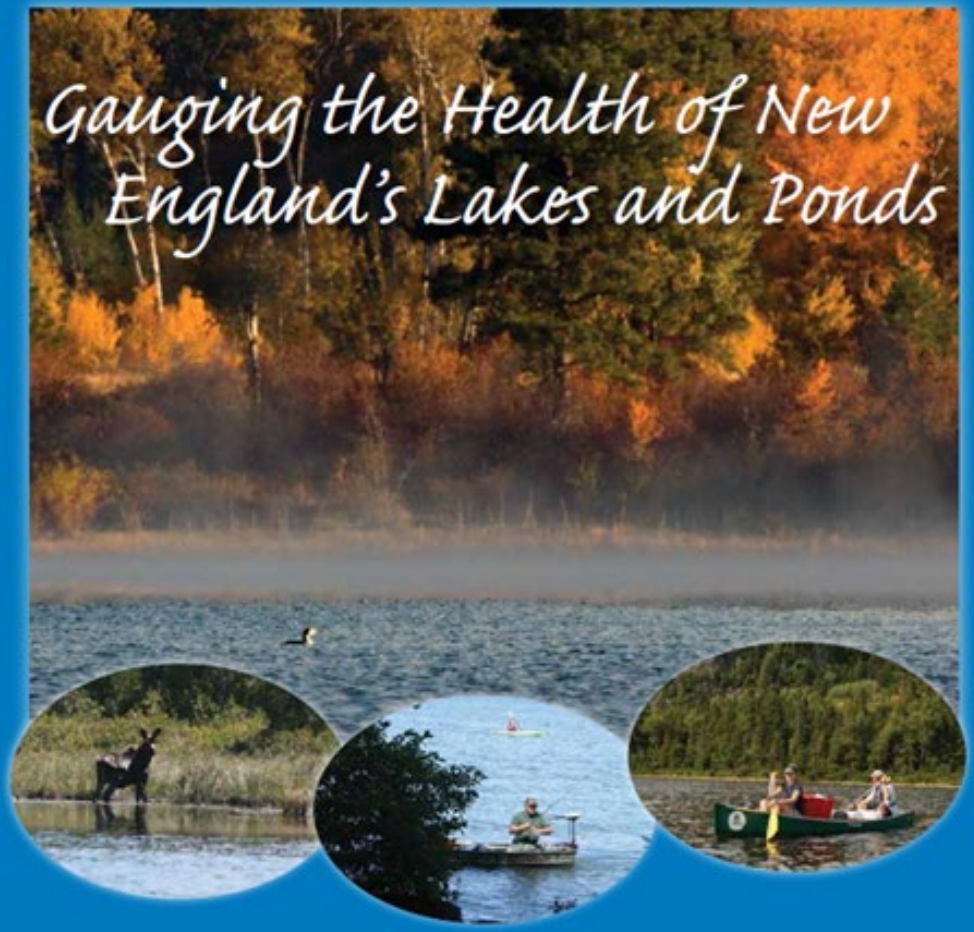
Cyanobacteria Monitoring Collaborative

History, tools, and lessons learned

USEPA Region 1

Laboratory Services and Applied Sciences Division

Gauging the Health of New England's Lakes and Ponds

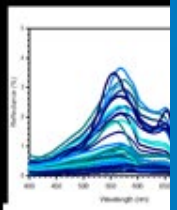


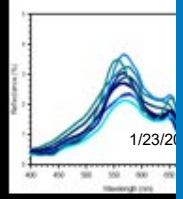
A Survey Report and Decision-Making Resource

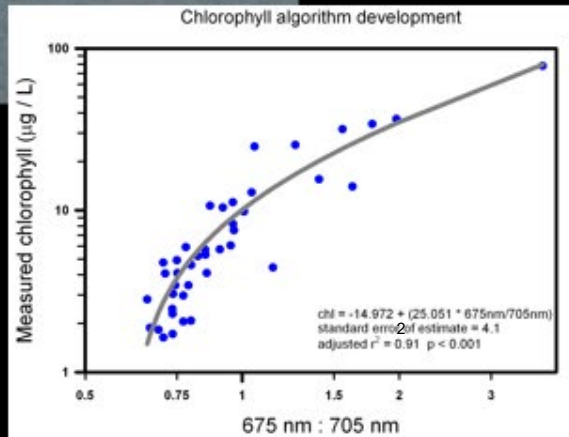
OCTOBER 2010

NEIWPCC
New England Interstate Water Pollution Control Commission

EPA United States Environmental Protection Agency







Initial Meeting Outcomes-Jun 26th, 2013

- Small group of technical experts ***(you)*** willing to work towards development of a standardized regional architecture to monitoring & documenting HABs
- Development of ***useful*** products
  - Federal/State/Local
- Not a replacement to existing programs-viewed as an enhancement to existing monitoring programs-All volunteer participation

Regional and National Partners

EPA Region 1 Working Group: Cyanobacteria Monitoring in New England
6 February 2014

Ideas/points for Discussion and Development of a Citizen-based Cyanobacteria Monitoring Program (CCMP)

1. **CCMP (full program) Features**
    1. **Universal Accessibility** (web portal with easy access to programs and data; all interested parties can participate, e.g. motivated individuals, lake associations, school classes)
    2. **Geographically Broad** (begin New England-wide, eventually??)
    3. **Citizen-centered Program** (role of "agencies" mainly supportive)
    4. **Designed to Minimize Costs** (reinforcing point "a")
    5. **Scientifically-based and Useful Objectives** (not just collecting data to collect data)
    6. **Utilize program-wide standardized operating procedures (**for consistency of data collection)
    7. **Designed to enhance learning about lake water quality issues and solutions**
    8. **Other?**
2. CCMP: consists of two complementary sub-programs
    1. **Bloom Watch (BW)**: focus on location, timing, composition and causes of cyanoblooms
        1. **Pros**: deals directly with blooms
        2. **Limitations**: does not address long-term changes in abundance/toxicity of lake populations of cyanobacteria
    2. **Non-Bloom Cyanobacteria Monitoring (NBCM):** focus on seasonal and long-term changes in the cyanobacteria and their toxicity for lakes and regions
        1. **Pros**: Tracks spatial/long-term changes in cyanobacteria
        2. **Limitations**: does not report on blooms that are often ephemeral and small spatial scale.

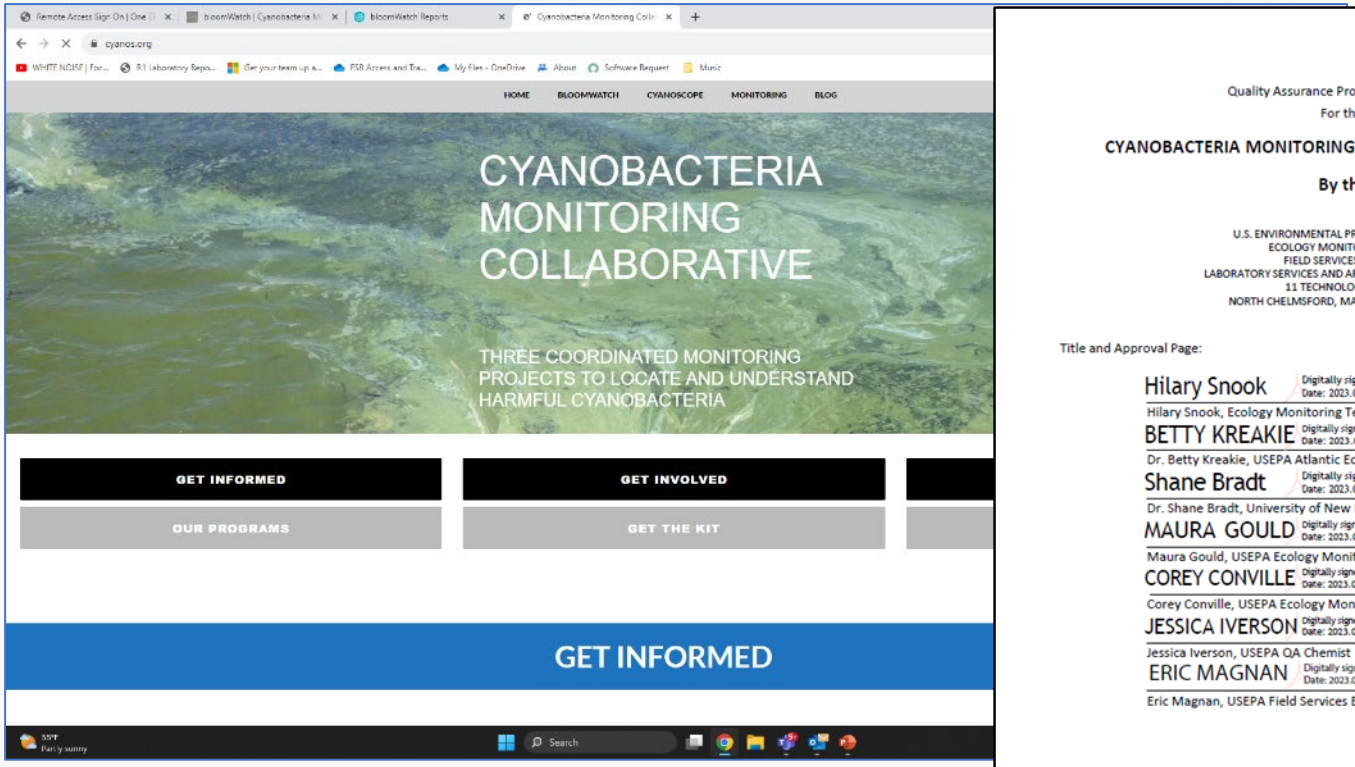
Tool Development

CyanoMon
Tracking progression
Forecasting/Trends
Temporal component

CyanoScope
System understanding
Education/awareness

bloomWatch
Notification/surveillance

Website development



Cyanobacteria Monitoring Collaborative Program QAPP
Rev: 1
June 22, 2021
Page 1 of 62

Quality Assurance Program Plan (QAPP)

For the:

CYANOBACTERIA MONITORING COLLABORATIVE PROGRAM

By the

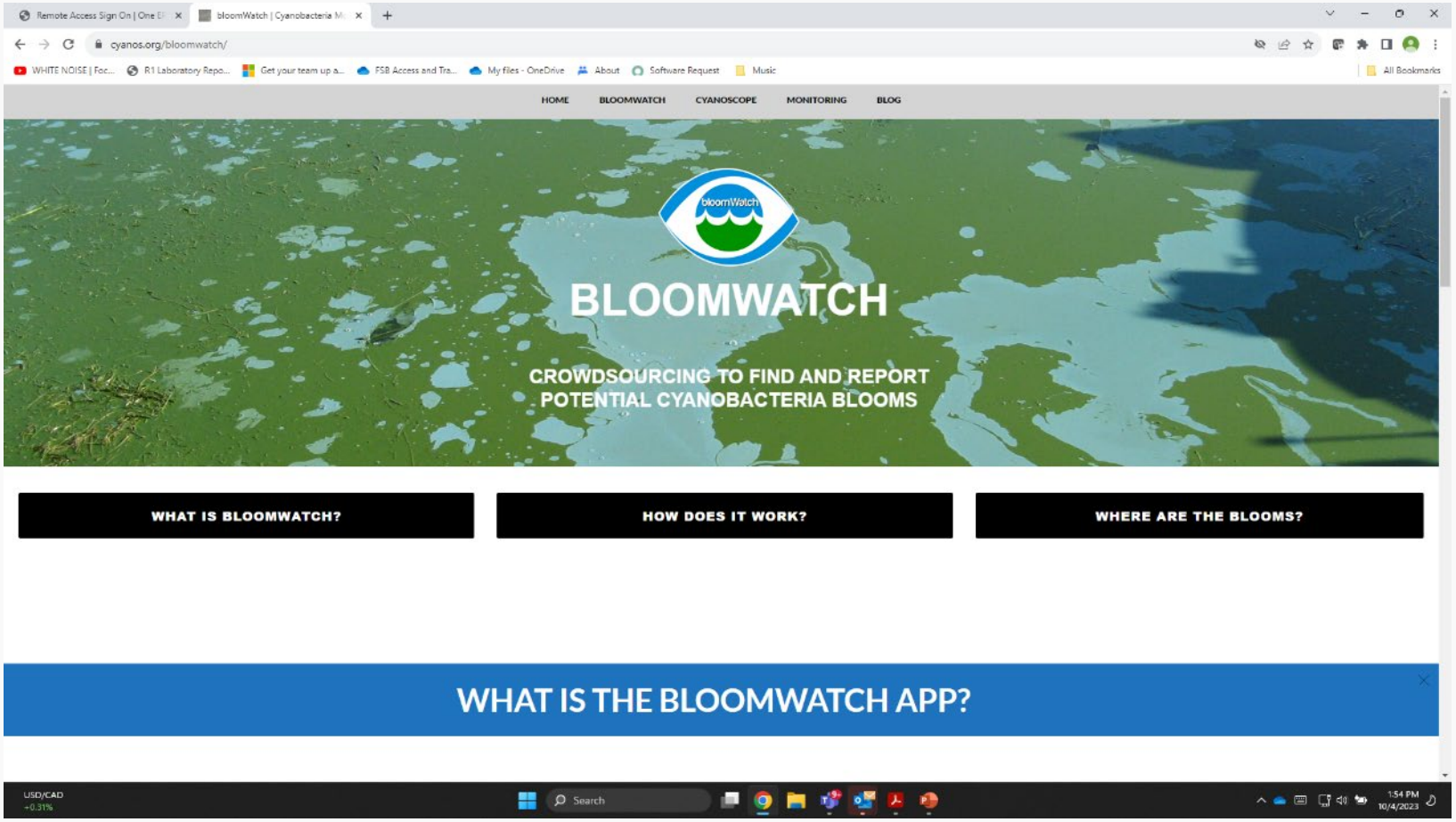
U.S. ENVIRONMENTAL PROTECTION AGENCY
ECOLOGY MONITORING TEAM
FIELD SERVICES BRANCH
LABORATORY SERVICES AND APPLIED SCIENCES DIVISION
11 TECHNOLOGY DRIVE
NORTH CHELMSFORD, MASSACHUSETTS 01863

Title and Approval Page:

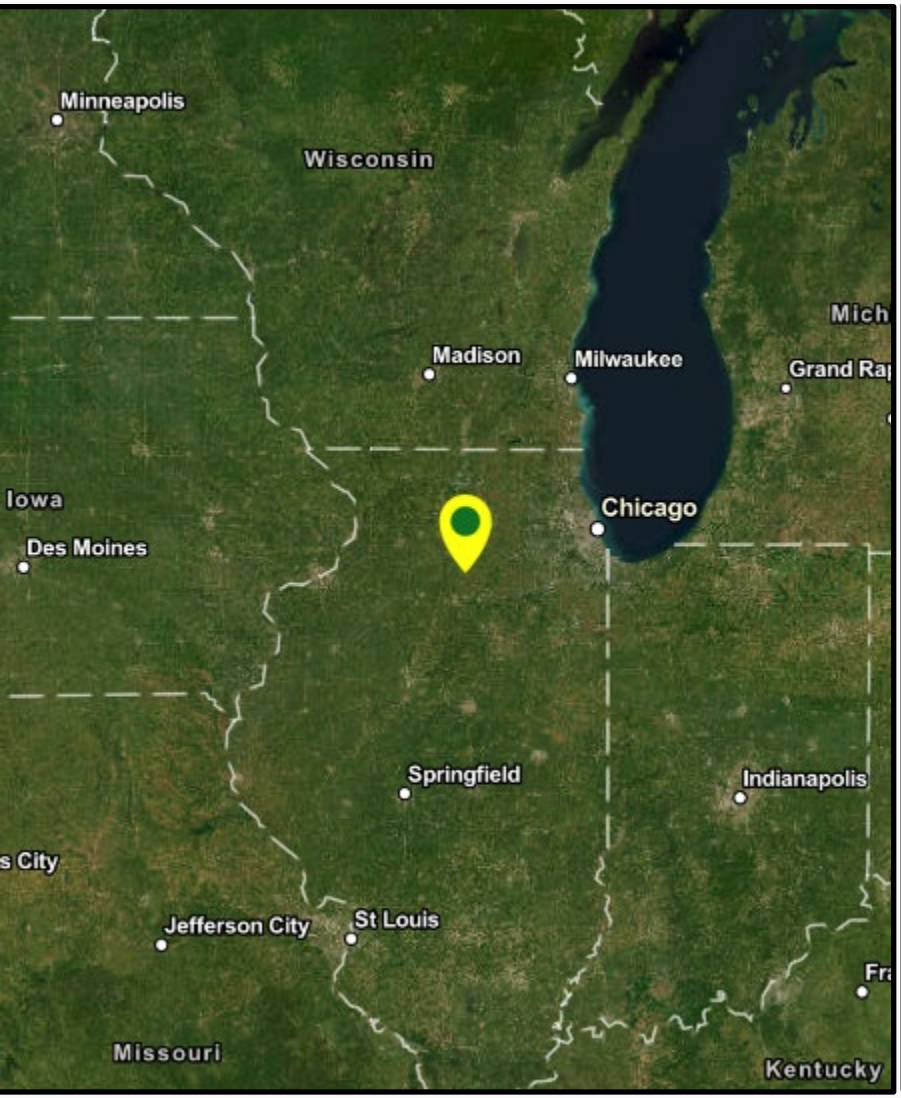
Hilary Snook — Digitally signed by Hilary Snook Date: 2023.07.31 15:19:05 -04'00'
Hilary Snook, Ecology Monitoring Team Project Lead
BETTY KREAKIE — Digitally signed by BETTY KREAKIE Date: 2023.07.31 16:00:06 -04'00'
Dr. Betty Kreakie, USEPA Atlantic Ecology Division
Shane Bradt — Digitally signed by Shane Bradt Date: 2023.07.31 17:11:03 -04'00'
Dr. Shane Bradt, University of New Hamshire
MAURA GOULD — Digitally signed by MAURA GOULD Date: 2023.08.03 12:46:19 -04'00'
Maura Gould, USEPA Ecology Monitoring Team
COREY CONVILLE — Digitally signed by COREY CONVILLE Date: 2023.07.31 15:24:38 -04'00'
Corey Conville, USEPA Ecology Monitoring Team
JESSICA IVERSON — Digitally signed by JESSICA IVERSON Date: 2023.08.01 09:45:54 -04'00'
Jessica Iverson, USEPA QA Chemist
ERIC MAGNAN — Digitally signed by ERIC MAGNAN Date: 2023.08.09 19:17:48 -04'00'
Eric Magnan, USEPA Field Services Branch Manager

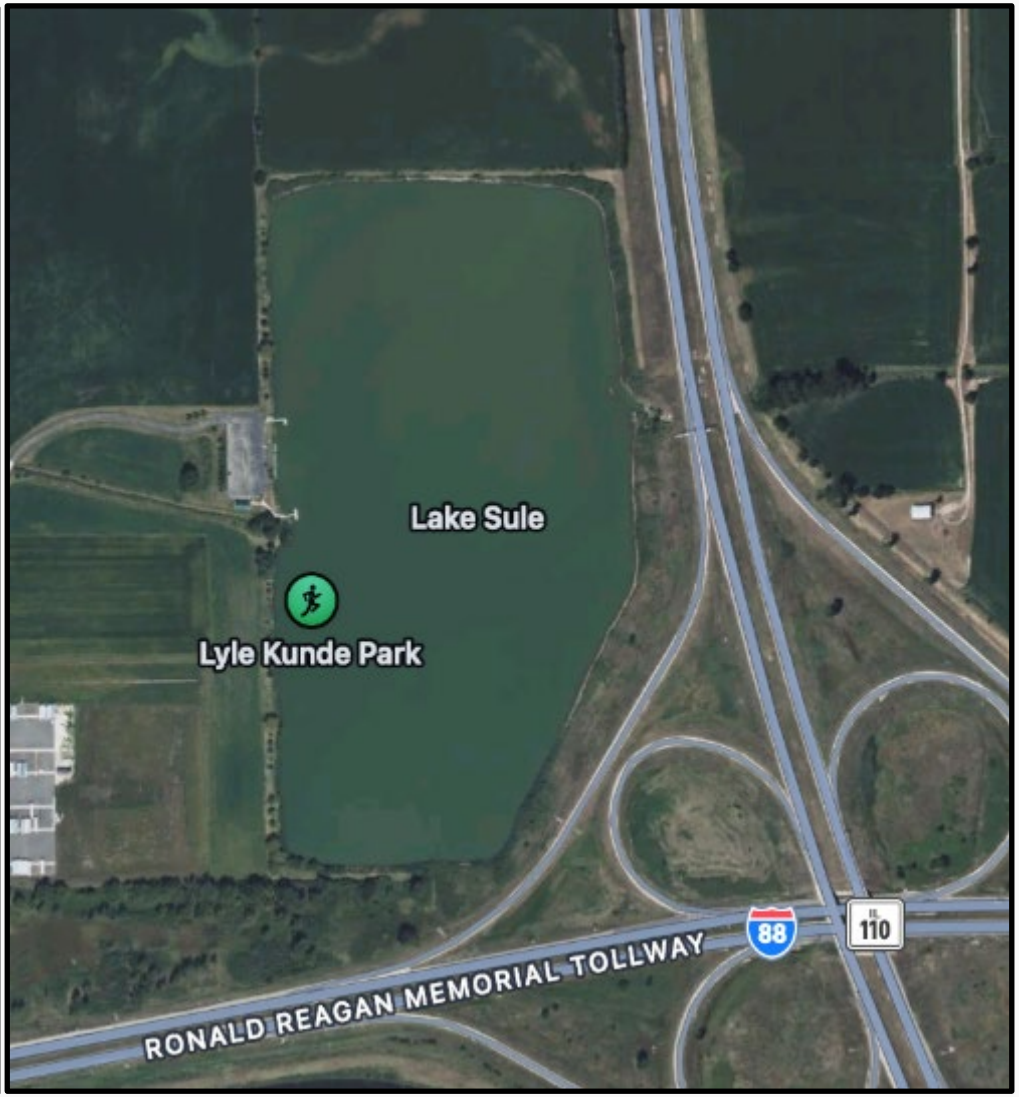
Video training clips, conference/webinar recordings, workshop recordings, equipment links, blog posts, quality assurance plans,

Real time reporting of extent, frequency, and duration



Lake Sule, Rochelle, IL July 21 to August 31, 2023





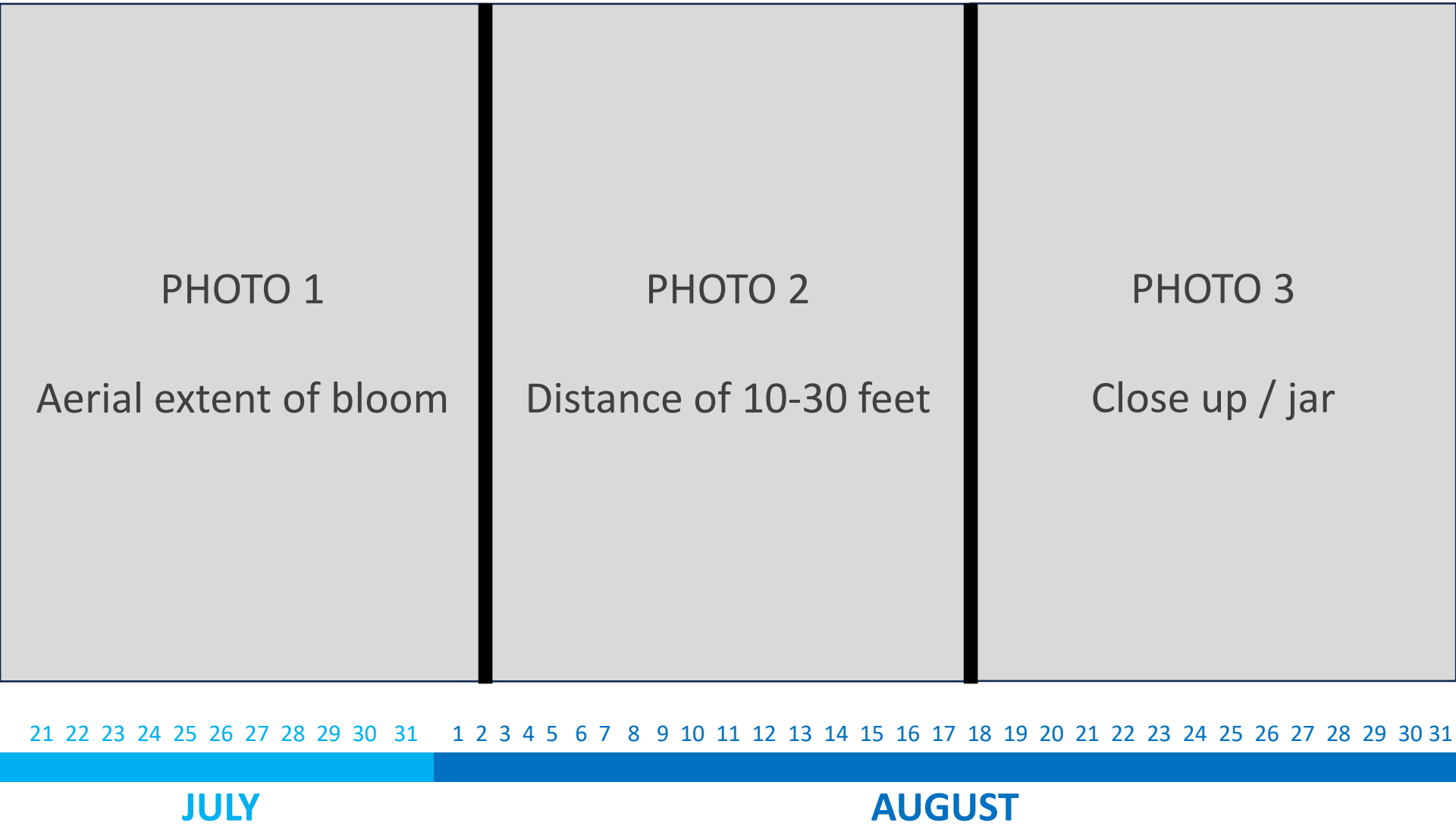
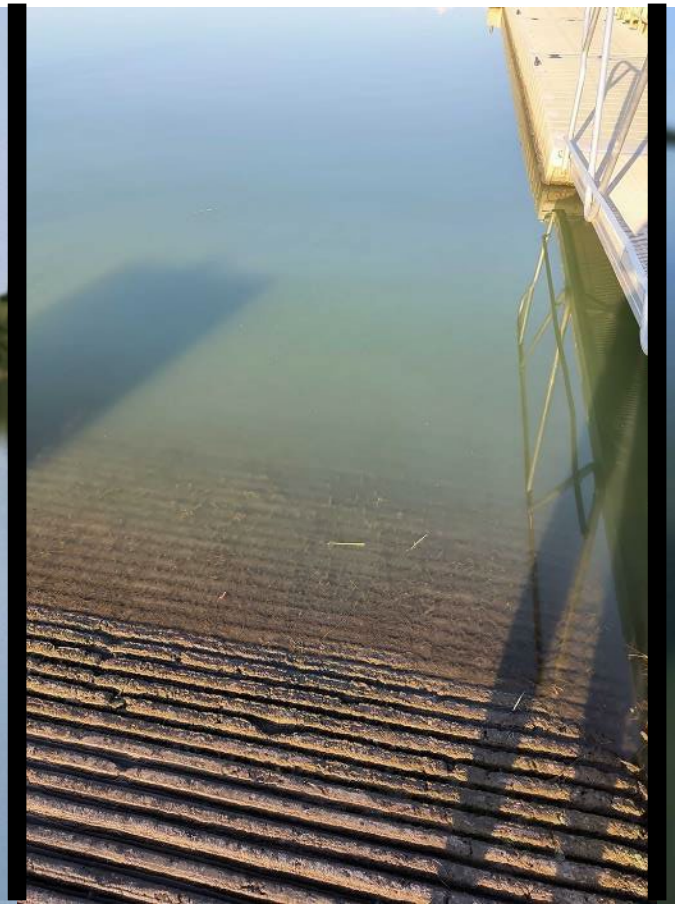


PHOTO 1
Aerial extent of bloom
PHOTO 2
Distance of 10-30 feet
PHOTO 3
Close up / jar
21 22 23 24 25 26 27 28 29 30 31
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
JULY
AUGUST



July 21st

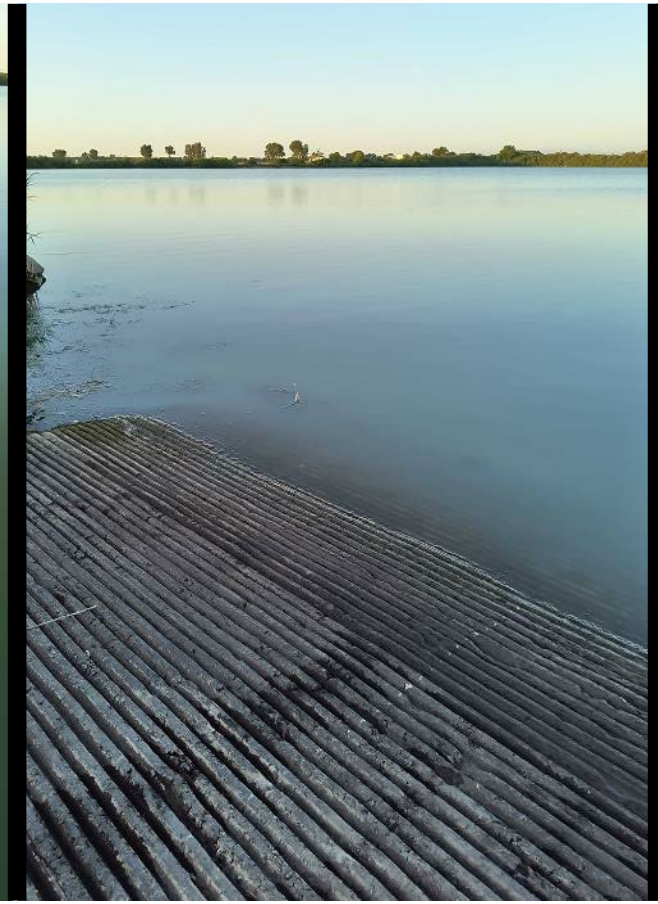
JULY

AUGUST

July 23rd

JULY

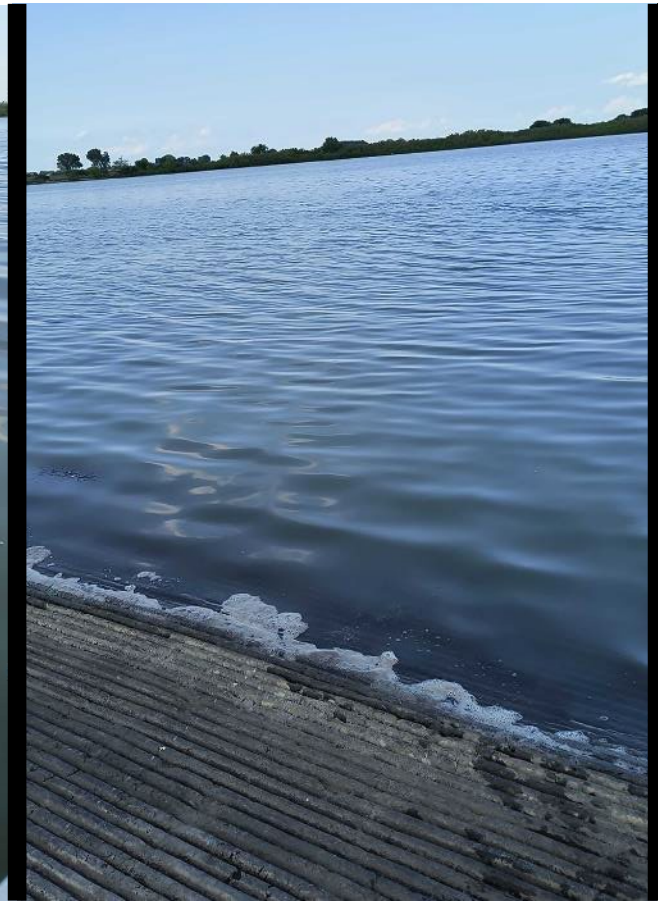
AUGUST



July 26th

JULY

AUGUST



July 31st

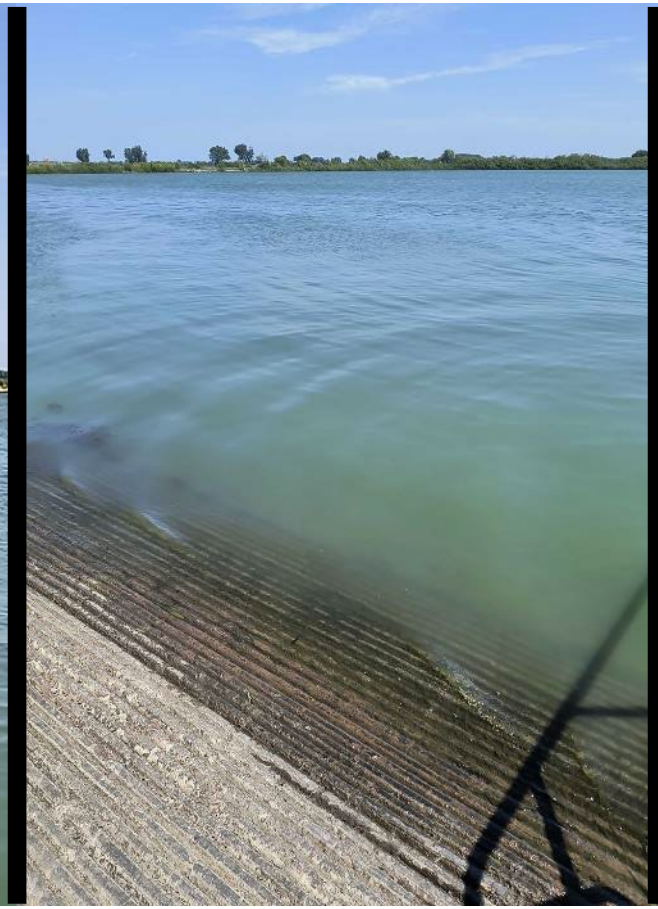
JULY

AUGUST

August 3rd

JULY

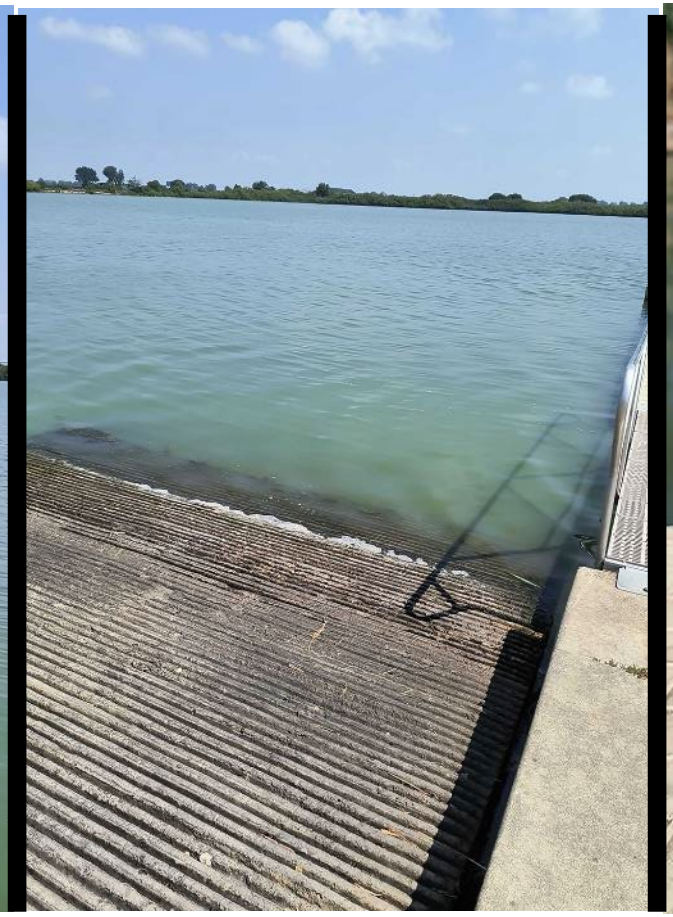
AUGUST



August 19th

JULY

AUGUST



August 22nd

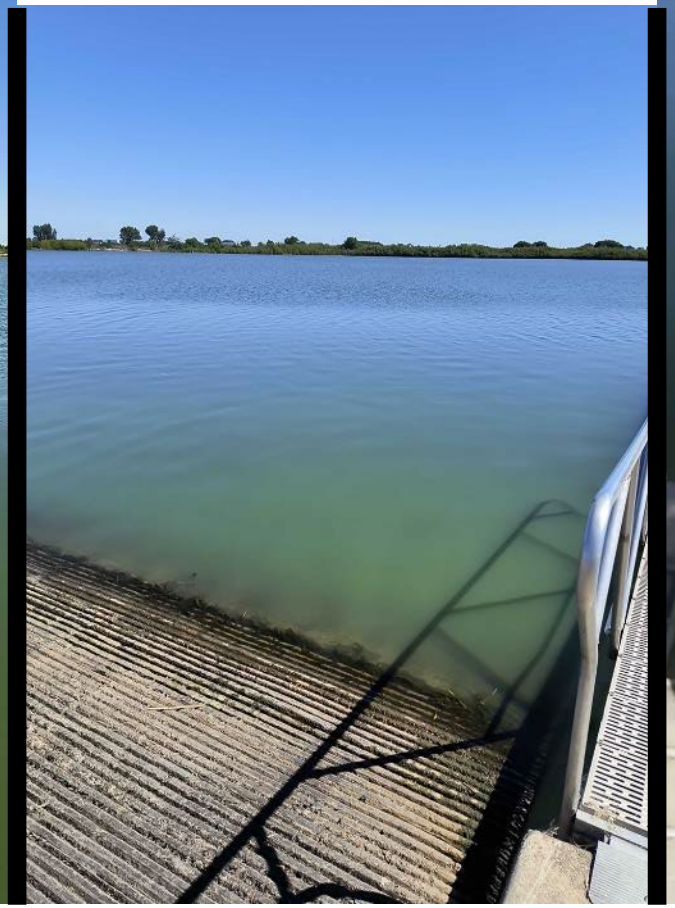
JULY

AUGUST

August 29th

JULY

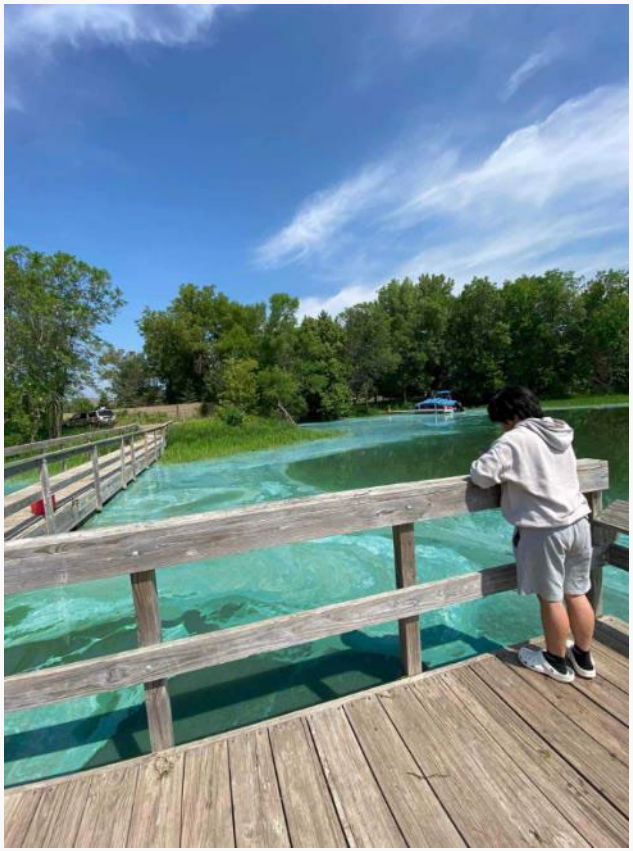
AUGUST

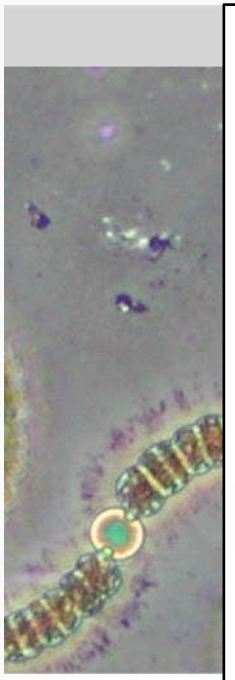


August 31st

JULY

AUGUST





cyanoScope

MAPPING CYANOBACTERIA ONE SLIDE AT A TIME

ADD OBSERVATIONS

cyanoScope

Stats

Totals

3200
Observations »

178
Species »

212
People »

Most Observations

clark_county_public_health
472 observations

h2opurist
245 observations

lanabluege
198 observations

townofbarnstable
195 observations

Most Species

kbeza31979
19 species

willbmisled
14 species

larryzsherman
11 species

skmayer
10 species

Most Observed Species

Microcystis aeruginosa
383 observations

Woronichinia naegeliana
180 observations

Dolichospermum lemmermannii
118 observations

Aphanizomenon flosaquae
89 observations

« Projects

Terms & Rules | Join this project

cyanoScope

MAPPING CYANOBACTERIA ONE SLIDE AT A TIME

Toxic Cyanobacteria of New England

cyanoScope

Print

The inaturalist cyanoscope project https://www.inaturalist.org/projects/cyanoscope is a citizen science based program to photograph and identify cyanobacteria and other phytoplankton. This guide is a work in ...more ↓

All 16

TAGS

- BMAA 1
- Cyanobacteria 1
- Microcystin 1
- toxin 1

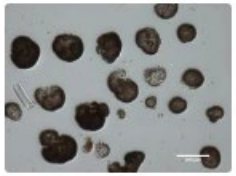
TAXONOMY

- Order Chroococcales 1
- Order Nostocales 8
- Order Oscillatoriales 5
- Order Synechococcales 1

Search | Search

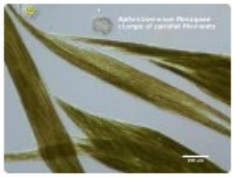
Sort | Grid | Card

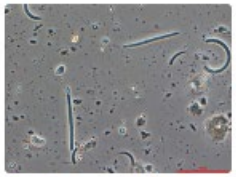

Microcystis [1]


Woronichinia [1]


Anabaena [1]

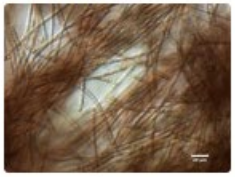

Dolichospermum [1]

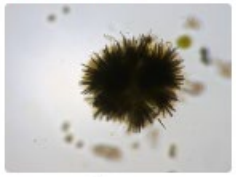

Aphanizomenon [1]

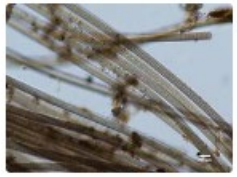

Cylindrospermopsis [1]


Planktothrix [1]

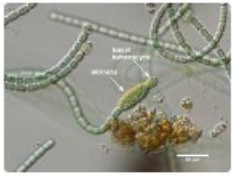

Nostoc [1]

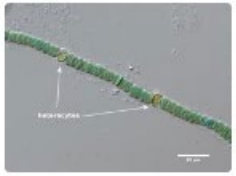

Phormidium [1]


Gloeotrichia [2]


Oscillatoria [1]


Lyngbya [1]


Cylindrospermum [1]


Nodularia [1]


Oscillatoriales [1]

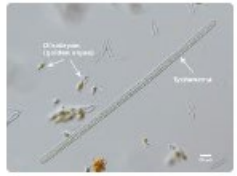

Tychonema [1]

Photo Credits

1. (c) rmatth, some rights reserved (CC BY-NC-SA), uploaded by rmatth, 2. (c) Kyle Kerger, some rights reserved (CC BY-NC), uploaded by Kyle Kerger

Other bookmarks

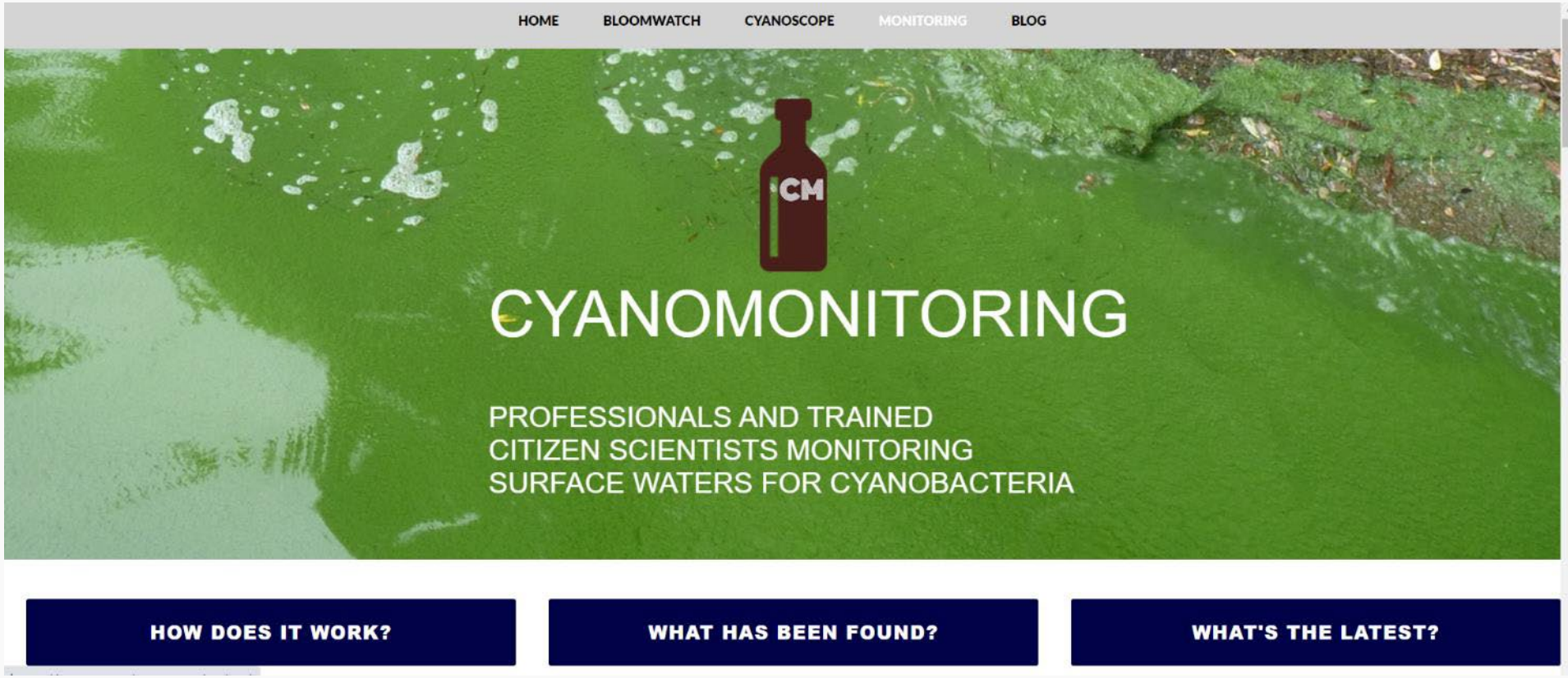
Filters

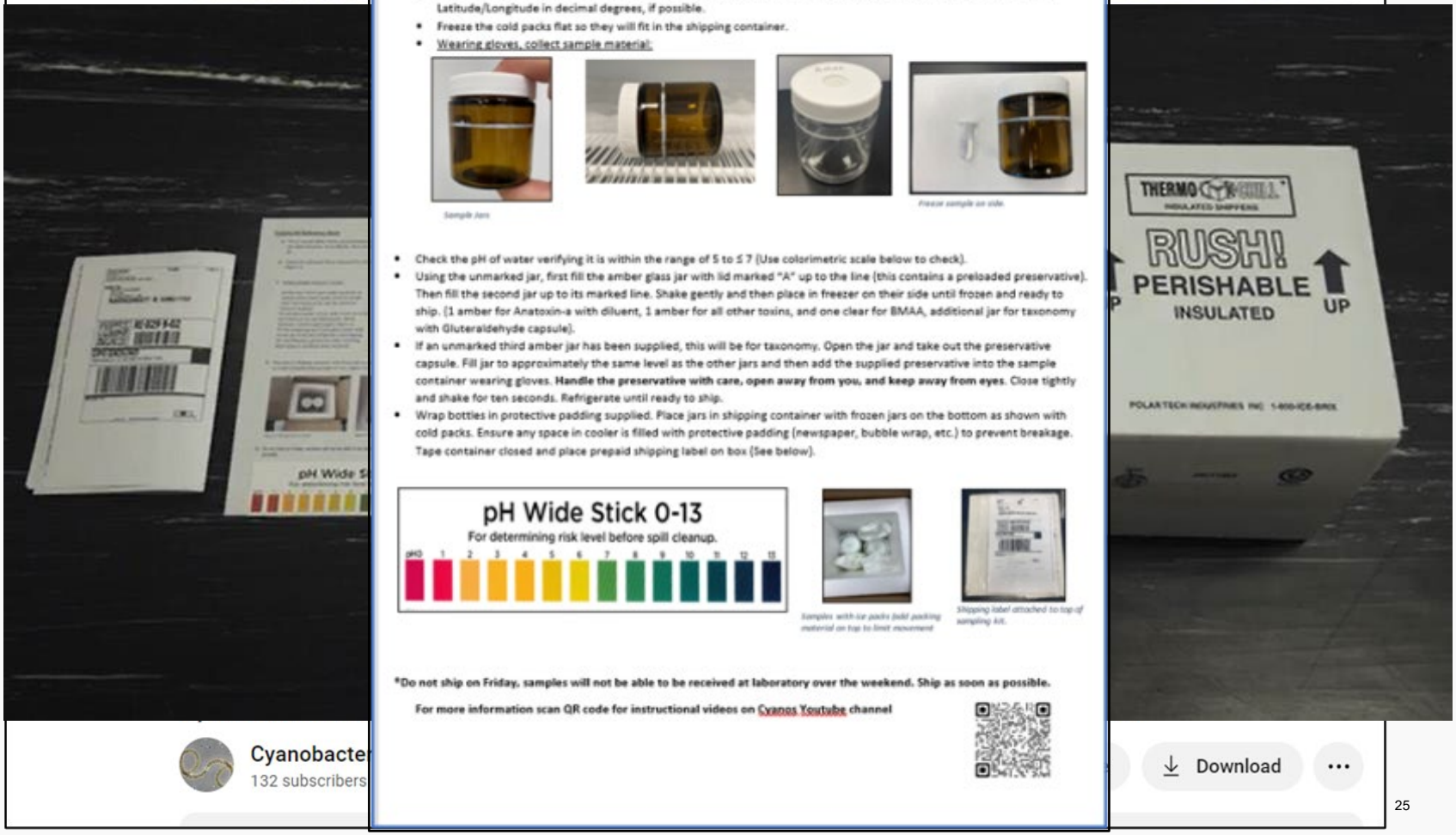
1mo

3mo

9:03 AM
4/26/2023

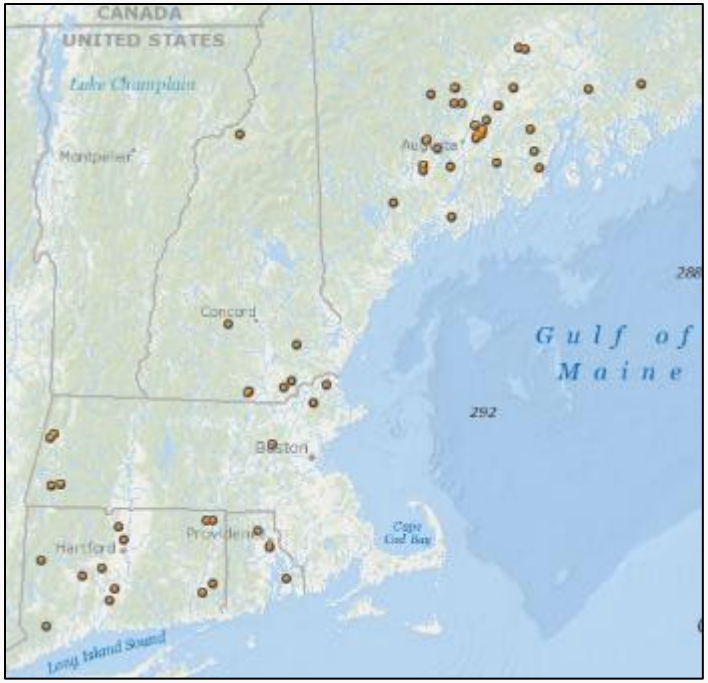
Tools


HOME
BLOOMWATCH
CYANOSCOPE
MONITORING
BLOG
CM
CYANOMONITORING
PROFESSIONALS AND TRAINED
CITIZEN SCIENTISTS MONITORING
SURFACE WATERS FOR CYANOBACTERIA
HOW DOES IT WORK?
WHAT HAS BEEN FOUND?
WHAT'S THE LATEST?

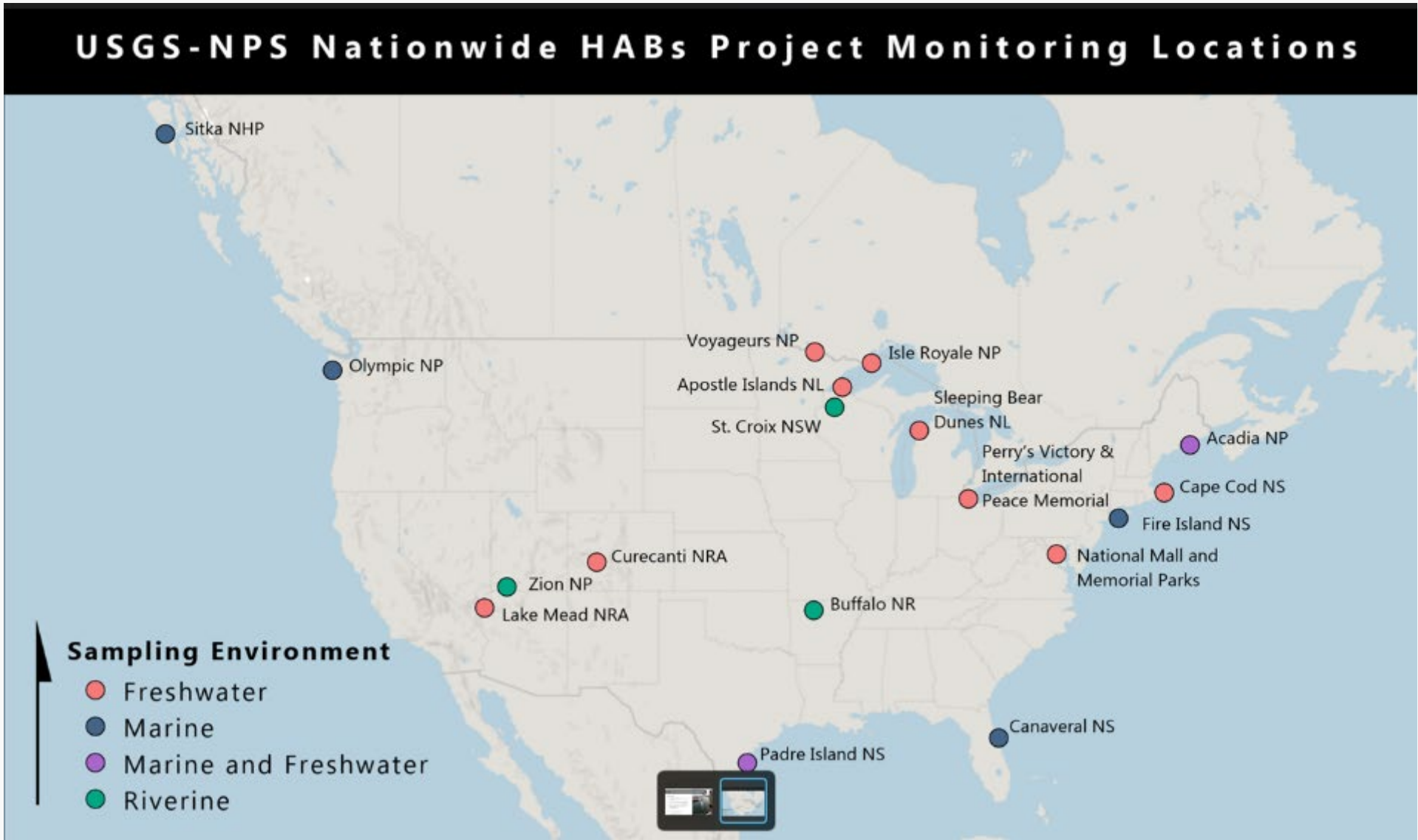

YouTube
Cyanobacte
132 subscribers
Download
Cyanobacteria Sample Kit Reference Sheet
In the field, first take any bloomWatch images and submit them in the app. Record location coordinates (lat:long) on the sample jar.
View sampling instructional video prior to collection (see QR code below).
Fill out sample labels clearly and completely and apply to sample jars. There are two labels for each jar. Please fill out Latitude/Longitude in decimal degrees, if possible.
Freeze the cold packs flat so they will fit in the shipping container.
Wearing gloves, collect sample material:
Check the pH of water verifying it is within the range of 5 to ≤ 7 (Use colorimetric scale below to check).
Using the unmarked jar, first fill the amber glass jar with lid marked "A" up to the line (this contains a preloaded preservative). Then fill the second jar up to its marked line. Shake gently and then place in freezer on their side until frozen and ready to ship. (1 amber for Anatoxin-a with diluent, 1 amber for all other toxins, and one clear for BMAA, additional jar for taxonomy with Gluteraldehyde capsule).
If an unmarked third amber jar has been supplied, this will be for taxonomy. Open the jar and take out the preservative capsule. Fill jar to approximately the same level as the other jars and then add the supplied preservative into the sample container wearing gloves. Handle the preservative with care, open away from you, and keep away from eyes. Close tightly and shake for ten seconds. Refrigerate until ready to ship.
Wrap bottles in protective padding supplied. Place jars in shipping container with frozen jars on the bottom as shown with cold packs. Ensure any space in cooler is filled with protective padding (newspaper, bubble wrap, etc.) to prevent breakage. Tape container closed and place prepaid shipping label on box (See below).
pH Wide Stick 0-13
For determining risk level before spill cleanup.
pH 0 1 2 3 4 5 6 7 8 9 10 11 12 13
*Do not ship on Friday, samples will not be able to be received at laboratory over the weekend. Ship as soon as possible.
For more information scan QR code for instructional videos on Cyanos Youtube channel
THERMO
INSULATED SHIPPERS
RUSH!
PERISHABLE
INSULATED
UP

Region 1 Engagement

- Grab samples collected by state and local partners, LSASD supplied kits
- Samples shipped to lab for toxin analysis
- 100+ samples analyzed for multiple toxins



USGS-NPS Nationwide HABs Project Monitoring Locations



USGS-NPS Nationwide HABs Project Monitoring Locations

Sitka NHP
Olympic NP
Voyageurs NP
Isle Royale NP
Apostle Islands NL
St. Croix NSW
Sleeping Bear Dunes NL
Perry's Victory & International Peace Memorial
Acadia NP
Cape Cod NS
Fire Island NS
National Mall and Memorial Parks
Yosemite
Devil's Postpile
Curecanti NRA
Zion NP
Lake Mead NRA
Buffalo NR
Canaveral NS
Padre Island NS

Sampling Environment

- Freshwater
- Marine
- Marine and Freshwater
- Riverine

Trainings - Mobile Laboratory On-Site & Remote


CONNECTICUT
Conservation Districts
University of Massachusetts Amherst
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ROGER WILLIAMS PARK
Conservancy
Aemera
Norwich Public Utilities
American Water Works Association
Dedicated to the World's Most Vital Resour
Massachusetts Department of Public Health
Cyanobacteria in Recreational Waters in Massachusetts
2022 Local Board of Health Guidance
Wolfeboro
NEW HAMPSHIRE
Official Town Website
NH LAKES
LAKE STEWARDS OF MAINE
Volunteer Lake Monitoring Program
RIEMC
RHODE ISLAND ENVIRONMENTAL MONITORING COLLABORATIVE
Harmful Algal Blooms
CALIFORNIA WATER BOARDS
Central Valley - R5
THE HERRING PONDS
WATERSHED ASSOCIATION
Association of Clean Water Administrators
ACWA
Stormwater Innovation Center
AWWA
UMass Dartmouth
Public university in Dartmouth, Massachusetts
FRIENDS OF PETERS POND
Pisces Foundation
CitSci
National Park Service
scistarter
Science we can do together.
LAKE STEWARDS OF MAINE
VOLUNTEER LAKE MONITORING PROGRAM
US Army Corps of Engineers
Royalston, Massachusetts
The City of WORCESTER
WALPA
Washington State Lake Protection Association
New England Chapter
NALMS
CISMA
Sudbury-Assabet-Concord River Watershed
APCC
Association to Preserve Cape Cod
MANILA WATER
CARE IN EVERY DROP
MA COLAP
Massachusetts Congress of Lake and Pond Associations
KINGSTON
Massachusetts
SHARON
MASSACHUSETTS
PENNICHUCK
Lake Archer
A Massachusetts Lake Community

Success Stories

Bloomwatch (EPA)

CyanoHAB Report (CA)

The City of WORCESTER

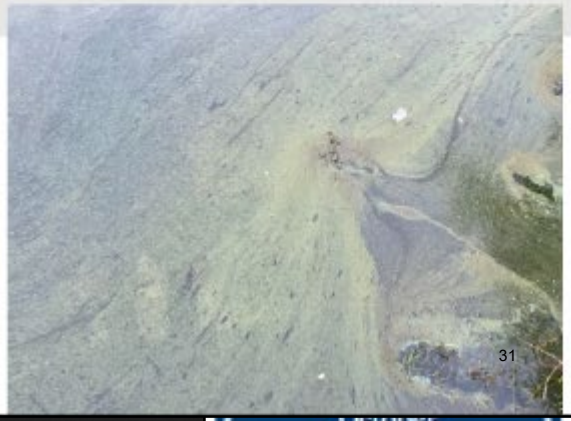
Search... GO!

WORCESTER 311 DEPARTMENTS TRANSLATE

Stormwater Innovation Center

HOME ABOUT MONITORING STORMWATER BMPs MAP TRAINING VIDEO EVENTS GET INVOLVED More

CYANOBACTERIA



Lessons learned

- Human nature is a constant
- Funding helps!
- Little wins are still wins
- Passion is essential, along with persistence
- Big data is not essential to success
- Simplicity works

bloomWatch- Monique’s section here?

Contact info:

Questions?

Hilary Snook – snook.hilary@epa.gov

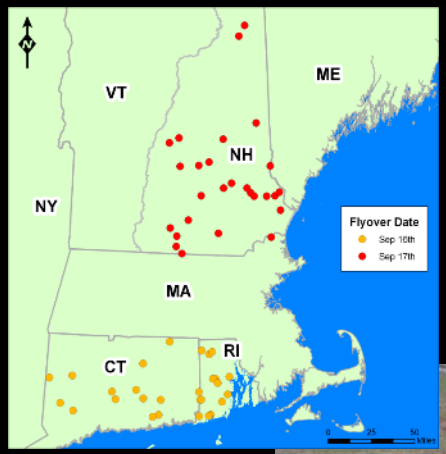
Corey Conville – conville.corey@epa.gov

Scan to download Bloomwatch App!

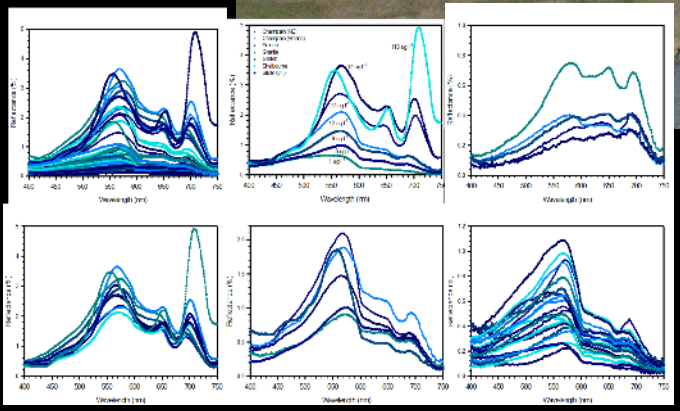
Apple

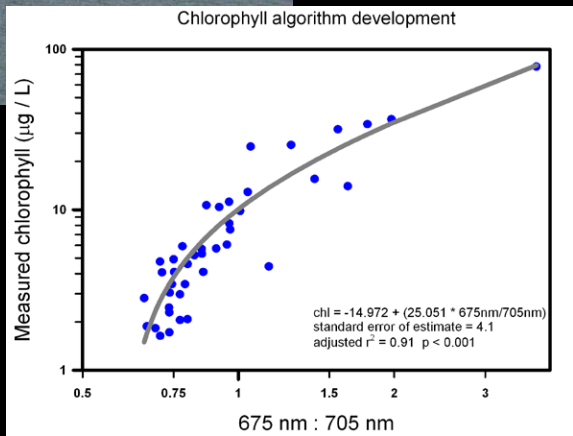
Android

Cyanos.org


VT
ME
NH
NY
MA
RI
CT
Flyover Date
Sep 16th
Sep 17th

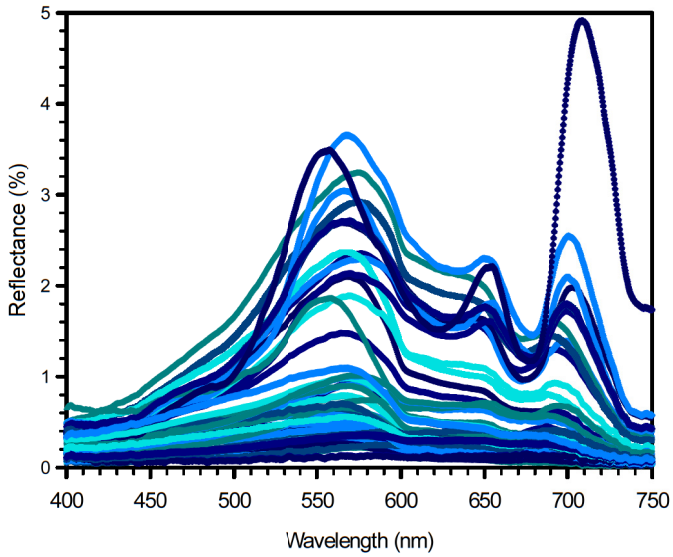

NASA
504
N504NA



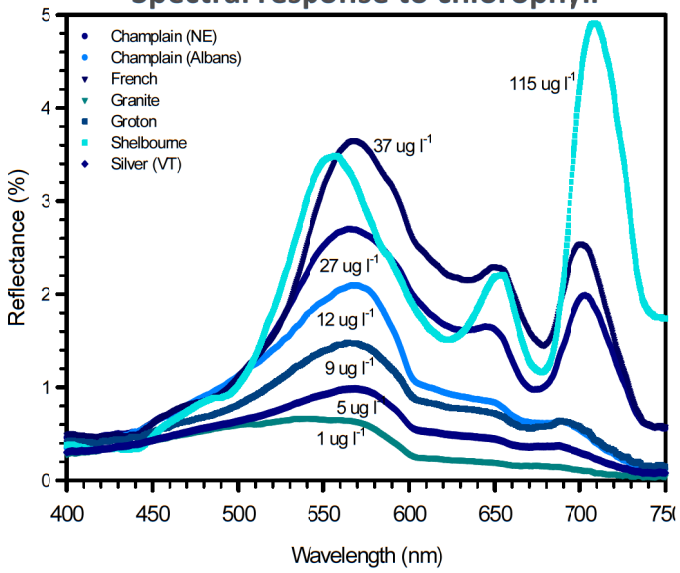

Chlorophyll algorithm development
Measured chlorophyll (µg / L)
100
10
1
0.5
0.75
1
1.5
2
3
675 nm : 705 nm
chl = -14.972 + (25.051 * 675nm/705nm)
standard error of estimate = 4.1
adjusted r² = 0.91 p < 0.001

Lake Color (Shane Bradt, UNH)

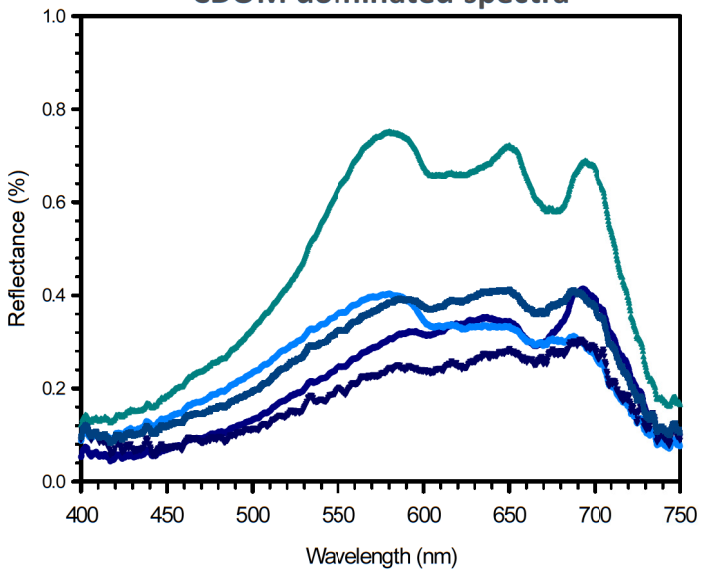
44 spectra from New England lakes



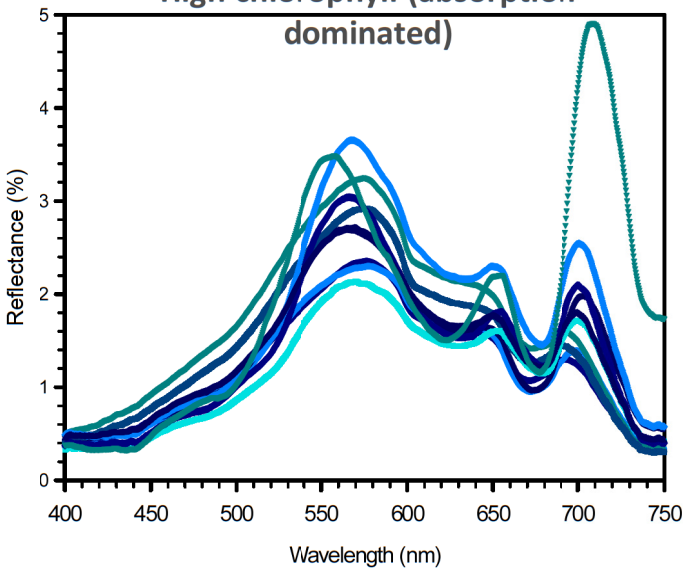
Spectral response to chlorophyll



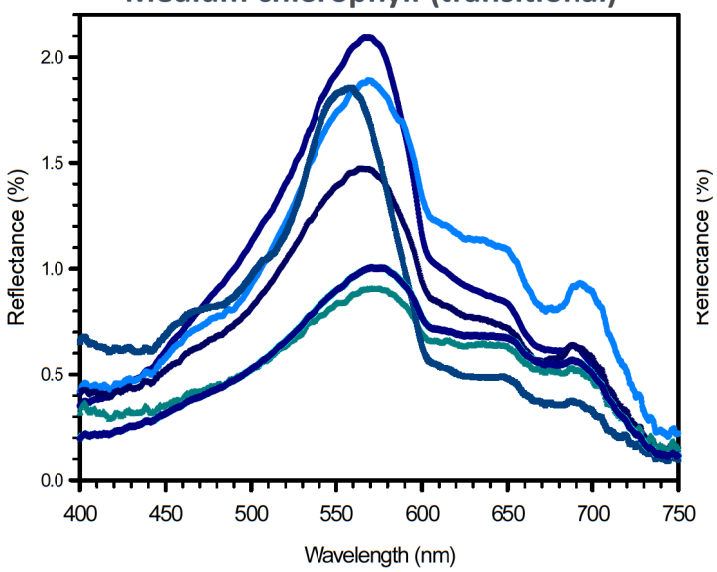
CDOM dominated spectra



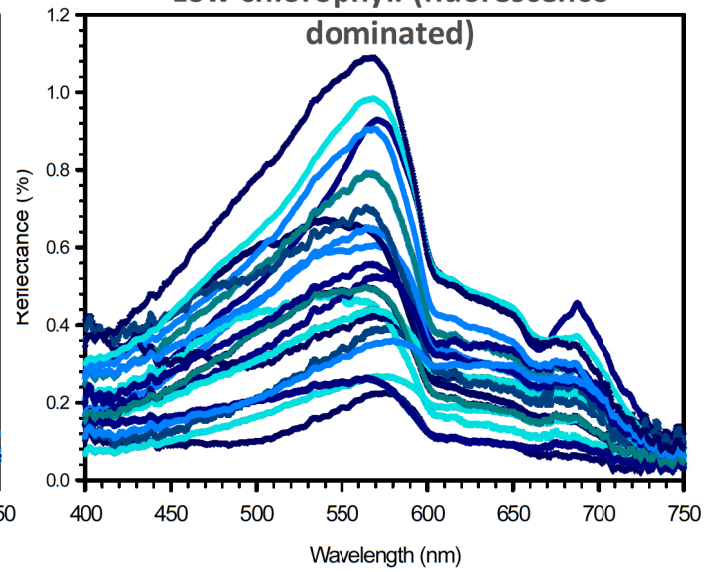
High chlorophyll (absorption dominated)

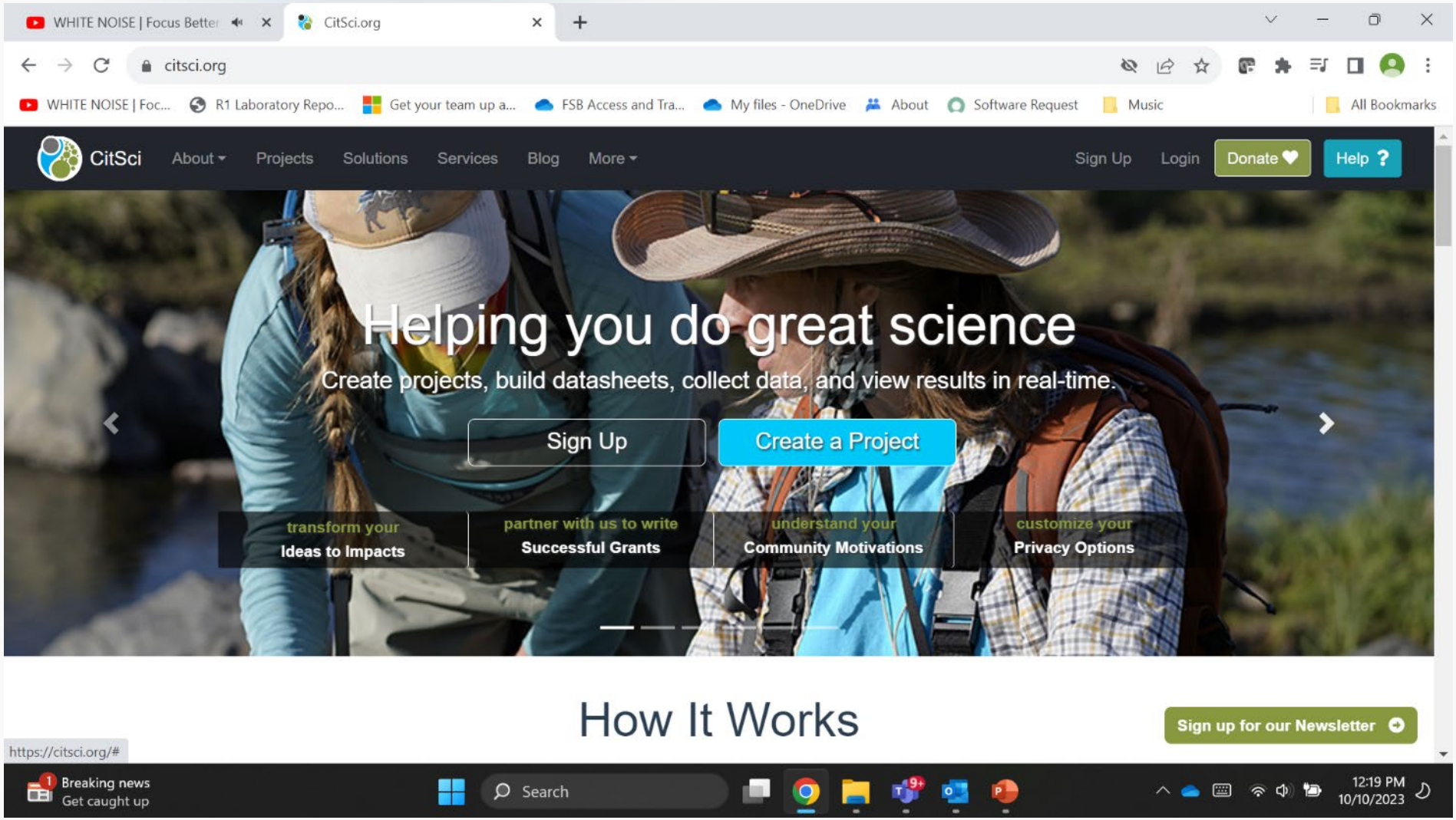


Medium chlorophyll (transitional)



Low chlorophyll (fluorescence dominated)

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Report to the Chairman, Subcommittee on Water Resources and Environment, Committee on Transportation and Infrastructure, House of Representatives

March 2000

WATER QUALITY

Key EPA and State Decisions Limited by Inconsistent and Incomplete Data

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