

Ohio Department of Higher Education HAB Research Initiative Update (ODHE HABRI)

Dr. Chris Winslow, Director

Ohio Sea Grant and Ohio State University's Stone Lab

Dec. 6th, 2023



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



2023



HARMFUL ALGAL BLOOM

PROJECT
UPDATE

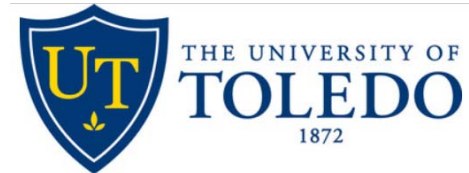
RESEARCH INITIATIVE



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



Thank you University
of Toledo



Agency Advisory Board

Ohio Department of Agriculture

Kirk Hines, Chief, Division of
Soil and Water Conservation

Terry Mescher, H2Ohio WLEB Program Coordinator,
Division of Soil and Water Conservation

Greg Nageotte, Grants and Watershed
Administrator, Division of Soil and
Water Conservation

Ohio Department of Health

W. Gene Phillips, Chief, Bureau of Environmental
Health and Radiation Protection

Mary Shaffer, Assistant Chief, Bureau of
Environmental Health and Radiation Protection

Allison Buck-Priddy, Health Planning Administrator

Bryce Kerr, Environmental Specialist

Mridula Gupta, Environmental Scientist



HARMFUL ALGAL BLOOM

RESEARCH INITIATIVE

PROJECT UPDATE | SEPTEMBER 2023



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



Ohio Department of Natural Resources

Mindy Bankey, Assistant Director

Scudder Mackey, Chief,
Office of Coastal Management

Scott Hale, Executive Administrator, Fish
Management and Research, Division of Wildlife

Eric Saas, H2Ohio Program Manager

Rich Zweifel, Inland Fisheries Program
Administrator, Division of Wildlife

Janice Kerns, Reserve Manager,
Old Woman Creek National Estuarine
Research Reserve

Ohio Environmental Protection Agency

Tiffani Kavalec, Chief, Division of Surface Water

Amy Klei, Chief, Division of
Drinking and Ground Waters

Paul Gledhill, Environmental
Specialist, Division of Surface Water

Ruth Briland, State HAB Specialist –
Emerging Contaminants Section,
Division of Drinking and Ground Water

Ohio Lake Erie Commission

Joy Mulinex, Executive Director

Lynn Garrity, Program Administrator

Sandra Kosek-Sills, Environmental Specialist

HABRI Success

- Since 2015, HABRI has been a statewide response to the threat of HABs; now informing H₂Ohio.
- Intended to help state agencies to prevent and manage future algal issues.
- Ninety-seven projects have positioned Ohio as a leader in understanding this emerging global threat.
- Arguably, with H₂Ohio, has elevated Ohio's role within both GLWQA Annex IV and the WLEB Partnership.
- Ohio Sea Grant recently asked to participate NOAA/NCCOS HABHRCA review.



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



CFAES's OHIO SEA GRANT and STONE LABORATORY

TIME SPAN	NUMBER OF PROJECTS	STATUS	RESULTS	FUNDING AMOUNT (before 1:1 match by universities)	FUNDING SOURCE
2015-2017 (FY15)	19	Complete	2017 Report	\$2 Million	ODHE
2016-2018 (FY16)	14	Complete	2019 Report	\$2 Million	ODHE
2018-2020 (FY17&18)	21	Complete	2021 Report	\$4.5 Million	ODHE and OEPA
2019-2021 (FY19)	12	Complete	2023 Report	\$2 Million	ODHE
2021-2023 (FY20&21)	19	In Progress	2024 Report	\$4 Million	ODHE
2022-2024 (FY22&23)	12	Just Awarded	2025 Report	\$5 Million	ODHE



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



FY 24' and 25' Update

- 52 Pre-proposals were reviewed on Friday, Dec. 1st.
- 31 have been encouraged to submit full proposals (due January 18th).
- Objectives will be dropped, questions will be added, budgets will be modified, and calls will be scheduled.
- New awards to start on March 1st.
- \$8M in asks, \$266k average (\$25k-\$425), and nine institutions

Cleveland State University
The University of Toledo
The Ohio State University
Bowling Green State University
Case Western Reserve University
Heidelberg University
The University of Northwestern Ohio
University of Cincinnati
Youngstown State University



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



CFAES's OHIO SEA GRANT and STONE LABORATORY

HABRI Universities



The initiative arose out of the 2014 **TOLEDO DRINKING WATER CRISIS**

when elevated levels of the
algal toxin microcystin in Lake Erie
threatened drinking water for over

500,000

people in northwest Ohio.

*“HABRI-funded research
provides information to
our agencies to make
informed decisions about
policy and keep Ohio
residents safe.”*



— Joy Mulinex, Executive Director,
Ohio Lake Erie Commission on behalf of
Ohio Department of Natural Resources,
Ohio Environmental Protection Agency
and Ohio Department of Agriculture



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



FOCUS AREA	CHALLENGE	CRITICAL NEEDS OR KNOWLEDGE GAPS IDENTIFIED BY AGENCIES*
 <h2>Track Blooms From the Source</h2>	<p>Algal blooms are not necessarily “harmful” unless they contain certain algae species and have the right mix of conditions to make toxins such as microcystin. With standard detection methods, public health officials may have to wait for hours or even days to confirm whether blooms are toxic and how they are growing and moving in the water body.</p>	<ul style="list-style-type: none"> • Rapid determination of whether blooms are toxic and where toxins are moving (even apart from the main algae mass) • Prediction capability for the location and severity of blooms, even months ahead of time • The ability to track nutrients and stormwater upstream and correlate them with particular sources, storm events and algal bloom characteristics • Assessment of bloom and toxin locations within the vertical water column
 <h2>Produce Safe Drinking Water</h2>	<p>When pollutants end up in the water source for a city, water treatment officials need to know what they’re dealing with and how best to clear them out of the water. But toxins from harmful algal blooms present a relatively new challenge globally, and the detection and treatment protocols are not mature.</p>	<ul style="list-style-type: none"> • Laboratory testing of water treatment methods that give treatment facilities effective and cost-efficient options for clearing out algal toxins using their current infrastructure • Development of new, innovative techniques for producing safe drinking water



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



Specific FY 22/23 Projects

Projects in this Focus Area

Evaluation of a Low-Cost In Situ Water Quality Monitoring Network to Assess Physical and Biological Changes in Ohio's Recreational and Drinking Water Sources
Darren Bade, Kent State University

Investigation of Temporal Trends of Saxitoxin-Producing Cyanobacteria in Northern Ohio Lakes
Justin Chaffin, The Ohio State University

Evaluating the Impact of Rivers on Phosphorus Delivery to Western Lake Erie
James Hood, The Ohio State University

Quantifying the Role of Sediment in P Exports From Drainage Networks: Sources, Recency, and DRP Interactions
James Hood, The Ohio State University

Exploring and Understanding Fate and Transport of Cyanotoxin in Porous And Fractured Media: Integrating Numerical Modeling, Laboratory Experiments and Field Studies
Ganming Liu, Bowling Green State University

Evaluating the Interactive Effects of Dissolved Organic Matter and Nutrients on Cyanobacteria and Their Toxins
Craig Williamson, Miami University

Synergies of Multisource Remote Sensing and In Situ Water Quality Data to Enhance Satellite-Based Monitoring of HABs in Ohio's Inland Lakes and Waters
Kaiguang Zhao, The Ohio State University



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



Specific FY 22/23 Projects

Projects in this Focus Area

Developing Fast Responding Solutions for Removing Cyanobacteria, Cyanotoxins and Nutrients With Coagulation/Flocculation/Sedimentation By Characterizing Site-Specific Bloom-Related Environmental Factors

Soryong Chae, University of Cincinnati

Evaluating Combined Approach of PAK-27 and Phoslock® to Mitigate Harmful Algal Blooms and Reduce PO4 in Surface Water

Teresa Cutright, The University of Akron

Removing Cyanotoxins in Drinking Water Plants: Best Strategy When Saxitoxin and Anatoxin-a Present Alone or With Microcystin

Teresa Cutright, The University of Akron

Management of Harmful Algal Blooms By Clay-Biopolymer Composite Through Flocculation of Cyanobacterial Cells and Adsorption of Phosphorus

Dionysios Dionysiou, University of Cincinnati

Development of Corncob-based Materials and Filters for Removal of Cyanotoxins From Water

Dragan Isailovic, The University of Toledo

Discovery of Novel Cyanotoxins in HAB Samples From Lake Erie and Maumee River and Investigation of Their Toxicity

Dragan Isailovic, The University of Toledo

Optimization and Field Validation of a Full-Scale Dissolved Air Flotation System for Small Scale Water Treatment Plants Impacted by Harmful Algal Blooms



Youngwoo Seo, The University of Toledo



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



FOCUS AREA	CHALLENGE	CRITICAL NEEDS OR KNOWLEDGE GAPS IDENTIFIED BY AGENCIES*
 <p>Protect Public Health</p>	<p>Algal toxins such as microcystin are known to have risks for humans and animals under certain circumstances. But the laboratory studies needed to make public health guidelines have not yet been updated and tailored for the more severe, persistent algal blooms we're seeing in Lake Erie and other freshwater sources around the world.</p>	<ul style="list-style-type: none"> • New laboratory methods to detect the presence of algal toxins and their byproducts in living tissue such as blood • Laboratory studies on the effects of algal toxins at the cellular level and beyond • Testing of fish from affected water bodies to aid officials in advising anglers
 <p>Engage Stakeholders</p>	<p>Effective crisis prevention and management involves many different types of people who need to be connected — ahead of time. The Toledo water quality crisis provided a galvanizing event that revealed the need for closer ties among scientists, agencies, municipalities and landowners.</p>	<ul style="list-style-type: none"> • Establishment of connections between various land management practices upstream and nutrient flows downstream



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



Specific FY 22/23 Projects

Projects in this Focus Area

How Much Is Too Much? Assessing the Microcystin Inhalation Risk to Shoreline Populations

April Ames, The University of Toledo

Health Effects of Aerosolized Cyanotoxins in At-Risk Pre-Existing Disease States

Steven Haller, The University of Toledo

Deep Phenotyping of Human Organ Biobank Specimens for Cyanotoxin Exposure in At-Risk Populations

Steven Haller and David Kennedy,
The University of Toledo

Microcystin Degrading Bacteria as a Novel Therapy for Microcystin Exposure and Hepatotoxicity

Steven Haller and David Kennedy,
The University of Toledo

Health Effects of Dermal Contact to Harmful Algal Bloom Cyanotoxins in At-Risk Pre-Existing Disease States

David Kennedy, The University of Toledo

Needle BioFET Sensors for Detection of Microcystins in Fish Tissue

Wu Lu, The Ohio State University

Toward the Improvement of Methods to Quantify Total Microcystins and Microcystin Congeners In Fish

Stuart Ludsin, The Ohio State University

The Role of Foreshore Sands in Human Exposure to Microcystin

W. Von Sigler, The University of Toledo



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



Specific FY 22/23 Projects

Projects in this Focus Area

Effect of Soil Properties on Leaching Potential and Crop Uptake of Microcystin in Land Applied Drinking Water Treatment Residuals

Nicholas Basta, The Ohio State University

Optimizing Manure Application Timing and Soil Health Testing to Improve Water Quality Outcomes and Farmer Profitability

Leonardo Deiss, The Ohio State University

Tracing Flow and Transport Pathways in Geographically Isolated Wetlands Using Rainwater and Ambient Temperature (RwAT)

Kennedy Doro, The University of Toledo

Development and Implementation of Low-Cost, On-Site, Real-Time Ionic Sensors for Assessing Water Quality From Land to Lake

Laura Johnson, Heidelberg University

What's the Real Nutrient Load Reduction Achieved Using Controlled Drainage Structures?

Steve Lyon, The Ohio State University

Using Stable Isotope Methods to Differentiate Among Agricultural Inorganic Phosphate Sources Seek Patterns of Addition Within the Grand Lake St. Marys Watershed

Melanie Marshall, Wright State University

Evaluating Field- and Watershed-Scale Water Quality Benefits of H2Ohio Conservation Practices in the Maumee River Watershed

Asmita Murumkar, Jay Martin, The Ohio State University, and Kevin Czajkowski, The University of Toledo

Quantifying Nutrient Reduction in a Constructed Wetland Complex Treating Storm Flows from East Fork Little Miami River

Ryan Winston, The Ohio State University

Evaluation of a Modified Two-Stage Ditch Design Approach for Sediment and Nutrient Removal

Jon Witter and Dan Mecklenberg, The Ohio State University

Priorities Coming Out of Ohio (but not unique)

- **Ohio DNR:** identifying, constructing, & managing wetland for nutrient & sediment reduction
- **Ohio Dept. of Agriculture:**
 - Effectiveness of various ***manure management*** practices & ***application*** methods
 - Cost-benefit analysis of ***subsurface placement***
 - Agricultural ***climate change adaptation***
 - ***Drainage retention/detention*** practice
 - Factors driving varying levels of ***farmer participation***
- **Lake Erie Commission:**
 - Modeling efforts to analyze the ***effectiveness of H₂Ohio and Ohio's DAP***
 - ***Paired/pilot watershed studies*** to assess effectiveness of stacked BMPs
 - ***Cost curve*** approach to assess “top ten” H₂Ohio BMPs
- **Ohio EPA and Dept. Health:** looking to source water protect, treatment and health risks



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



Matching funds
from participating
universities
doubled the
impact of
ODHE's HABRI
investment to
more than

\$37
MILLION
in research
funding.

By-the-Numbers

TO DATE

284
Undergraduate
Students

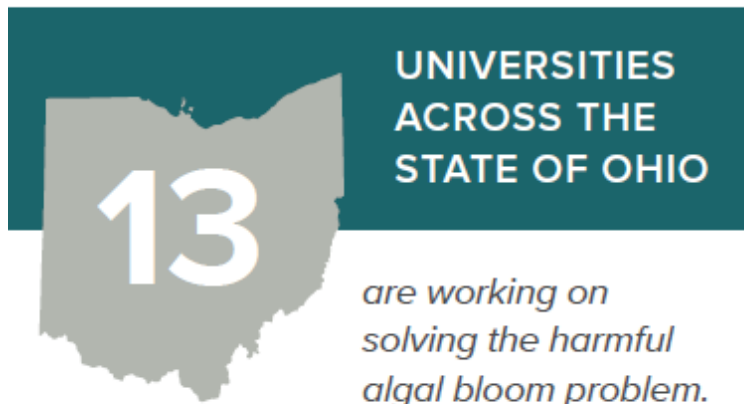
+

335
Graduate
Students

have participated in
hands-on learning
opportunities offered
by HABRI researchers.



33
Scientific
Peer-Reviewed
Publications



HABRI breaks down research
questions into bite-sized
chunks that scientists can
answer in **two years or less.**



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



Questions?



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES

