface waters

Understanding

These studies help to identify patterns linked to benthic characteristics

Targeted Monitoring

Continue to focus monitoring to answer outstanding questions

Informed Decisions

We can use that info to guide effective, proportional decisions

Know it, Avoid it, Report it

Contact Information

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Questions?

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