

Water Program Tools CWA Perspective: Recreation and ALU Applications

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USEPA National HAB Lead

The views expressed in this presentation are those of the author and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.

- Review EPA tools supporting state/tribal HAB management for CWA purposes



- Tools by Theme
- Research Activity
- Other Resources



Prevent

Monitor

Forecast

Respond

Control

- Water Quality Standards
 - Toxins
 - Nutrients

Table. Recommended magnitude for cyanotoxins.

Microcystins	Cylindrospermopsin
8 µg/L	15 µg/L



United States
Environmental
Protection Agency

Office of Water
Mail Code 4304T

EPA 822-R-19-001
May 2019

**Recommended Human Health Recreational
Ambient Water Quality Criteria or
Swimming Advisories for Microcystins
and Cylindrospermopsin**



United States
Environmental Protection
Agency

Office of Water
EPA 823-R-21-002
July 2021

**Final Technical Support Document:
Implementing the 2019 National Clean Water
Act Section 304(a) Recommended Human
Health Recreational Ambient Water Quality
Criteria or Swimming Advisories for
Microcystins and Cylindrospermopsin**

- Water Quality Standards
 - Toxins
 - Nutrients

The screenshot shows the EPA website's 'Nutrient Pollution' page. At the top is the EPA logo and navigation menu with options: Environmental Topics, Laws & Regulations, Report a Violation, and About EPA. A search bar is also present. The main heading is 'Nutrient Pollution'. Below it, there is a dark blue box with the text 'Adapting to Climate Change' and a sub-heading 'Warming water, droughts and sea level rise can make harmful algal blooms worse. Find out how a changing climate might lead to [more algae](#)'.

The screenshot shows the cover of an EPA document titled 'Ambient Water Quality Criteria to Address Nutrient Pollution in Lakes and Reservoirs'. It features the EPA logo, the text 'United States Environmental Protection Agency', 'Office of Water Mail code 4304T', and 'EPA-822-R-21-005 August 2021'. Below the title is a photograph of a serene lake at sunset with a small boat on the water.

The screenshot shows the header of the 'N-STEPS Online' website. It includes the title 'N-STEPS Online', navigation links for 'Develop Criteria', 'Case Studies', and 'Resources', and social media icons for Facebook, Twitter, and LinkedIn. Below the header is the main heading 'Nutrient Scientific Technical Exchange Partnership & Support (N-STEPS) Online' and the subtitle 'A Resource for Numeric Nutrient Criteria Development'.

The screenshot shows the content area of the N-STEPS Online website. It features three main sections: 'LEARN' with a sub-heading 'The Problem' and links to 'Sources and Solutions', 'The Effects', and 'Where It Occurs'; 'ACT' with a sub-heading 'In Your Home' and links to 'In Your Yard', 'In Your Community', and 'In Your Classroom'; and 'POLICY & DATA' with a sub-heading 'Nutrient Policy, Tools, Data, and Technical Resources' and links to '2022 EPA Nutrient Reduction Memorandum' and 'EPA's Efforts to Reduce Nutrient Pollution'.

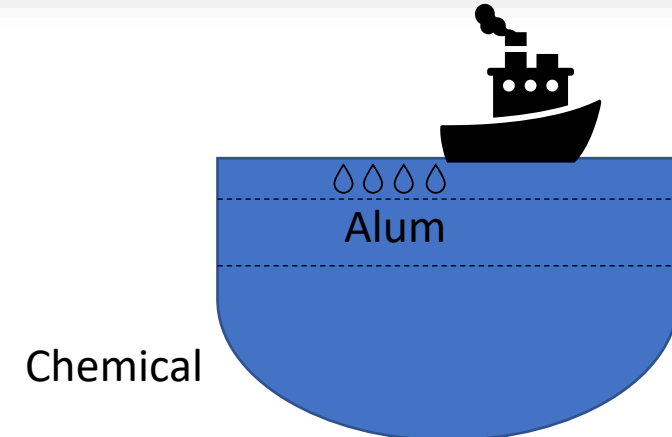
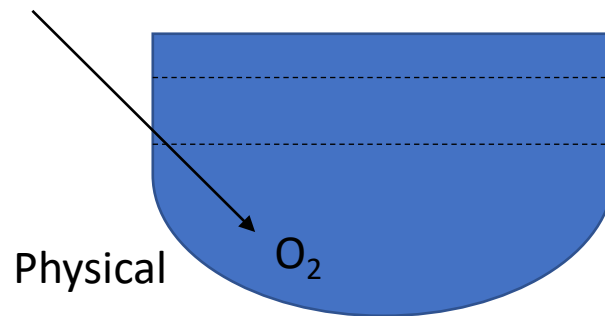
Prevent

- Waterbody HAB Control

Biological



The screenshot shows the EPA website header with the logo and search bar. Below the header is a navigation menu with 'Environmental Topics', 'Laws & Regulations', 'Report a Violation', and 'About EPA'. The main content area features the title 'Preventative Measures for Cyanobacterial HABs in Surface Water' and a sub-header 'Related Topics: Cyanobacterial HABs | Ground Water and Drinking Water | Water Quality Criteria'. A 'CONTACT US' link is visible in the top right. The text below the title discusses preventative measures for cyanobacterial blooms, mentioning anthropogenic influences like nutrient runoff and management practices for nitrogen and phosphorus. A disclaimer at the bottom states: 'DISCLAIMER: U.S. EPA does not endorse any of the measures presented on this page.'

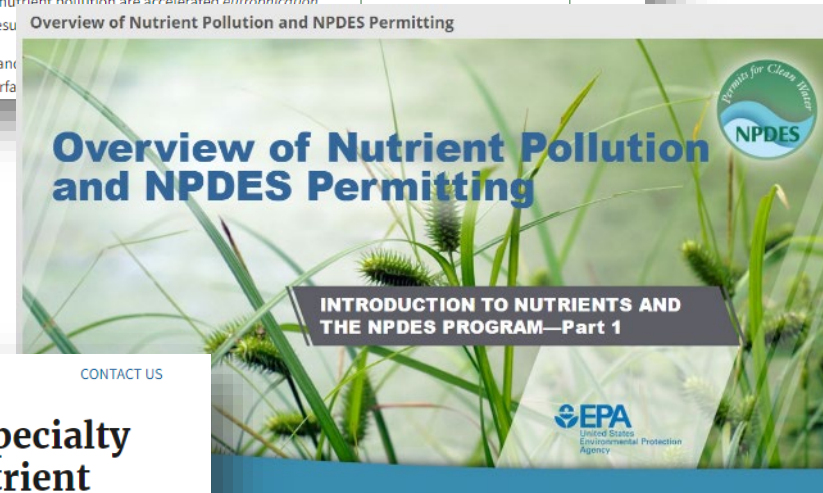


Prevent

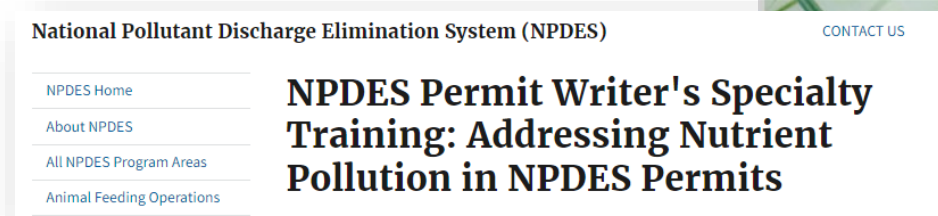
- Nutrient Control Programs
 - NPDES
 - NPS



The screenshot shows the EPA website's NPDES Permit Limits-Nutrient Permitting page. The header includes the EPA logo, search bar, and navigation menu. The main content area features a sidebar with links to various NPDES program areas and a main section titled "Permit Limits-Nutrient Permitting" with introductory text. A green callout box highlights "NPDES Permit Limits Topics" with an "Overview" link.



The graphic features a background of green grass and a circular logo with the text "Permits for Clean Water" and "NPDES". The main title is "Overview of Nutrient Pollution and NPDES Permitting". Below it, a dark banner reads "INTRODUCTION TO NUTRIENTS AND THE NPDES PROGRAM—Part 1". The EPA logo is in the bottom right corner.



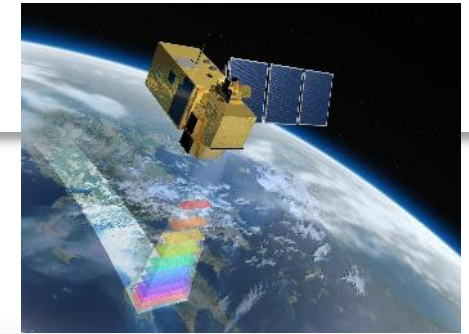
The screenshot shows the EPA website's NPDES Permit Writer's Specialty Training page. The header includes the EPA logo, search bar, and navigation menu. The main content area features a sidebar with links to various NPDES program areas and a main section titled "NPDES Permit Writer's Specialty Training: Addressing Nutrient Pollution in NPDES Permits".

Prevent

- Nutrient Control Programs
 - NPDES
 - NPS

The collage features several screenshots of the EPA website. The top right screenshot shows the 'Polluted Runoff: Nonpoint Source (NPS) Pollution' page with a '319 Grant Program for States and Territories' highlighted. The middle left screenshot shows the same page with 'New NPS Resources' highlighted, including links to CWSRF Best Practices and Land Conservation guides. The middle right screenshot shows the 'Tribal Nonpoint Source Program' page with a 'For Tribal Grantees' button. The bottom right graphic is a 'NONPOINT SOURCE SUCCESS STORY' for California, titled 'Watershed Restoration Efforts Reduce Cyanobacteria-Stimulating Nutrients in Pinto Lake', with a 'Waterbody Improved' badge.

Prevent



- Satellite Based Tool: CyAN

EPA United States Environmental Protection Agency

Search EPA.gov

Environmental Topics | Laws & Regulations | Report a Violation | About EPA

Related Topics: [Water Research](#) CONTACT US

Cyanobacteria Assessment Network Application (CyAN app)

Make faster decisions related to cyanobacterial algal blooms

EPA's Cyanobacteria Assessment Network mobile application (CyAN app) is an easy-to-use and customizable app that provides access to cyanobacterial bloom satellite data for over 2,000 of the largest lakes and reservoirs across the United States. EPA scientists developed the app to help local and state water quality managers make faster and better-informed management decisions related to cyanobacterial blooms.

Compatibility and Availability

The CyAN app is available as two versions: CyANWeb app and the CyAN Android™ app. Both are free apps that require an internet connection and provide the same information using different platforms. The CyANWeb app is a web browser-based interface available on EPA's website that will work with any operating system and is compatible with most devices. The CyAN Android™ app is available for download on Google Play™ and is designed for use on Android™ devices; it is compatible with versions 4.2-9.0 (API levels 18-26).

Disclaimer: Any mention of trade names, products, services, or enterprises does not imply an endorsement by the U.S. Government or EPA. Google Play and the Google Play logo are trademarks of Google LLC.

Capabilities and Applications

CyAN

Capabilities: The CyAN app provides an easy to use, customizable interface to scan water bodies for changes in cyanobacteria occurrence without requiring computer programming expertise. It provides water quality managers a user-friendly platform that reduces the complexities associated with accessing satellite data to allow fast and efficient initial assessments across water bodies that are roughly one square kilometer or greater.

Users can view information about cyanobacteria concentrations on a national scale or can zoom in to

On this Page

- [Compatibility and Availability](#)
- [Capabilities and Applications](#)
- [Background and Collaboration](#)
- [Resources](#)
- [Technical Support](#)

CyANWeb app:

[Go to CyANWeb](#)

CyAN Android™ app:

[GET IT ON Google Play](#)

Monitor

EPA Cyanobacteria Assessment Network v1.1.27

My Locations | Compare | Notifications **169**

New Hope Church -- 1

35°49'50"N, 78°57'31"W

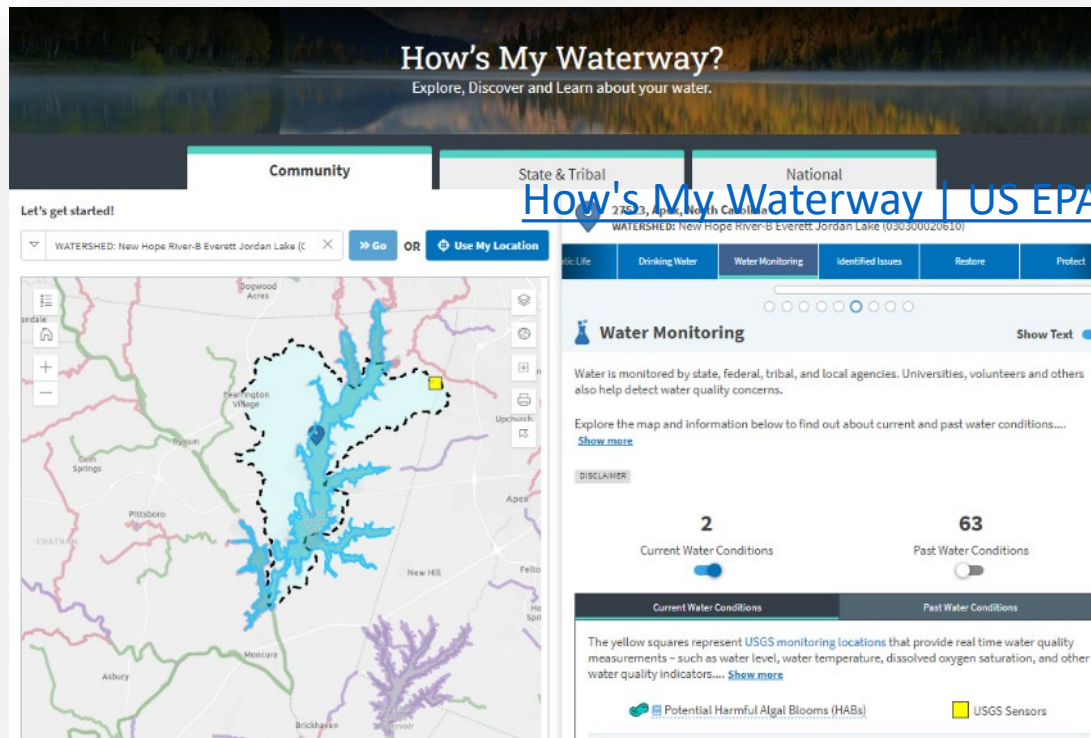
Counts of cyanobacteria

Date: 06-24-2023

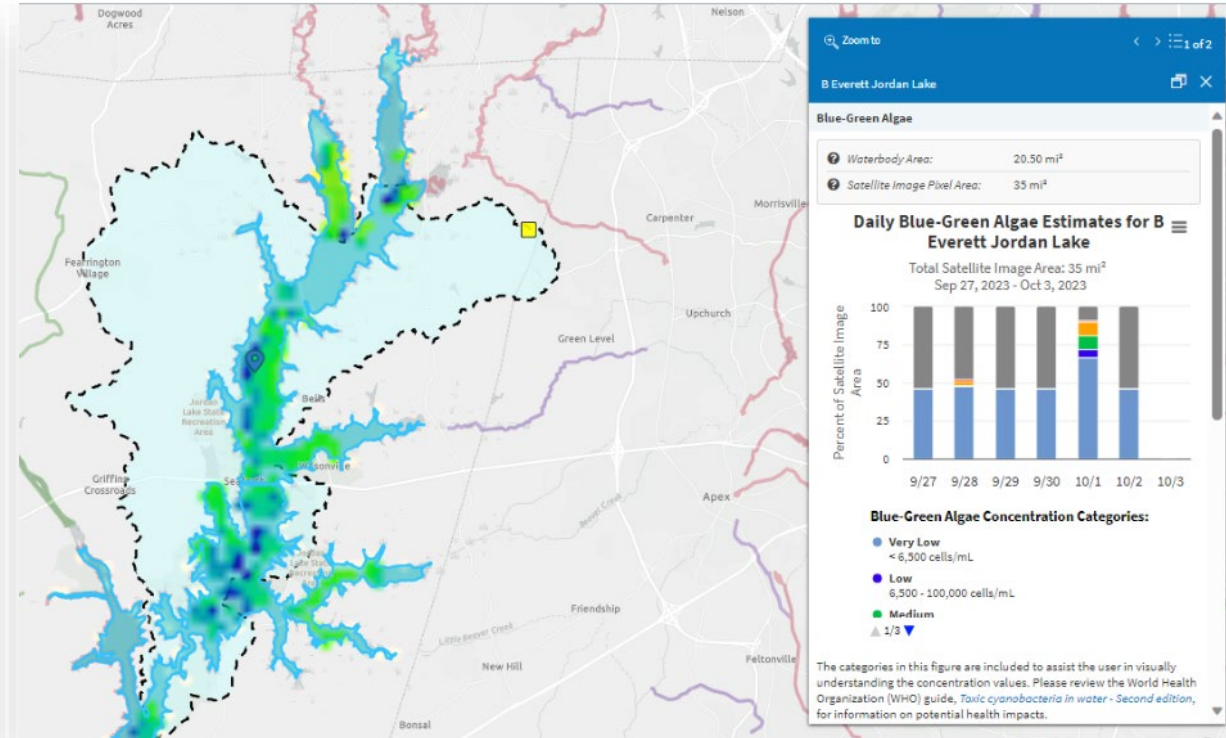
1,770,109 cells/mL

↓ 49,592 cells/mL since 06-17-2023

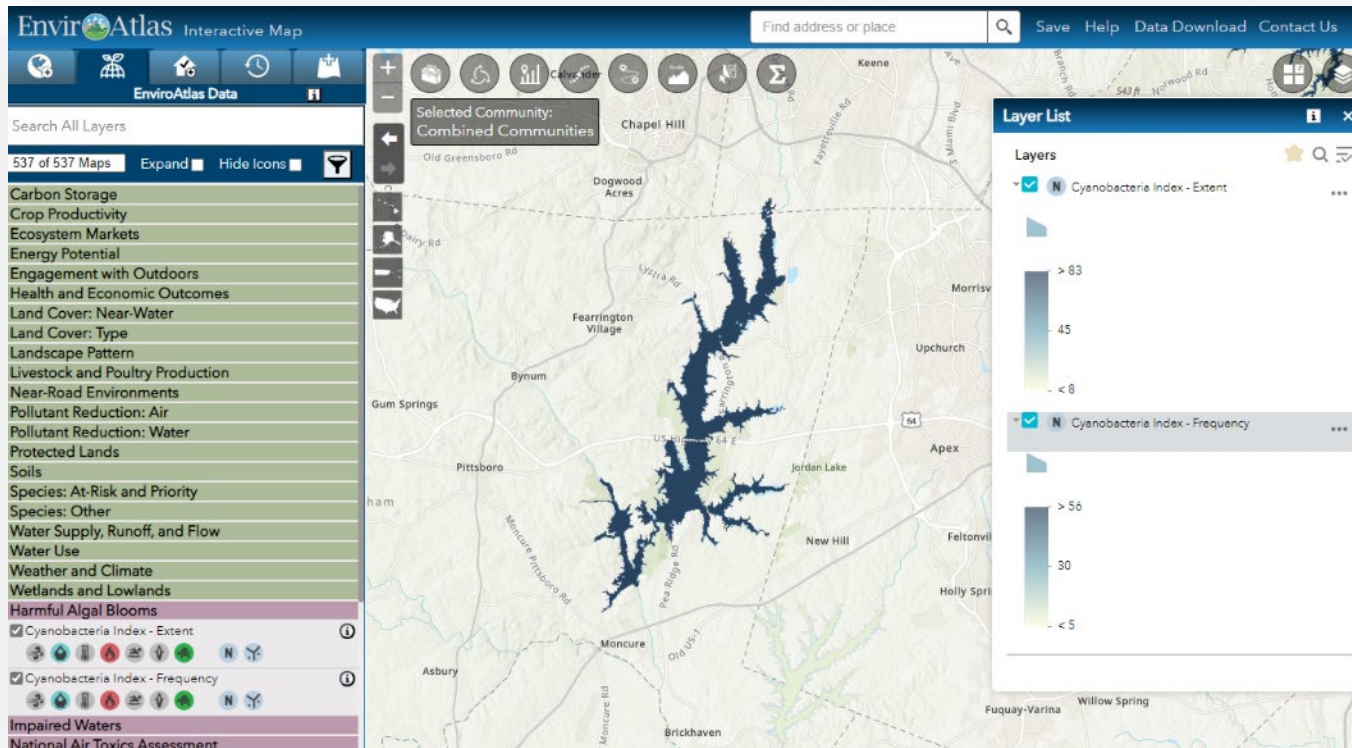
- CyAN – data served on How’s My Waterway, EnviroAtlas and Report on the Environment



Monitor



- CyAN – data served on How’s My Waterway, EnviroAtlas and Report on the Environment



Monitor

Cyanobacteria Index - Extent

Lake Name: B. Everett Jordan Lake

Lake Name: B. Everett Jordan Lake
 State : NC
 COMID: 166755060.0
 Lake Area: 53.0
 Number of Pixels: 124.0
 2021 Percent Median Lake Area: 96.4
 2020 Percent Median Lake Area: 86.7
 2019 Percent Median Lake Area: 63.7
 2018 Percent Median Lake Area: 41.5
 2017 Percent Median Lake Area: 68.9
 2011 Percent Median Lake Area: 39.8
 2010 Percent Median Lake Area: 66.5
 2009 Percent Median Lake Area: 30.1
 2008 Percent Median Lake Area: 24.6

Cyanobacteria Index - Frequency

Lake Name: B. Everett Jordan Lake

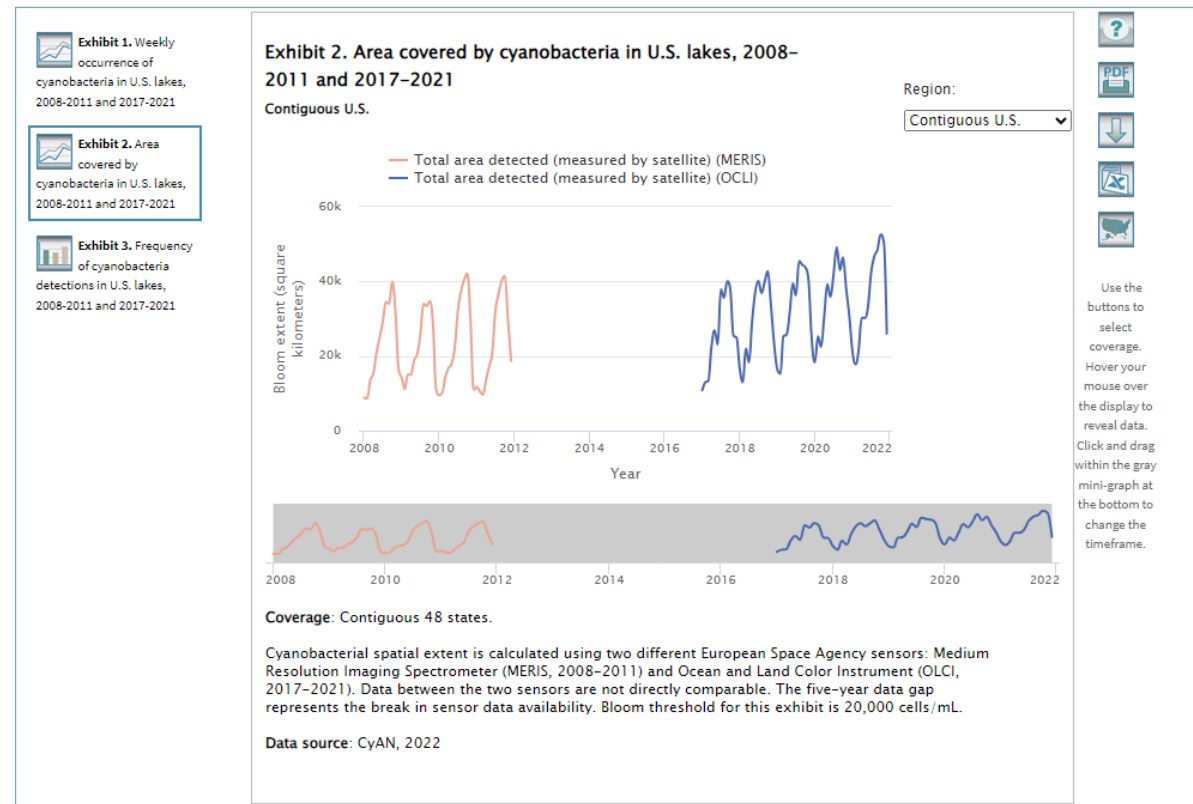
Lake Name: B. Everett Jordan Lake
 State : NC
 COMID: 166755060.0000
 Number of Pixels: 124.0000
 2021 Average Bloom Frequency: 62.6300
 2020 Average Bloom Frequency: 56.4600
 2019 Average Bloom Frequency: 45.5700
 2018 Average Bloom Frequency: 23.4700
 2017 Average Bloom Frequency: 47.1000
 2011 Average Bloom Frequency: 45.5400
 2010 Average Bloom Frequency: 43.6800
 2009 Average Bloom Frequency: 31.5400
 2008 Average Bloom Frequency: 30.4500

- CyAN – data served on How's My Waterway, EnviroAtlas and Report on the Environment

- Entire US or Regions
- Intra-Annual Trends
- Inter-Annual Trends
- Extent and Frequency

Monitor

Cyanobacteria in Lakes



- Water Quality Exchange/Water Quality Portal

Water Quality Data



Water Quality Download

Water quality data submitted from over 900 federal, state and tribal agencies, watershed organizations and other groups are available to support your water quality analyses.

Water Quality Data Download



Water Quality Data Upload with WQX

There are two options for you to share your data using WQX. You can choose a standard web-based application (WQX Web) that uses Microsoft Excel spreadsheets or you can choose to create a custom submission application using WQX XML schema through Exchange Network Nodes or Node Clients.

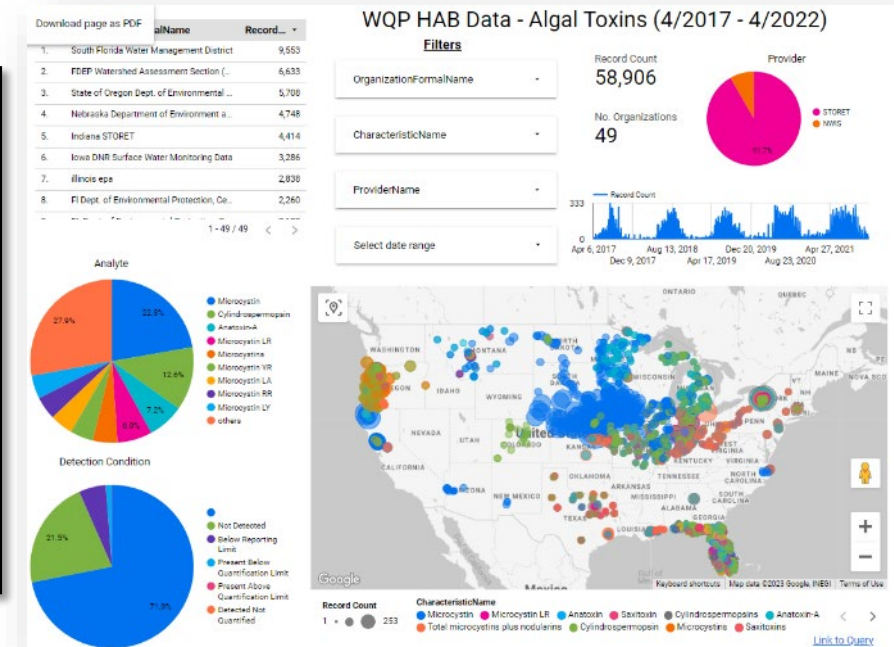
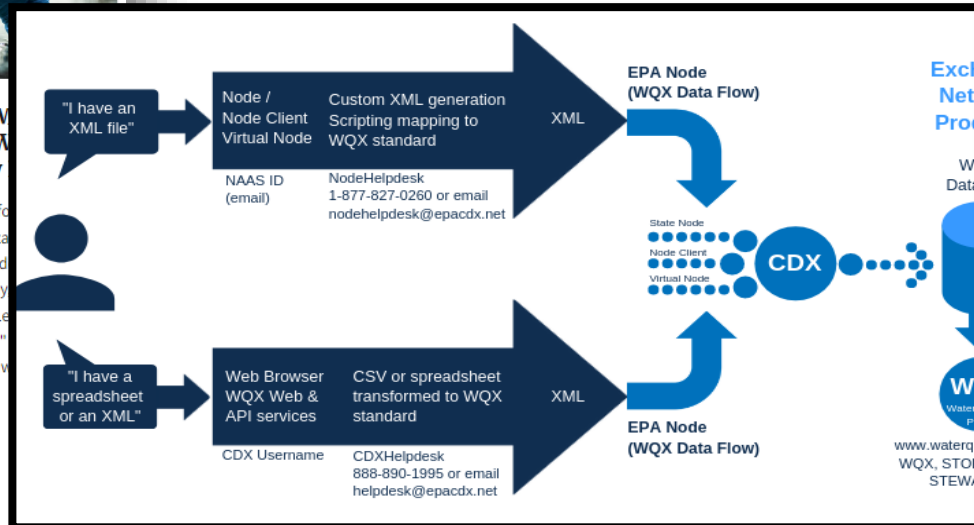
Water Quality Data Upload with WQX



Learn More about Water Quality

General Information, Data Assistance, Training Videos, Community Funding. Let us get "1 on 1" assistance with you.

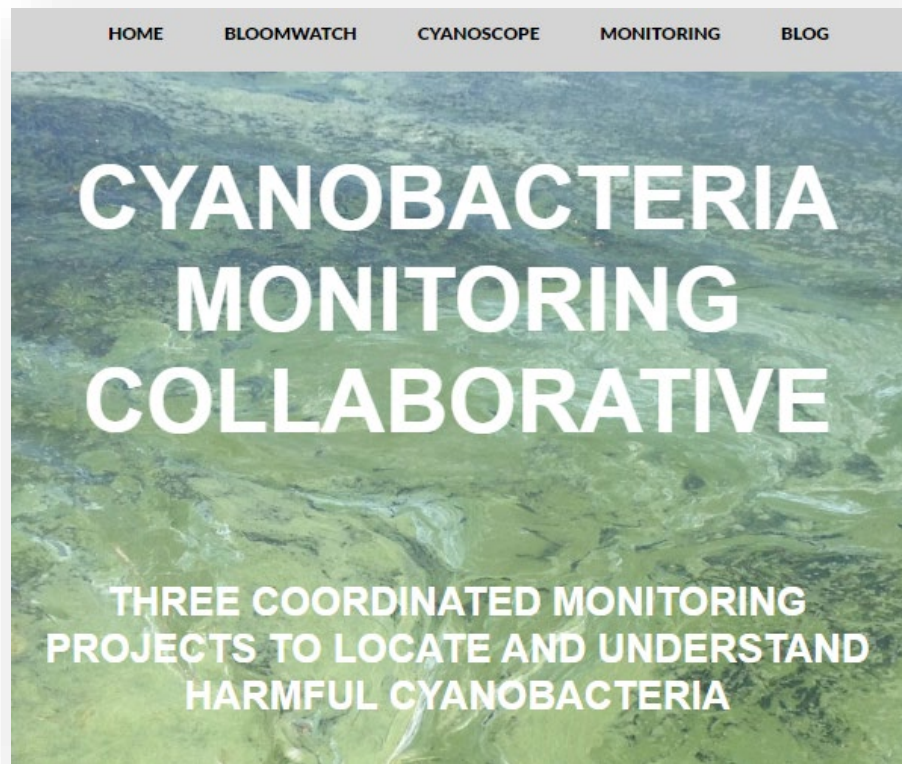
Learn More about Water Quality Data



Mock Dashboard – For Example Only

Monitor

- Monitoring Tools: Participatory Science



Monitor



<https://cyanos.org/>

- Monitoring Tools: Participatory Science



Monitor

ENGLISH ESPAÑOL About bloomWatch

BLOOMWATCH | REPORTS

reports currently
1,129
visible on the map

BLOOM REPORTED |
Avery Pond, Preston, CT on September 30, 2023
Lake condition: Ripples Weather: Rain
Location: 41.49188, -71.98214

BLOOM REPORTED |
Lake Sule, Rochelle, IL on September 30, 2023
Lake condition: Choppy Weather: Clear
Location: 41.90917, -89.04387

BLOOM REPORTED |
Wenscott Reservoir, North Providence, RI on September 28, 2023
Lake condition: Ripples Weather: Clear
Location: 41.87271, -71.46297

NO BLOOM OBSERVED
Slack Reservoir, Greenville, RI on September 28, 2023
Lake condition: Ripples Weather: Overcast
Location: 41.86663, -71.55250

NO BLOOM OBSERVED
Mashapaug Pond, Cranston, RI on September 28, 2023
Lake condition: Ripples Weather: Partly Cloudy
Location: 41.79212, -71.43245

NO BLOOM OBSERVED
Georgiaville Pond, Smithfield, RI on September 28, 2023
Lake condition: Ripples Weather: Clear
Location: 41.89559, -71.51011

Reports evaluated

Cyanos (suspected)	270
Not able to evaluate using image	55
Not an actual bloom	252
Non-cyanos (suspected)	27
No images submitted	72
(confirmed)	7

Report dates

Report dates: 2021, 2022, 2023


Esri, FAO, NOAA, USGS Powered by Esri

← Click on a report to display associated photos and notes.
(not all reports have photos)

- Monitoring Tools: Participatory Science




HOW DOES CYANOSCOPE WORK?



Collect cyanobacteria

1) collect cyanobacteria with a net tow, 2) prepare your microscope slides, 3) identify cyanobacteria found in your sample

EQUIPMENT AND METHODS



Submit your images


1) take pictures of cyanobacteria found in your sample, 2) upload the images and relevant info on iNaturalist.org

NOTE: Be sure to include basic information about where and when the sample was collected.

NOTE: If not sure what cyanobacteria you have, that's fine! Go ahead and upload your image.

To submit your images, sign in or register at:

CYANOSCOPE ON INATURALIST

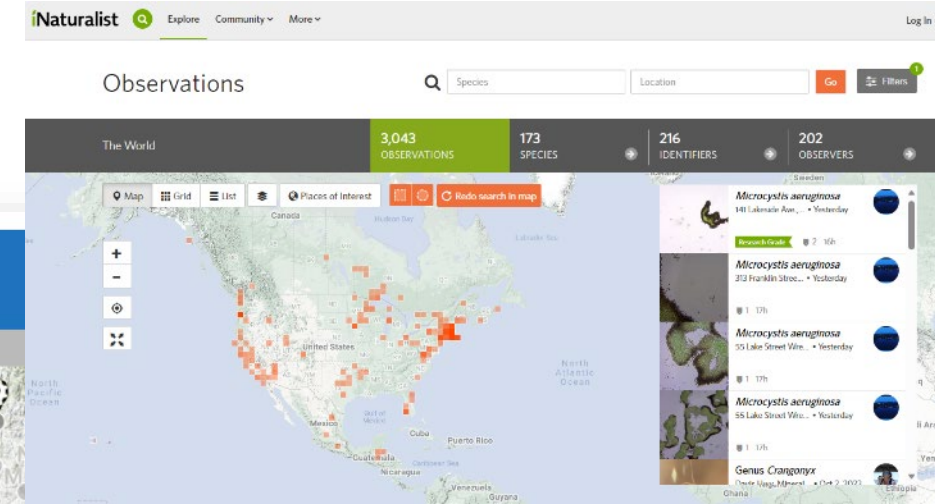


Interact online

1) the iNaturalist community can help confirm the identity of cyanobacteria, 2) you can view and comment on images submitted by others, 3) everyone can explore patterns of the appearance of cyanobacteria

To view and comment on images, sign in or register at:

CYANOSCOPE ON INATURALIST






Monitor

- Monitoring Tools: Participatory Science

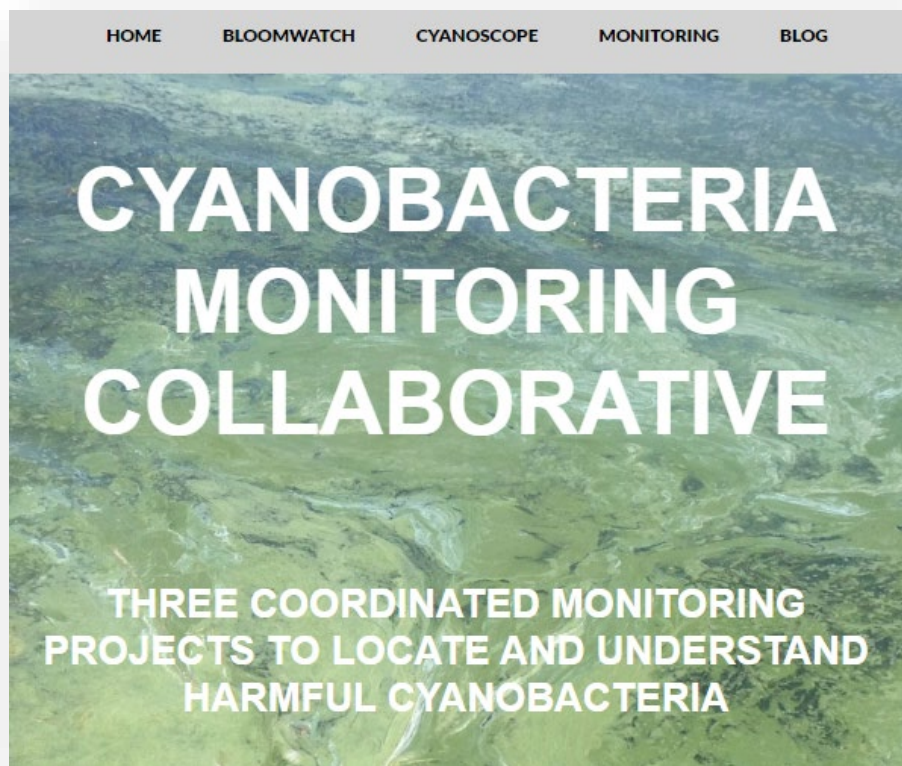


HOW DOES CYANOMONITORING WORK?

 <p>Collect water samples</p> <p>EQUIPMENT AND METHODS</p>	 <p>Analyze your samples</p> <p>EQUIPMENT AND METHODS</p>	 <p>Submit and explore data</p> <p>COMING SOON</p>
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Monitor

- Monitoring Tools: Participatory Science

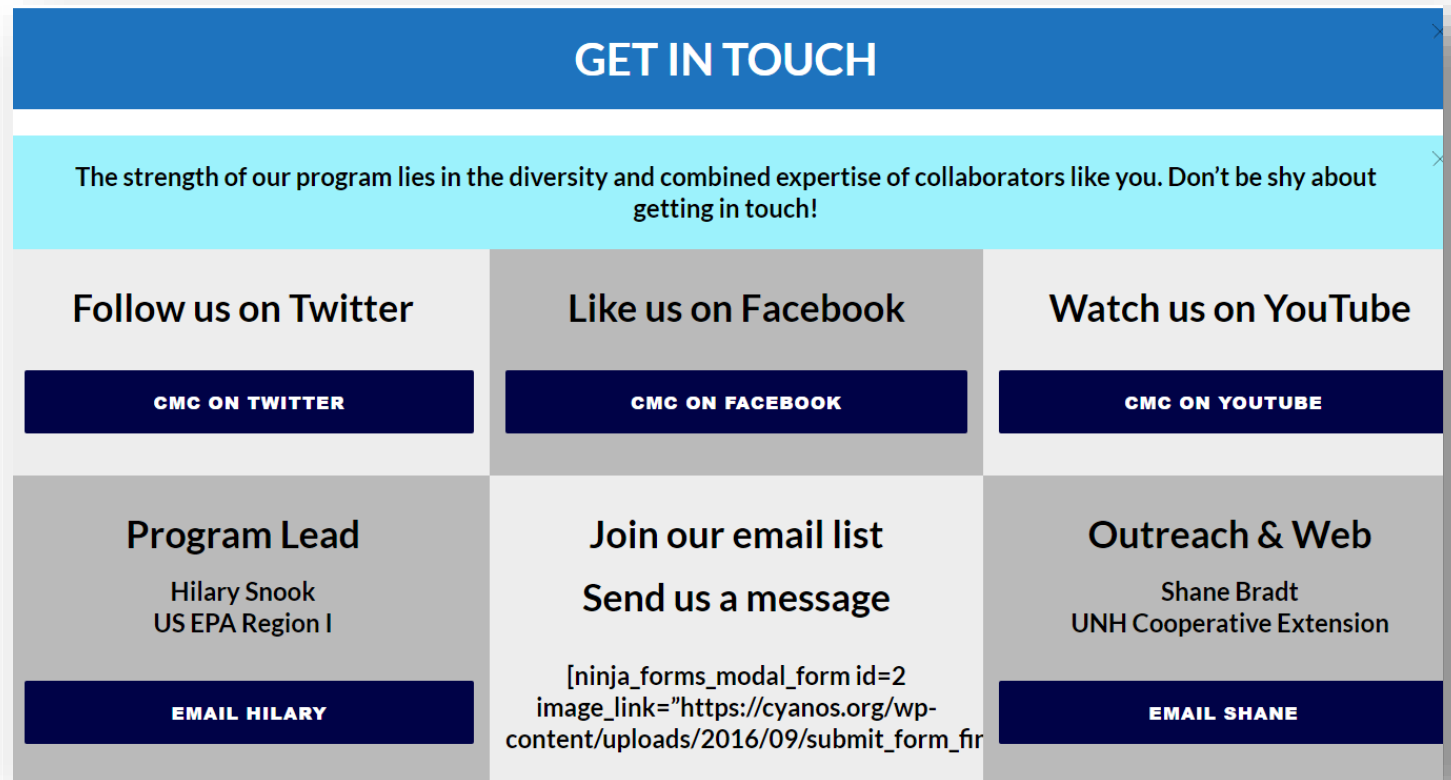


HOME BLOOMWATCH CYANOSCOPE MONITORING BLOG

CYANOBACTERIA MONITORING COLLABORATIVE

THREE COORDINATED MONITORING PROJECTS TO LOCATE AND UNDERSTAND HARMFUL CYANOBACTERIA

Monitor

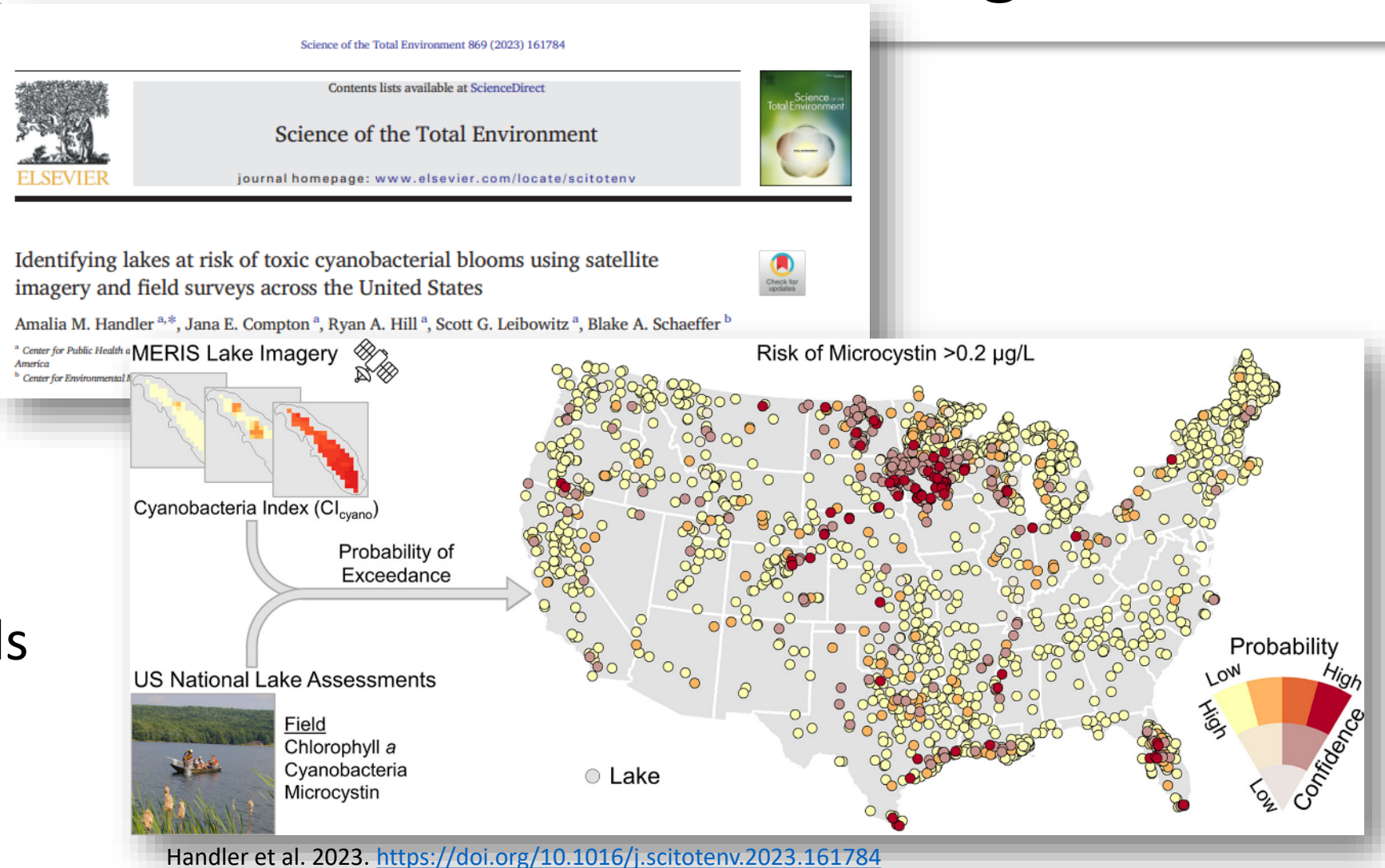


GET IN TOUCH

The strength of our program lies in the diversity and combined expertise of collaborators like you. Don't be shy about getting in touch!

<p>Follow us on Twitter</p> <p>CMC ON TWITTER</p>	<p>Like us on Facebook</p> <p>CMC ON FACEBOOK</p>	<p>Watch us on YouTube</p> <p>CMC ON YOUTUBE</p>
<p>Program Lead</p> <p>Hilary Snook US EPA Region I</p> <p>EMAIL HILARY</p>	<p>Join our email list</p> <p>Send us a message</p> <p>[ninja_forms_modal_form id=2 image_link="https://cyanos.org/wp-content/uploads/2016/09/submit_form_fir</p>	<p>Outreach & Web</p> <p>Shane Bradt UNH Cooperative Extension</p> <p>EMAIL SHANE</p>

- Focused Effort
- E.g., ML models to forecast at risk lakes
- CyAN Forecast Models
 - 7-10d forecasts
 - CyAN Population



Forecast



Tools - Response

- Wide Range of Tools
- Our Regional HAB Leads are Superstars

Monitoring and Responding to Cyanobacteria and Cyanotoxins in Recreational Waters

This information is intended for recreational waterbody managers, which may include public health officials, lake managers, or other state, local or tribal officials, involved in monitoring water quality and protecting the health of people and animals that use waterbodies within their jurisdiction.


DISCLAIMER: This information does not impose legally binding requirements on EPA, states, tribes, or the public, nor does it confer legal rights. It does not constitute a regulation, nor does it change or substitute for any Clean Water Act provision or EPA regulation. Any mention of trade names, products, or services does not convey and should not be interpreted as conveying official EPA approval, endorsement, or recommendation for use.

On this page:

- [Visual signs of a Cyanobacterial Bloom](#)
- [Developing an Emergency Response Plan for Cyanotoxins](#)

Related Information

- [Communicate Cyanobacteria Recreational](#)
- [Nutrient Pol](#)
- [Recreation or Swimm Cyanotoxins](#)
- [Final Techn Implementi Recreationa Advisories fr Cylindrospe](#)



PRESS RELEASE

RECREATIONAL WATER CLOSURE ISSUED

FOR IMMEDIATE RELEASE
Media Contact: [insert name, title, telephone and fax number, and e-mail of spokesperson]

WHY IS THERE A CLOSURE?

- [Cyanotoxin or cyanobacteria name], a toxin produced by cyanobacteria (formerly known as blue-green algae) was detected in the water at levels that could cause harm at [location] on [date].
- Samples collected on [dates] show [cyanotoxins or cyanobacteria name] in [location] at [levels and/or ranges], which are above the state-designated recreational water health advisory levels.

WHAT SHOULD I DO?

- Do not swim, wade or come in contact with the water, scum, foam or algae at [location].
- Seek medical attention if you or family members are experiencing illness after swimming or playing in water. Recreational waters containing [cyanotoxin or cyanobacteria name] at levels exceeding the state's guidelines for issuing a Health Advisory can put you at risk of various adverse health effects including upset stomach, vomiting and diarrhea. Exposure to concentrations of cyanotoxins higher than the state's guideline values could potentially result in more serious illnesses, including liver or kidney damage.
- Animals may be vulnerable to adverse health effects of [cyanotoxin or cyanobacteria name] at the detected levels indicated above. Contact a veterinarian if animals show signs of illness.
- If you, your family members or your animals have experienced adverse [cyanotoxin or cyanobacteria-related] health effects, please contact [State or local Health Department] to report the illness.



US EPA Cyanotoxins Preparedness and Response Toolkit

EPA

Incident Action Checklist – Harmful Algal Blooms

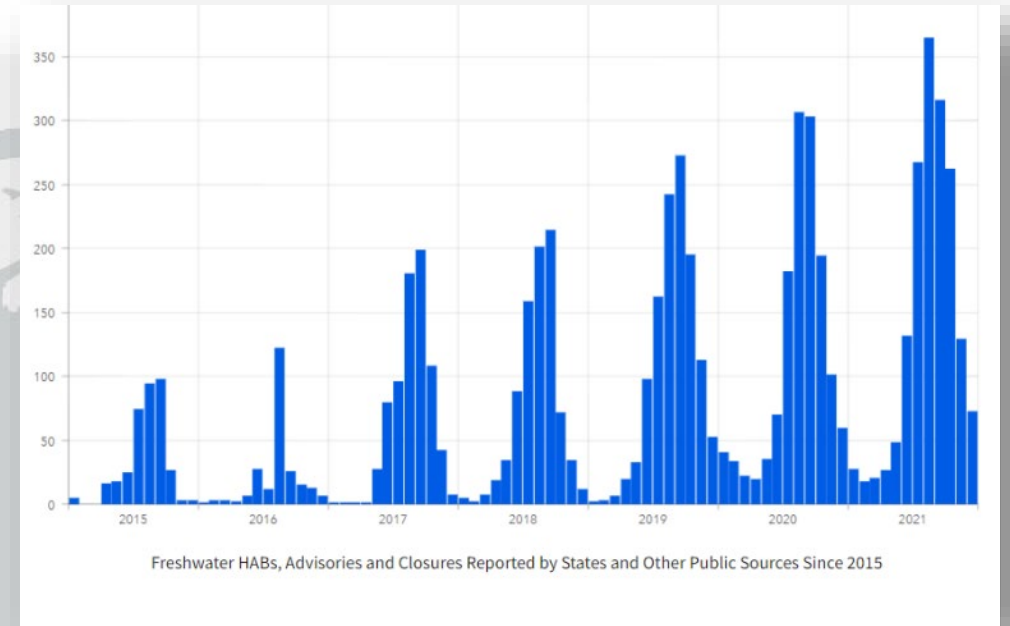
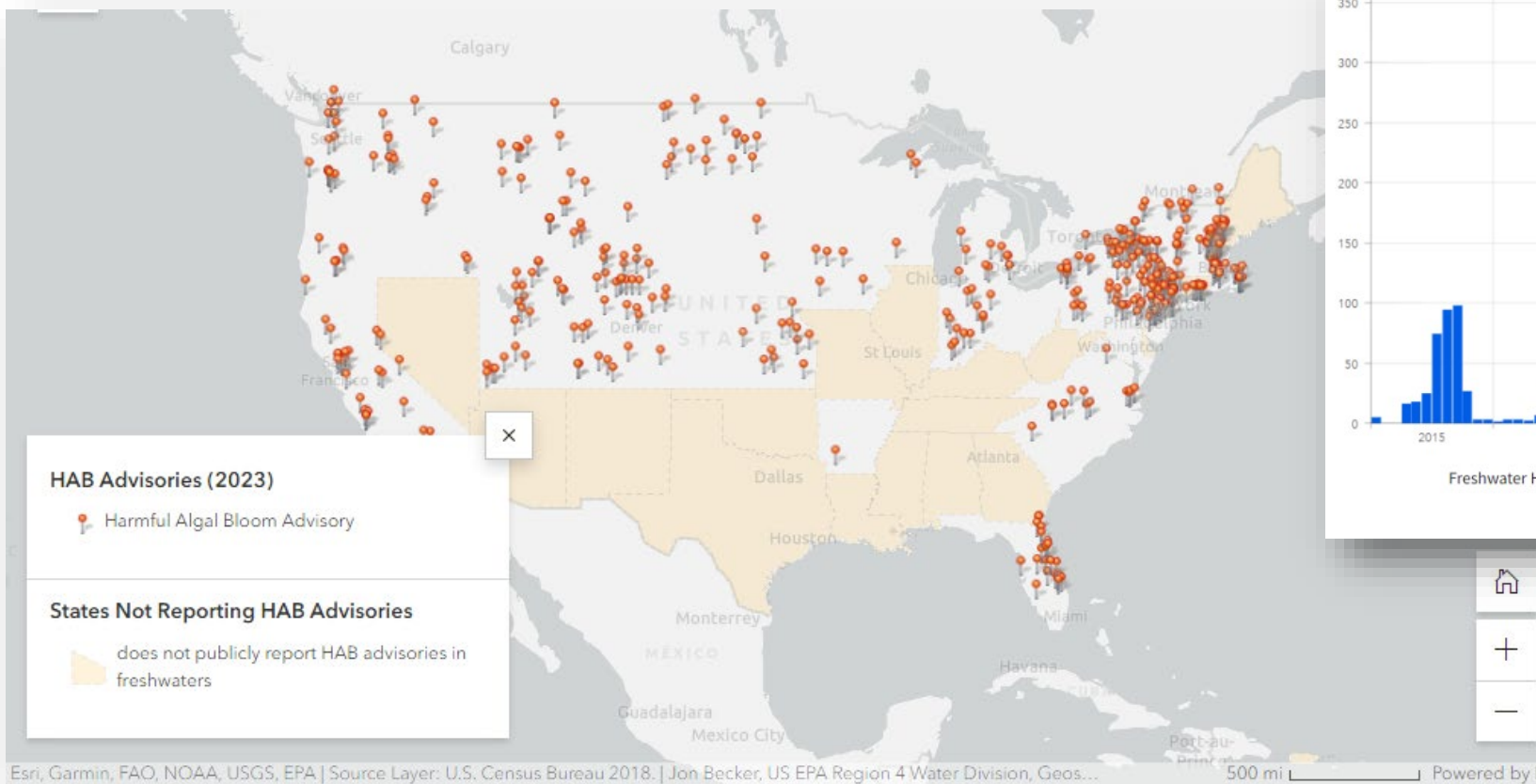
convenience, the actions in this checklist are divided up into three "rip & run" sections and are examples of surface water utilities can take to: prepare for, respond to and recover from harmful algal bloom (HAB) can also populate the "My Contacts" sections with critical information that your utility may need during the

Algal Bloom Incidents and Water Utilities

Water utilities face harmful algal bloom or HAB challenges as they try to ensure the delivery of safe water to their customers. HABs can create toxins that are difficult to treat, which can lead to prolonged outages that can impact both human health and a community's economy. Blue-green algae



- We track advisories too



August 2023

Respond



Tools - Control

- We provide control support as well

Control Measures for Cyanobacterial HABs in Surface Water

Measures can be employed once blooms have already occurred to control the phytoplankton blooming rate and to remove blooms. The table provides a summary of the common physical and chemical measures for cyanobacterial blooms in surface waters and their respective effectiveness and limitations.

To learn more about ways to manage cyanobacterial blooms visit: [Report: Solutions for managing cyanobacterial blooms: A scientific summary for policy makers \(PDF\)](#) or the [ITRC's Strategies for Preventing and Managing Benthic Harmful Cyanobacterial Blooms Management Criteria Tool](#).

DISCLAIMER: U.S. EPA does not endorse any of the measures presented on this page.

A Summary of Waterbody Management Measures for Cyanobacterial Blooms

Waterbody Management Measure	Description	Effectiveness	Limitations
Physical Controls			
Aeration	Aerators operate by pumping air through a diffuser near the bottom of the waterbody, resulting in the formation of plumes that rise to the surface and create vertical circulation cells as they propagate outwards from the aerator. This mixing of the water column disrupts the behavior of cyanobacteria to migrate vertically in addition to limiting the accessibility of nutrients.	Successfully implemented in small ponds and waterbodies. May also provide more favorable growth conditions for competing organisms.	Generally more efficient in deeper water columns. Also highly dependent upon the degree of stratification and the air flow rate.

Determination of Cyanotoxins in Drinking and Ambient Freshwaters

Freshwater Cyanotoxins				
Techniques	Anatoxins	Cylindrospermopsins	Microcystins	Saxitoxins
Biological Assays				
Mouse	Yes	Yes	Yes	
Protein Phosphatase Inhibition Assays (PPIA)	No	No	Yes	
Neurochemical	Yes	No	No	
Enzyme-Linked Immunosorbent Assays (ELISA)	Yes	Yes	Yes	Yes
Chromatographic Methods				
Gas Chromatography				
Gas Chromatography with Flame Ionization Detection (GC/FID)	Yes	No	No	No
Gas Chromatography with Mass Spectrometry (GC/MS)	Yes	No	No	No
Liquid Chromatography				
Liquid Chromatography / Ultraviolet-Visible Detection (LC/UV or LC/PDA)	Yes	Yes	Yes	Yes
Liquid Chromatography/Fluorescence (LC/FL)	Yes	No	No	Yes
Liquid Chromatography Combined with Mass Spectrometry				
Liquid Chromatography Ion Trap Mass	Yes	Yes	Yes	Yes
Liquid Chromatography Time-of-Flight Mass Spectrometry (LC/TOF MS)	Yes	Yes	Yes	Yes
Liquid Chromatography Single Quadrupole Mass Spectrometry (LC/MS)	Yes	Yes	Yes	Yes
Liquid Chromatography Triple Quadrupole Mass Spectrometry (LC/MS/MS)	Yes	Yes	Yes	Yes





Tools

- From Prevention to Control
- You Can Find CWA HAB Support at USEPA

The screenshot shows the EPA website header with the logo and navigation menu. The main heading is "Cyanobacterial Harmful Algal Blooms (CyanoHABs) in Water Bodies". Below the heading is a paragraph of text and a "Related Resources" box. A dashed circle highlights the "CONTACT US" button in the top right corner of the page content.

<https://www.epa.gov/cyanohabs>

Best Tool

Contact Us about CyanoHABs

EPA Office of Water and Regions Harmful Algal Bloom Contact Information

You can also contact the spill hotline at 206-553-1263 and select the option to reach the Regional Duty Officer.

EPA Office of Water and Regions Contact Information	Staff Name	Email	Phone
Office of Ground Water and Drinking Water	Tom Waters Angela Davis	waters.tom@epa.gov davis.angela@epa.gov	513-569-7611 202-564-7562
Region 1 (CT, ME, MA, NH, RI, and VT)	Hilary Snook	snook.hilary@epa.gov	617-918-8670
Region 2 (NJ, NY, Puerto Rico, and the U.S. VI)	Robert Nyman Michael Flood	nyman.robert@epa.gov flood.michael@epa.gov	212-637-3809 212-637-4365
Region 3 (DE, DC, MD, PA, VA, and WV)	Frank Borsuk Denise Hakowski Chiamaka Alozie Patti Kay Wisniewski	borsuk.frank@epa.gov hakowski.denise@epa.gov alozie.chiamaka@epa.gov wisniewski.patti-kay@epa.gov	304-234-0241 215-814-5726 215-814-2788 215-814-5668
Region 4 (AL, FL, GA, KY, MS, NC, SC, TN)	Christopher J. McArthur Ashley Aspinwall-Barron Rachel Hart	mcArthur.christopher@epa.gov aspinwallbarron.ashley@epa.gov hart.rachel@epa.gov	404-562-9391 404-562-9256 404-562-9279
Region 5 (IL, IN, MI, MN, OH, and WI)	Wendy Drake Micah Bennett	drake.wendy@epa.gov bennett.micah@epa.gov	312-886-6705 312-886-7946
Region 6 (NM, TX, OK, AR, LA)	Mike Schaub Jatin Mistry	schaub.mike@epa.gov mistry.jatin@epa.gov	214-665-7314 214-665-7483
Region 7 (IA, KS, MO, and NE)	Steve Schaff Laura Webb 24 hours Spill Line 913-281-0991	schaff.steve@epa.gov webb.laura@epa.gov	913-551-7447 913-551-7435
Region 8 (MT, WY, UT, CO, ND, SD)	Tina Laidlaw Robert Clement	laidlaw.tina@epa.gov clement.robert@epa.gov	406-457-5016 303-312-6653
Region 9 (AZ, CA, HI, NV, American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Marshall Islands, and Republic of Palau)	Susan Keydel Corine Li Michael Mayfield Yeana Kwagh	keydel.susan@epa.gov li.corine@epa.gov mayfield.michael@epa.gov kwagh.yeana@epa.gov	619-321-1961 415-972-3560 415-972-3678 415-972-3751
Region 10 (AK, ID, OR, WA and 271 native tribes)	Rochelle Labiosa Samuel Perry Michelle Maier Caitlin Bates You can also contact the spill hotline at 206-553-1263 and select the option to reach the Regional Duty Officer.	labiosa.rochelle@epa.gov perry.samuel@epa.gov maier.michelle@epa.gov bates.caitlin@epa.gov	206-553-1172 206-553-2851 no phone number listed 503-326-2653

Prevent

Monitor

Forecast

Respond

Control

- USEPA ORD is a HAB Research Leader
- Strategic Areas (2023-2026)
 - Health Effects and Toxicity
 - Managing HABs in the Built and Natural Environment
 - Science of harmful cyanobacteria bloom forecasting
- 58 Planned Projects



Research papers

Satellite and *in situ* cyanobacteria monitoring: Understanding the impact of monitoring frequency on management decisions

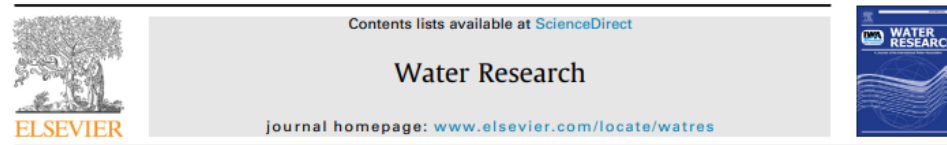
Natalie Reynolds^{a,b,*}, Blake A. Schaeffer^c, Lucie Guertault^b, Natalie G. Nelson^{b,d,*}



Article

The Comparative Toxicity of 10 Microcystin Congeners Administered Orally to Mice: Clinical Effects and Organ Toxicity

Neil Chernoff^{1,*}, Donna Hill¹, Johnsie Lang², Judy Schmid¹, Thao Le², Amy Farthing² and Hwa Huang²



Use of qPCR and RT-qPCR for monitoring variations of microcystin producers and as an early warning system to predict toxin production in an Ohio inland lake

Jingrang Lu^{a,*}, Ian Struewing^b, Larry Wymer^a, Daniel R. Tetttenhorst^a, Jody Shoemaker^a, Joel Allen^a

Review

Determination of Cyanotoxins and Prymnesins in Water, Fish Tissue, and Other Matrices: A Review

Devi Sundaravadivelu¹, Toby T. Sanan^{2,*}, Raghuraman Venkatapathy¹, Heath Mash², Dan Tetttenhorst², Lesley DAnglada³, Sharon Frey³, Avery O. Tatters⁴ and James Lazorchak^{5,*}



Article

Development of a Risk Characterization Tool for Harmful Cyanobacteria Blooms on the Ohio River

Christopher T. Nietch^{1,*}, Leslie Gains-Germain², James Lazorchak¹, Scott P. Keely¹, Gregory Youngstrom³, Emilee M. Urichich³, Brian Astifan⁴, Abram DaSilva⁴ and Heather Mayfield⁵



Article

Effective Early Treatment of *Microcystis* Exponential Growth and Microcystin Production with Hydrogen Peroxide and Hydroxyapatite

Ian Struewing¹, Nathan Sienkiewicz¹, Chiqian Zhang², Nicholas Dugan¹ and Jingrang Lu^{1,*}



Web Resources



EPA HABs Website (Getting a Facelift):

<https://www.epa.gov/cyanoHABs>



EPA Nutrient Pollution Website:

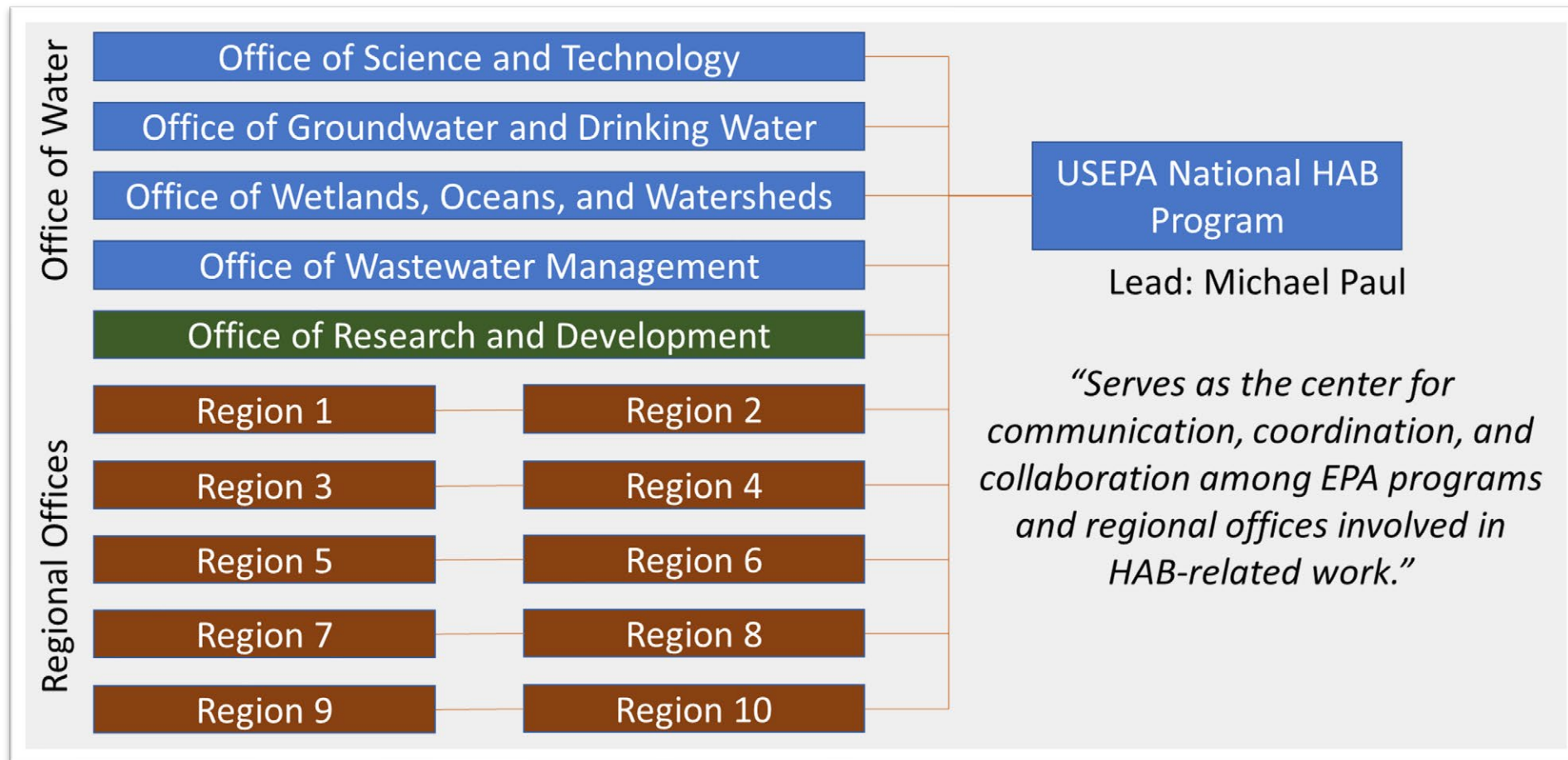
<https://www.epa.gov/nutrientpollution>



EPA NSTEPS Website:

<https://nsteps.epa.gov/>

- Formed: July 2023 to Improve Intra-agency Coordination



- One Year Plan
 - Continued Interagency Cooperation
 - NHP and Steering Committee Establishment
 - Workplan Development
 - Website Migration and Upgrade
 - Program Gaps Analysis and Prioritization Report
 - National HAB Response Plan
 - Long-term Monitoring and Forecasting Plan
 - Integration Planning with Nutrient Criteria Program



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- Longer Term
 - Updating Advisories and Ambient Criteria
 - Expanding/Improving Methods
 - Improved Data Communication Tools
 - Improve Advisory Reporting/Tracking
 - Improved Satellite Monitoring



Thank You

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<https://www.epa.gov/cyanoahabs>