HABs State of the Science webinar series: HABs & Public Health

Speakers:

Virginia Roberts – Centers for Disease Control and Prevention

Donna Francy – U.S. Geological Survey

Barbara Saltzman – University of Toledo

Joe Duris – U.S. Geological Survey

Rebecca Coleman – Centers for Disease Control and Prevention

In partnership with:

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Sea Grant Ohio Sea Grant College Program

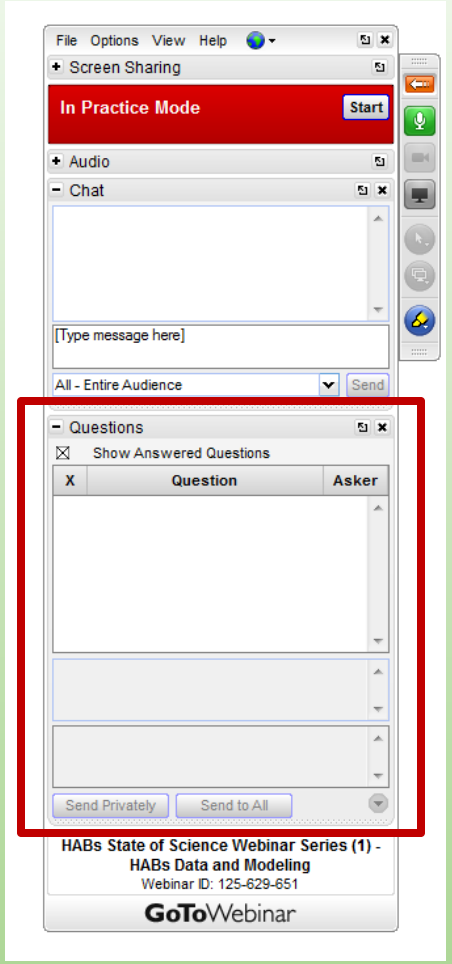
The Ohio State University

LimnoTech Water Environment Scientists Engineers

GoToWebinar Housekeeping Items

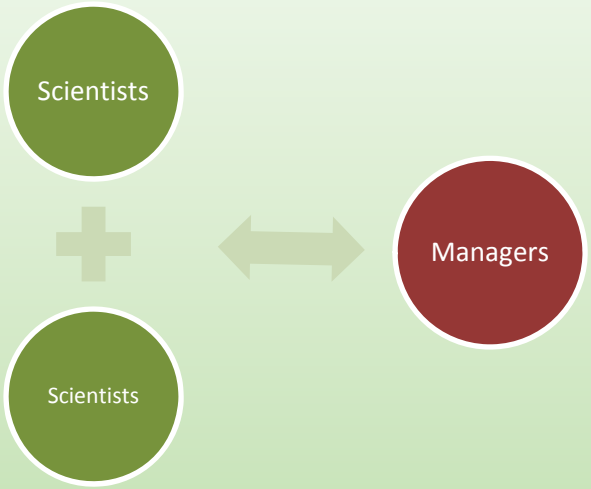
- Submit your text questions and comments using the Questions Panel

- Note: This webinar is being recorded and will be posted on the HABs Collaboratory website



Great Lakes HABs Collaboratory

"A virtual laboratory for information sharing and collective actions to address HABs"



- Multidisciplinary group, 100+ members from different Agencies, Ministries, Colleges, Universities and Organizations across the Great Lakes

Great Lakes Commission des Grands Lacs

USGS science for a changing world

HABs State of the Science webinar series

- Result of the inaugural meeting of the HABs Collaboratory
  - Identified need for communication between researchers, and between researchers and managers
- Present on-going research projects related to HABs in the Great Lakes region
- Goals:
  - Improve communication
  - Knowledge transfer
  - Opportunities for collaboration

Ohio Sea Grant / OSU Stone Lab

- Managing 55 HABS related projects (~$7,000,000)
  - 18 funded by Ohio Sea Grant
  - 5 funded by OSU's Field 2 Faucet initiative
  - 32 funded under the Ohio Department of Higher Education (OSU/UT; 18 vs. 14)
- Stone Lab Guest and Research Lecture Series
  - *June 16th, 23rd, 30th, July 7th, 14th,* **28th, and August 4th**
  - 7pm -9pm
  - https://ohioseagrant.osu.edu/news/calendar
- 9/15/16 "State of Science" meeting in Toledo
  - Stranahan Theater
  - Modeling, BMPs, and Public Health-Water treatment
  - https://ohioseagrant.osu.edu/news/calendar/2016/09/15/o47km/understanding-algal-blooms

Virginia Roberts
Epidemiologist
evl1@cdc.gov

Great Lakes HABs Collaboratory Summer Webinar Series
July 26, 2016

National Center for Emerging and Zoonotic Infectious Diseases
Division of Foodborne, Waterborne, and Environmental Diseases

HABs and Public Health

- Exposure pathways: ingestion (water or food), inhalation, dermal contact
- Emerging public health issue
  - Warming climate, nutrient pollution
- One Health issue – humans, animals, and the environment
- Challenges: identifying and characterizing HAB-associated illnesses

Source: Jill Siegrist

Source: USGS

Source: David Zapotosky

- Electronic reporting system launched in June 2016
  - Web-based, password-protected system
  - Event-based, not for routine water monitoring
  - Not a real-time notification or case investigation system
- Voluntary reporting to the Centers for Disease Control and Prevention (CDC)
- Collects data on foodborne and waterborne HAB events in fresh and marine water settings:
  - HAB events (environmental data)
  - HAB-associated human cases of illness
  - HAB-associated animal cases of illness
- Fills a gap in health surveillance, and will inform understanding of HAB occurrences and HAB-associated illnesses

HAB-associated Illness Reporting Systems in the U.S.

NORS National Outbreak Reporting System

- Web-based
- Outbreak data (≥2 human illnesses)
- Foodborne and waterborne HABs

2009-present

OHHABS ONE HEALTH Harmful Algal Bloom System

- HABs, human cases, & animal cases

2016

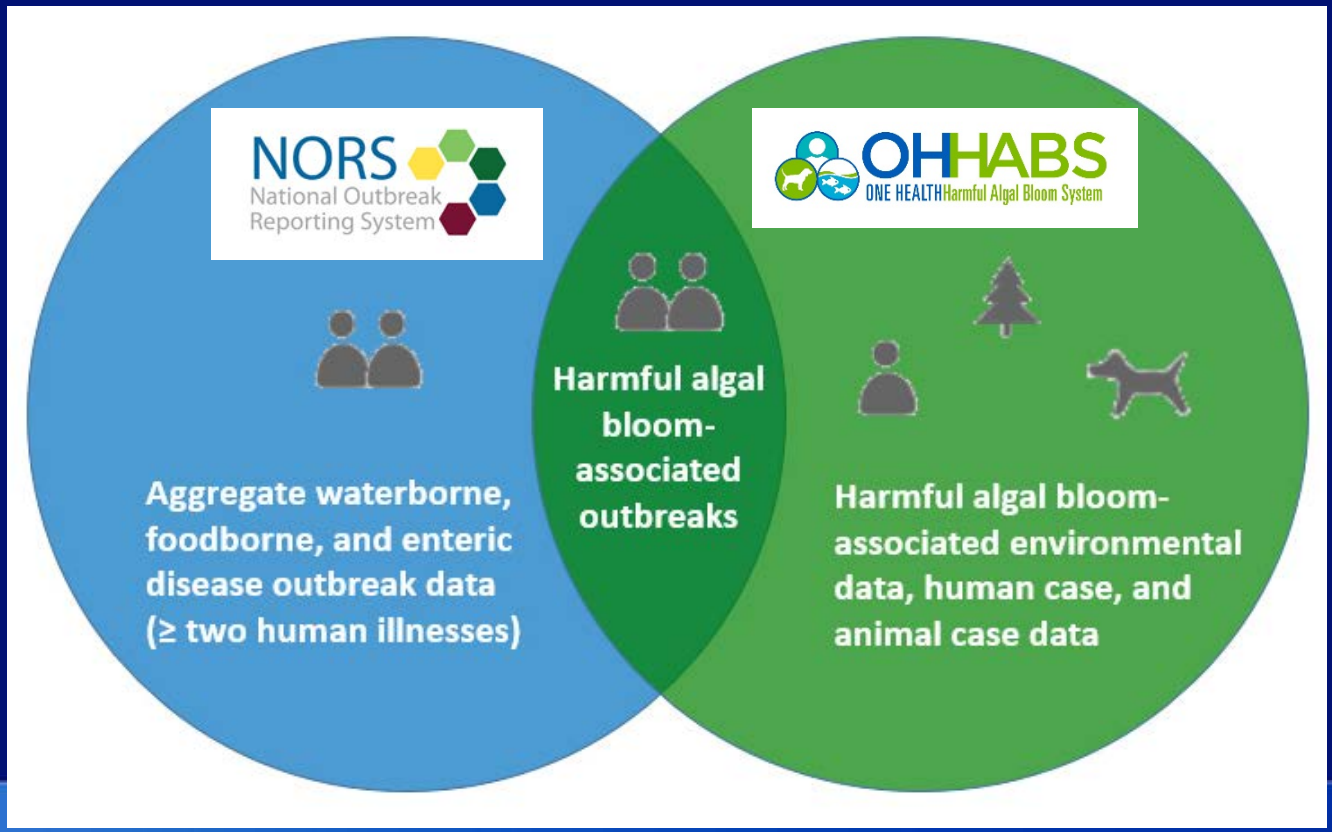
2009-2013

Harmful Algal Bloom-related Illness Surveillance System (HABISS)

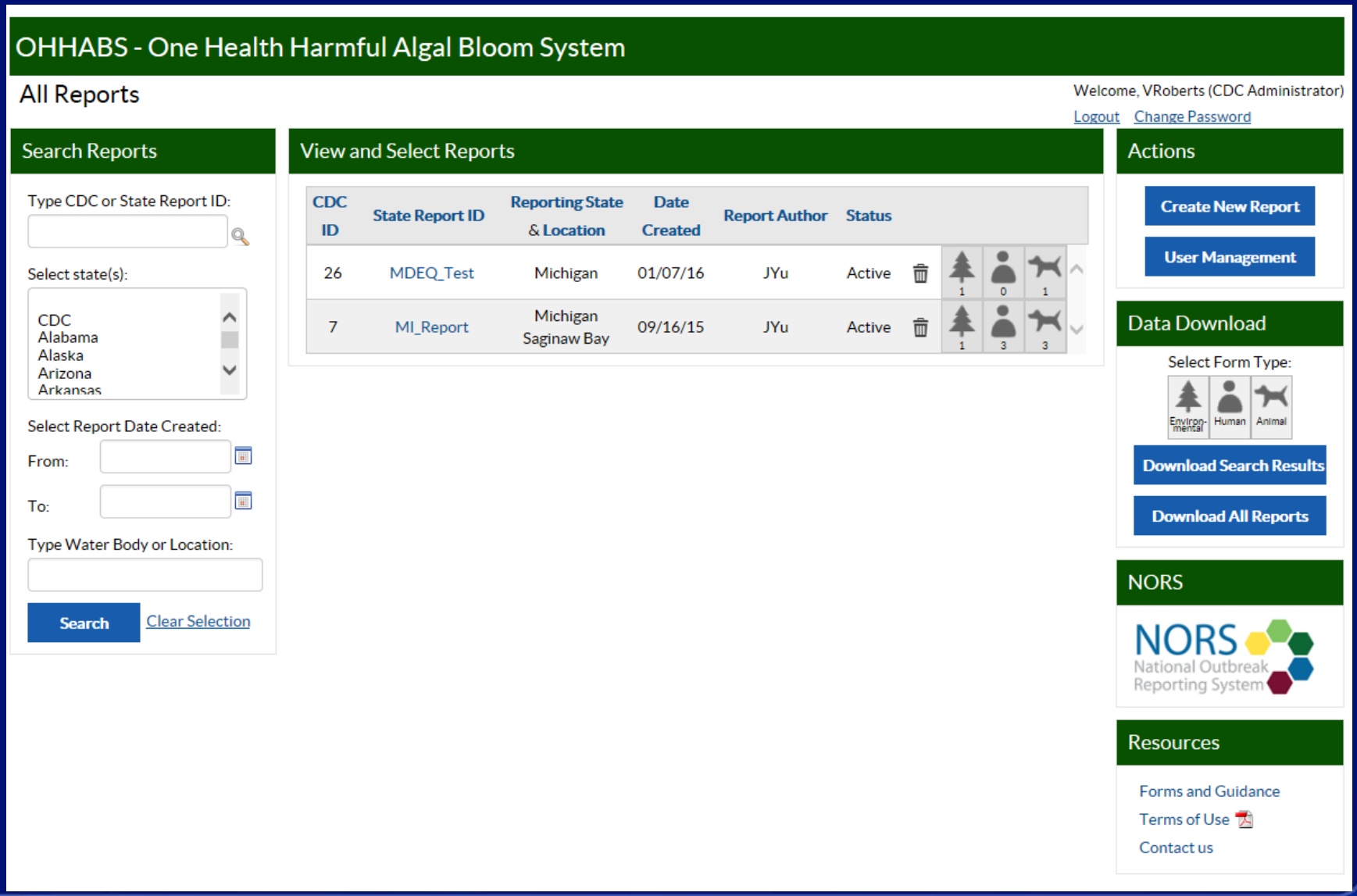
- HABs, human cases, animal cases
- Enhanced surveillance in 11 states
- Program ended in 2013

Who Can Report?

- Local, state, and territorial public health partners and their designated environmental health and animal health partners
- OHHABS and NORS are linked

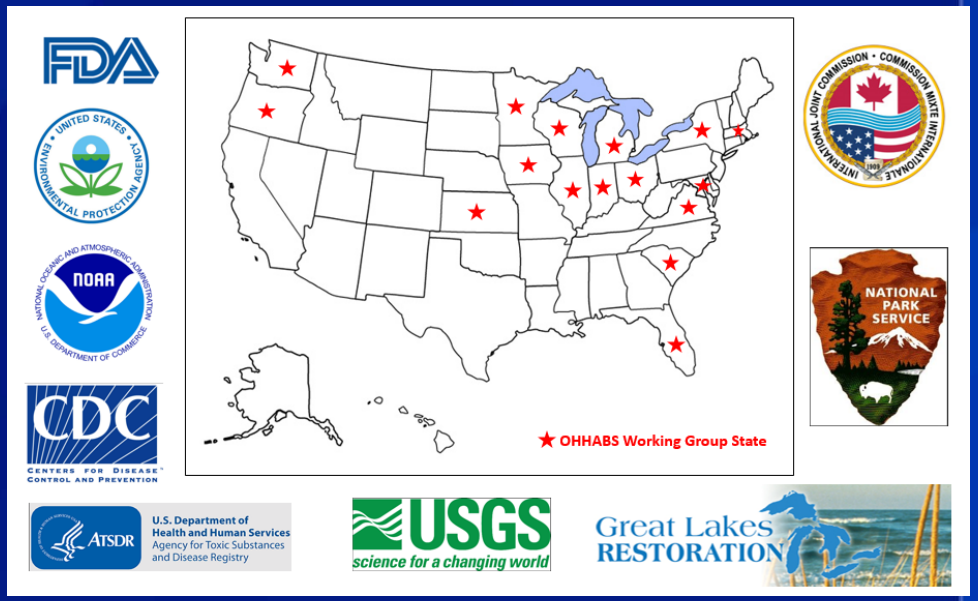


OHHABS User Interface



Partners

- Great Lakes Restoration Initiative (GLRI)
- OHHABS Working Group
- NORS Team



NORS
National Outbreak Reporting System

Resources and Training

- User resources: www.cdc.gov/habs/ohhabs
  - Guidance documents
  - Case and event definitions
  - Static and fillable PDF forms
- User training
  - Session 1 – OHHABS new user training
    - July 27, 4:00pm-5:00pm EST
    - August 2, 1:00pm-2:00pm EST
  - Session 2 – OHHABS administration and user management
    - July 28, 4:00pm-5:00pm EST
    - August 4, 4:00pm-5:00pm EST
- HAB – Associated Illness website: www.cdc.gov/habs
- Health promotion: http://www.cdc.gov/habs/materials
- Questions? NORSWater@cdc.gov

Thank You!

Harmful Algal Bloom (HAB)-Associated Illness

Harmful algal blooms (HABs) are the rapid growth of algae that can cause harm to animals, people, or the local ecology. A HAB can look like foam, scum, or mats on the surface of water and can be different colors. HABs can produce toxins that have caused a variety of illnesses in people and animals. HABs can occur in warm fresh, marine, or brackish waters with abundant nutrients and are becoming more frequent with climate change.

GENERAL INFORMATION
Frequently asked questions...

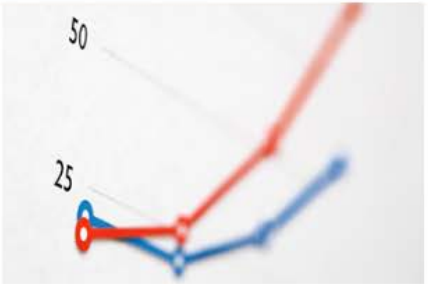
ILLNESS & SYMPTOMS
Signs, symptoms, and outcomes...

SOURCES OF EXPOSURE & RISK FACTORS
Who gets it and how...

HABS & THE ENVIRONMENT
Factors that promote growth of HABs...

PREVENTION & CONTROL
How to stay healthy and prevent illness...

Publications, Data, & Statistics



HAB Resources

Health Promotion Materials

One Health Harmful Algal Bloom System (OHHABS)

Healthy Water Sites

- Healthy Water
  - Drinking Water
  - Healthy Swimming
  - Global WASH
  - Other Uses of Water

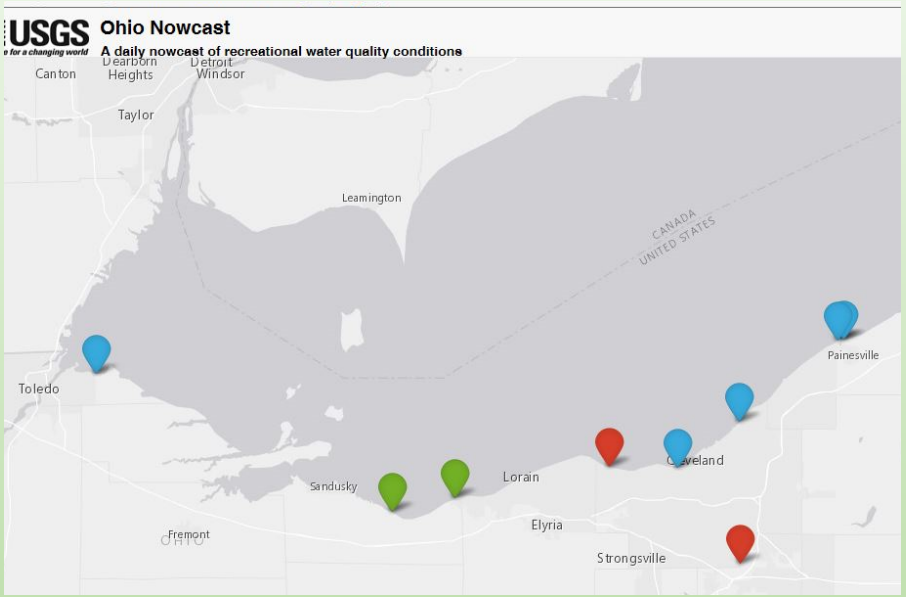
The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention

USING MODELS TO ESTIMATE MICROCYSTIN CONCENTRATION IN OHIO RECREATIONAL AND SOURCE WATERS

Donna Francy, Jennifer Graham, Erin Stelzer, Chris Ecker,
Amie Brady, Pam Struffolino, and Keith Loftin
USGS and University of Toledo

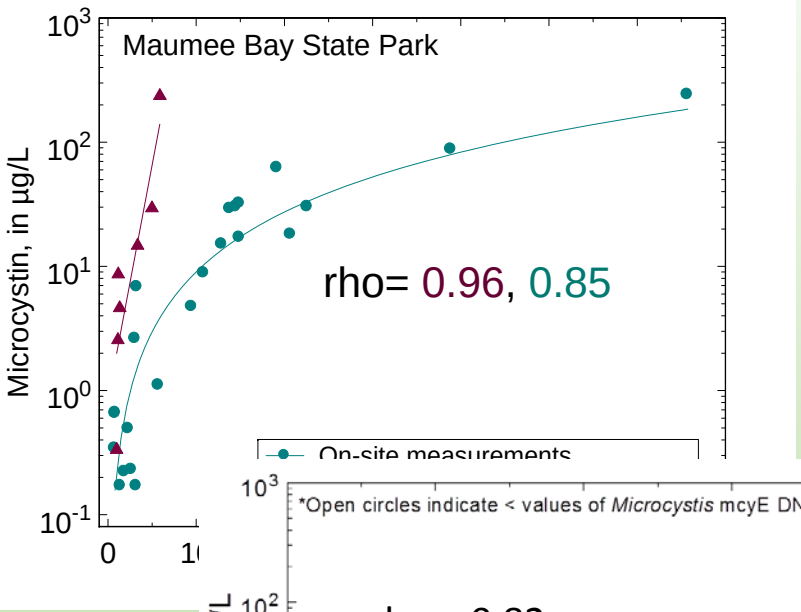
A nowcast for cyanoHABs?

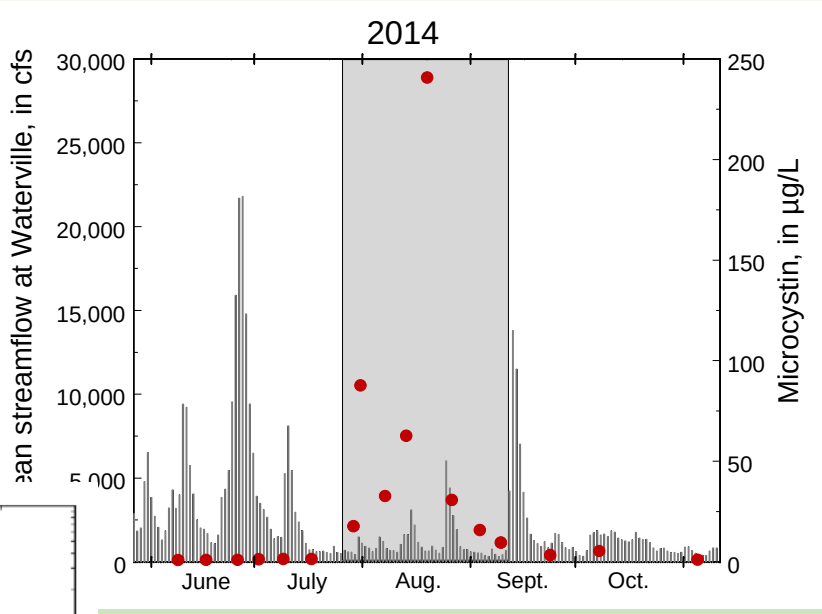
- Focus sample collection for toxins
- Provide real-time swim advisories
- Help optimize drinking-water treatment or intake options

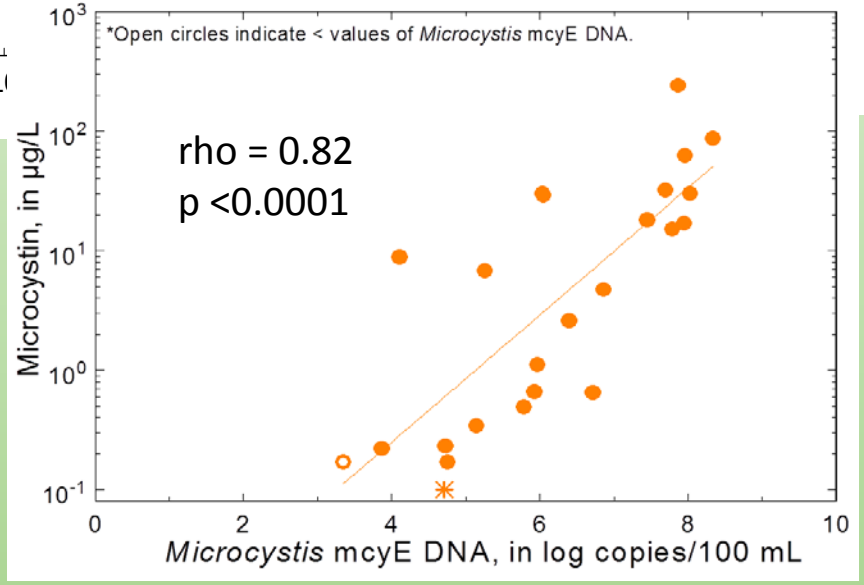


Ohio Nowcast for *E. coli*
http://ny.water.usgs.gov/maps/ohnowcast/

Recreational study: 2013–14







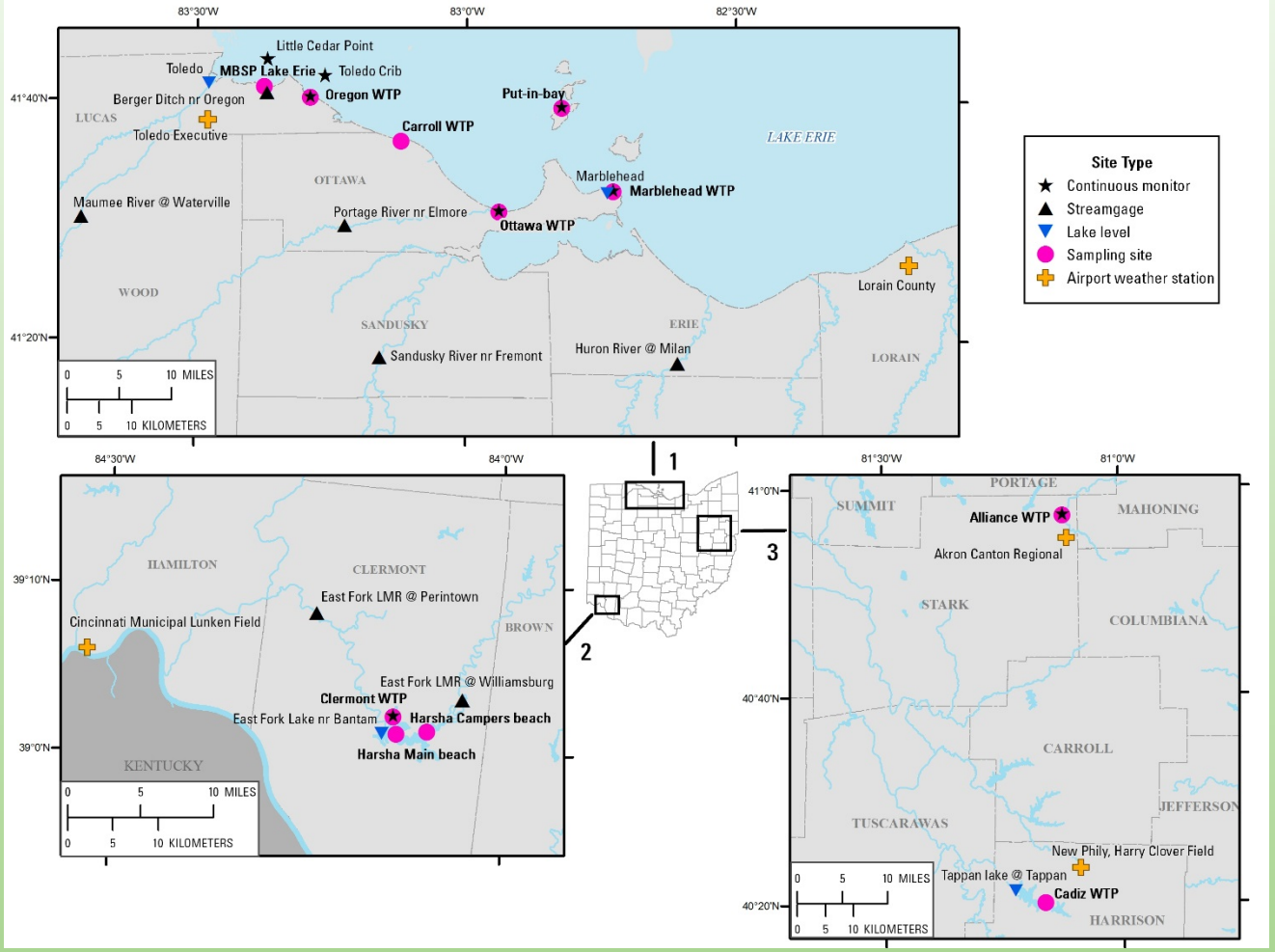
Francy and others, 2015, USGS Scientific Investigation Report 2015-5120

Project Overview: 2016–18

- USGS, University of Toledo, The Ohio State University Stone Laboratory, U.S. EPA, Stark County, NOAA, 7 drinking water plants
- Funded by Ohio Water Development Authority and USGS Cooperative Water Program

Research hypothesis: Factors related to microcystin concentrations could be used to develop real-time and comprehensive models

Sampling 3 times/week to semi-weekly in 2016–17



Approach

- Samples for microcystin, nutrients, cyanobacterial genes (general and *mcyE* toxin)
- Physical parameters (pH, temp, conductance, dissolved oxygen, phycocyanin, chlorophyll)
- Satellite imagery data

HABs Collaboratory

- Are measures of the algal community, phycocyanin, and pH correlated to microcystin at other sites?
- Can cyanobacterial genes and nutrients be used to forecast elevated toxin concentrations?
- Can satellite imagery data be used in regression models to predict toxin concentrations?
- Can useful models for microcystin be developed?

CHARACTERIZATION OF RECREATIONAL EXPOSURES TO CYANOTOXINS IN WESTERN LAKE ERIE BASIN

April Ames, Brian Fink, Barbara Saltzman, Michael Valigosky
University of Toledo

Project Overview

- Characterization of recreational exposures to cyanotoxins in western Lake Erie basin
- April Ames (PI), Brian Fink, Barbara Saltzman, Michael Valigosky(Co-PI); University of Toledo
- Ohio Department of Higher Education
- NW Ohio, 2016-2017
- Identify and evaluate the recreational users of Lake Erie in Northwest Ohio

Project background

- *What lead you to this project? (past projects, interests, etc.)*
  - Occupational and environmental health including exposure and risk assessment
  - Evaluating and controlling airborne contaminants
  - GIS and spatial relationships
  - Epidemiology

Approach

- *How will you meet your project objectives to answer your hypothesis?*
  - Develop water use survey
  - Examine spatial relationships
  - Outreach
- *What are your expected results?*
  - Results will establish populations, activities and locations for future proposed air sampling

HABs Collaboratory

- *What questions still need to be answered about HABs?*
  - What is the exposure to recreational and occupational users (airborne concentrations)?
  - Are there reported health symptoms being experienced by recreational and occupational users?

- *How can collaboration help your research?*
  - Collaboration would help establish relationships to further examine exposures in a variety of settings

USGS GREAT LAKES CYANOBACTERIAL HARMFUL ALGAL BLOOM RESEARCH

Joe Duris, USGS MI-OH WSC
jwduris@usgs.gov
517-887-8942

Project Overview

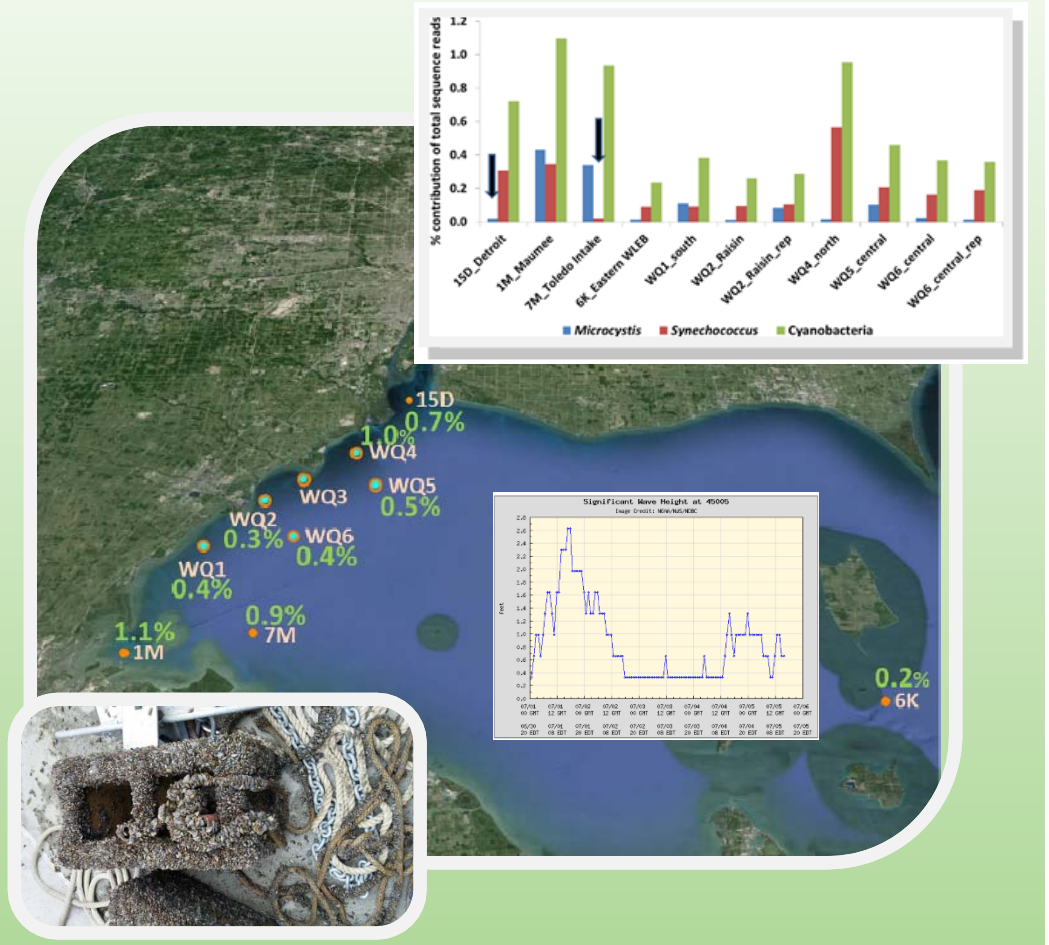
1. Does sediment seed next year's cHAB bloom?
2. Do types/forms nutrients affect intensity of blooms?
3. What are the effects of geospatial & physiochemical properties of water on cHABs formation/intensity?
4. How do communities of bacteria differ around the Great Lakes
5. What are the biotic controls (mussels, virus, heterotrophic bacteria) on cHABs formation/intensity?
6. *At a local level, are cHABs related to human health effects?*

- **USGS GLRI cHABs Research Team**
  - USGS MI-OH Water Science Center
    - Joe Duris
    - Carrie Givens
    - Erin Stelzer
    - Chris Ecker
  - USGS Great Lakes Science Center
    - Mary Anne Evans
  - USGS Upper Midwest Environmental Sciences Center
    - James Larson
  - USGS KS Water Science Center
    - Keith Loftin
  - USGS WI Water Science Center
    - Pete Lenaker
- **Partners**
- **Michigan DNR, Sterling State Park**
- **Wisconsin DNR, Green Bay**
- **University of Wisconsin, Milwaukee**
- **Monroe County, MI Health Department**
- **Funded through the USGS Great Lakes Restoration Initiative Template 683**
  - **2013-Current**

Summary of Findings

Findings to date:

- **The genetics of the sediment cyanobacteria are related to the genetics of the cyanobacteria in the water during blooms.**
- **Shared genetic groups of cyanobacteria in all but 2 locations across the western basin of Lake Erie**
- **Large river environments (Detroit River & Maumee River) affect have different cyanobacteria in the spring sediment**
- **HAB conditions generally followed mixing events, response dependent on nutrient availability**
- **Growth of secondary consumers (like mussels)and the availability of important fats in the western basin are centered on the Maumee river mouth**



2016 Approach

- **Routine monitoring**
  - Biweekly sampling
  - Improved temporal coverage of metals
  - Toxins, genetics, metals, nutrients, carbon physio-chemical parameters
- **Intensive sampling**
  - Over 7 day period at Sterling State Park
  - Collect samples every 2 hrs
    - Continuous data
    - OrthoP, NH4, toxins, qPCR→Fine time scale
    - Metagenomics, TOF MS, congeners→Selected
- **Relate all back to any available HD data (Monroe County & MDHHS)**

HABs Collaboratory

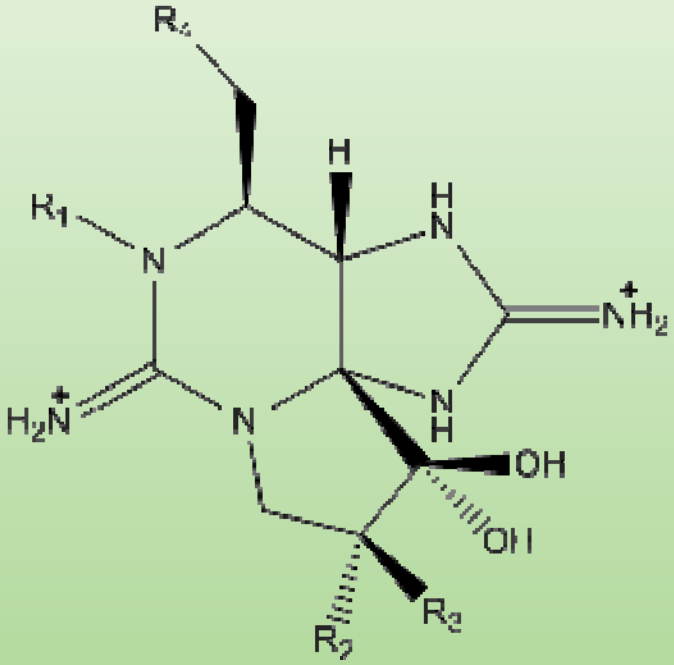
- **Need a more mechanistic view, changes happening rapidly**
  - **Use current correlations to develop proper hypotheses to test mechanisms of toxin triggers**
- **Improve understanding of how cyanobacteria and heterotrophic bacteria interact**
  - **Do early cyanobacteria & heterotrophic bacteria "set the stage" for the bloom?**
- **Pair environmental data with health data (humans & wildlife) to begin to understand potential health effects**
  - **Need health & environmental scientists to work together**

CLINICAL ANALYSIS: HUMAN EXPOSURES TO ALGAL TOXINS

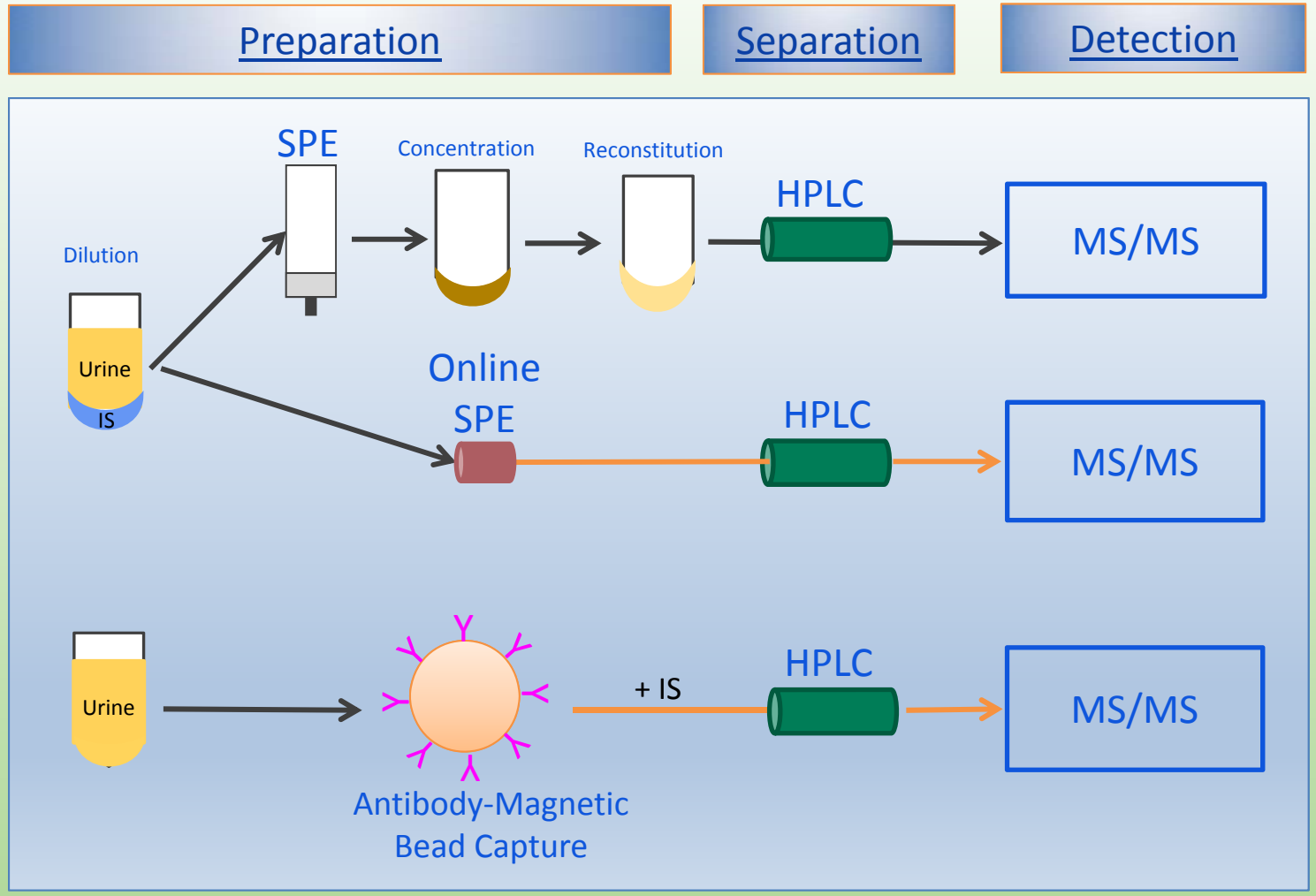
Rebecca Coleman- Centers for Disease Control and Prevention
Atlanta, GA

Project Overview

- Identification of human exposures to algal toxins
  - Current capabilities
    - Saxitoxin/neosaxitoxin (urine)
    - Gonyautoxins 1-4 (urine)
    - Tetrodotoxin (urine)
  - In development
    - Microcystins
    - Domoic Acid



Approaches


Preparation
Separation
Detection
SPE
Concentration
Reconstitution
HPLC
MS/MS
Dilution
Urine
IS
Online
SPE
HPLC
MS/MS
Urine
+ IS
HPLC
MS/MS
Antibody-Magnetic
Bead Capture

Summary of Findings

- Confirmation of exposures to STX, NEO, and GTXs

Paralytic Shellfish Poisoning — Southeast Alaska, May-June 2011

Weekly
November 18, 2011 / 60(45);1554-1556

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6045a3.htm

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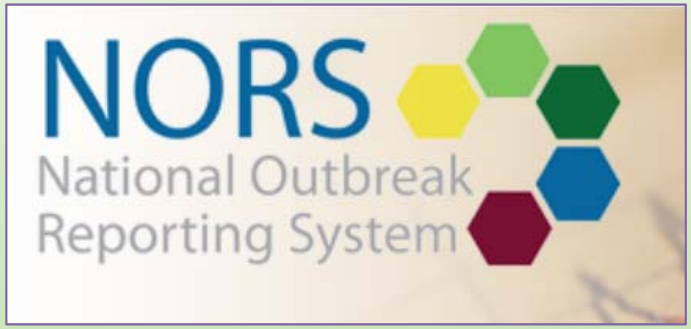
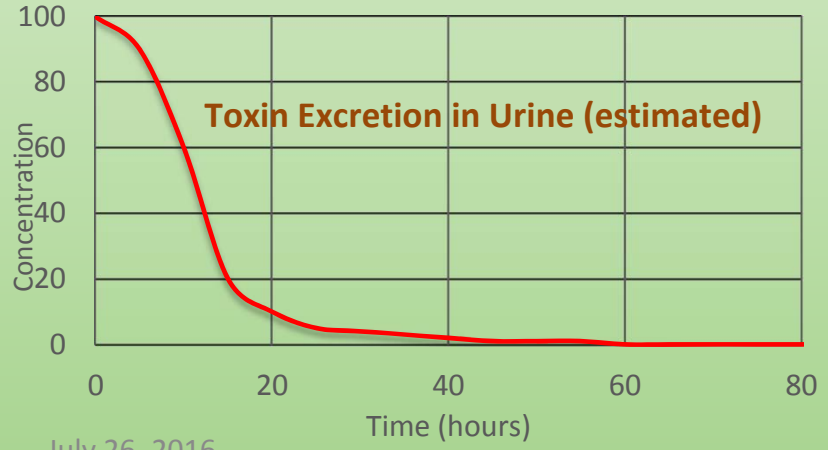
- If algal toxin exposure is suspected, collect samples for confirmation
  - Freeze urine and serum/plasma
  - Do not freeze blood
- Utilize online reporting





To communicate with the person responsible for the development of the microcystin identification, please send an email to: uyu3@cdc.gov

HABs & Public Health

In partnership with:

Coming up next:

HABs Blooms Monitoring & Forecasting
Thursday, August 11 2016, 1-2 pm (EDT)

HABs Blooms Sources & Toxicity
Tuesday, August 16, 11 am – 12 pm (EDT)

HABs: Educate & Engage
TBD

To learn more about the HABs Collaboratory and the HABs State of the Science Webinar Series, visit us at:

http://glc.org/projects/water-quality/habs/