Mississippi River Harmful Algal Blooms

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U.S. Geological Survey

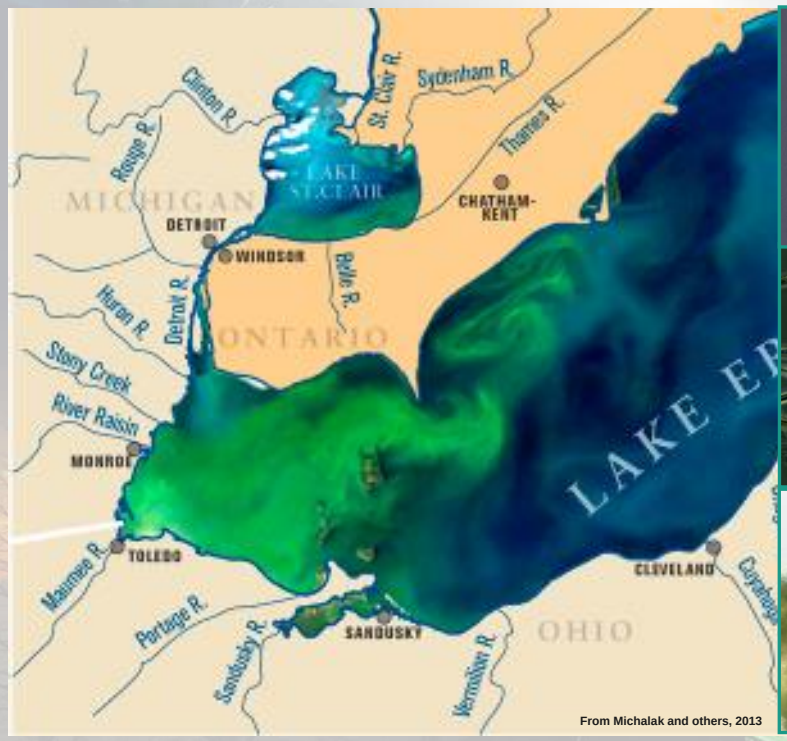
Mississippi River Science Forum
February 15-16, 2023

Bloomington, Iowa / painted and litho. by J.C. Wild. 1844
Library of Congress Prints and Photographs Division Washington, D.C https://lccn.loc.gov/2012647666

U.S. Department of the Interior
U.S. Geological Survey

What is a Harmful Algal Bloom?

- Definition is subjective
- Common definitions
  - High cell densities
  - Dominance by a single or a few species
  - Visible accumulation of algae
- Not all algal blooms are harmful, and not all harmful blooms are toxic



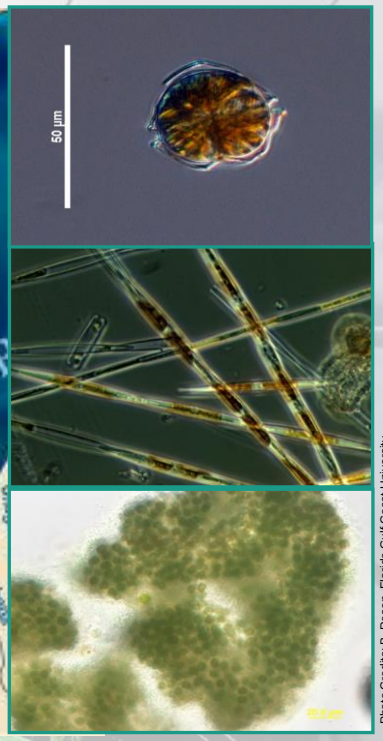


Photo Credits: B. Rosen, Florida Gulf Coast University

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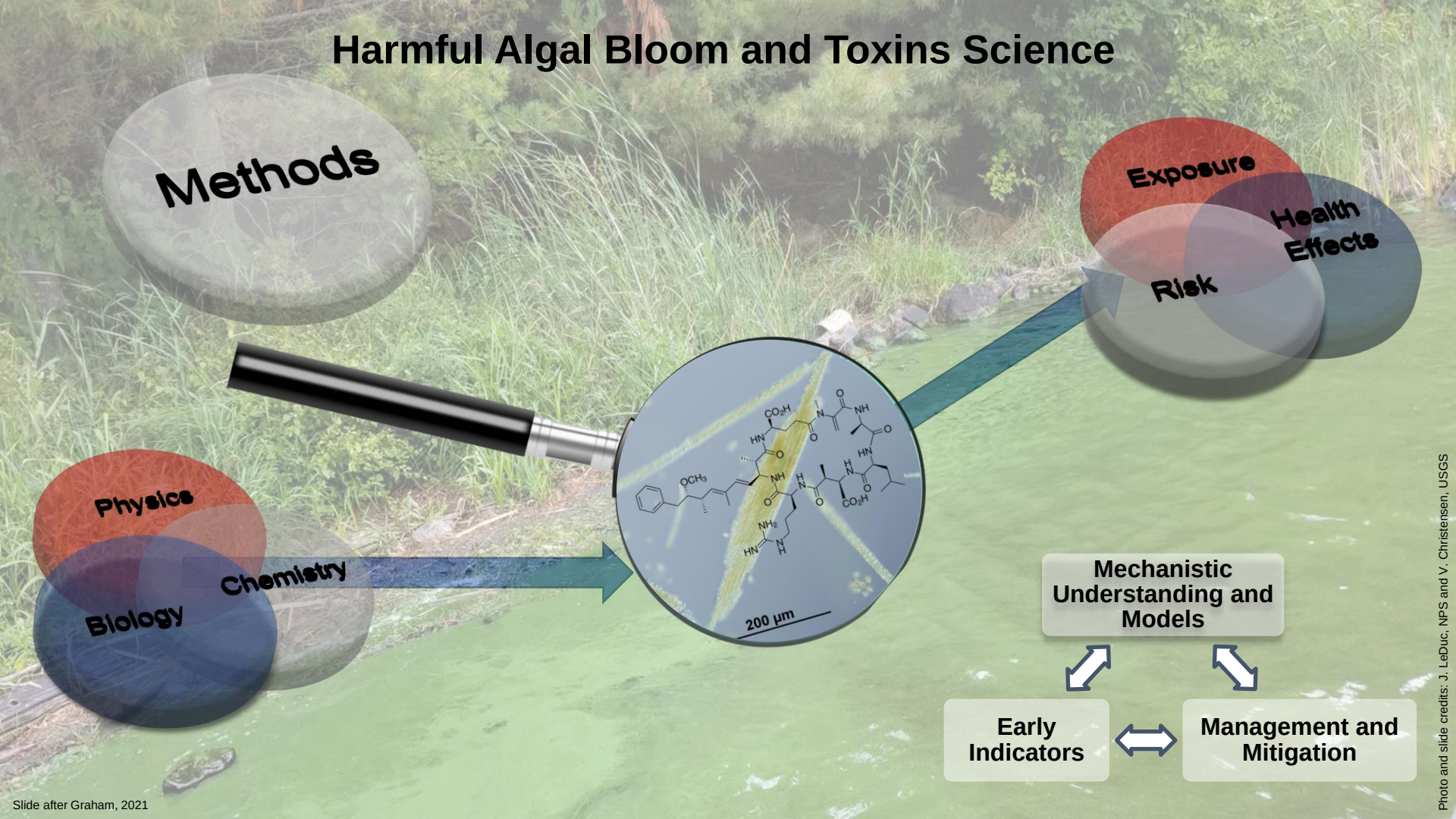
Harmful Algal Bloom and Toxins Science



Slide after Graham, 2021

Photo and slide credits: J. LeDuc, NPS and V. Christensen, USGS

HABs in the Mississippi River System

- Recurring blooms in Upper Mississippi River navigation pools and backwaters.
- 2011: **Kansas River** bloom stretches 180 miles
- 2015: **Ohio River** had a bloom that stretched 650 miles; smaller event in 2019
- 2018 & 2020: **Upper Illinois River** upstream of Starved Rock Dam.
- 2019: **MS gulf coast/MS Sound** extensive beach closures for >60 days.
- Increasing frequency of HABs within Lake Pontchartrain.

September 2015 Bloom Illinois River Starved Rock State Park & Lock and Dam

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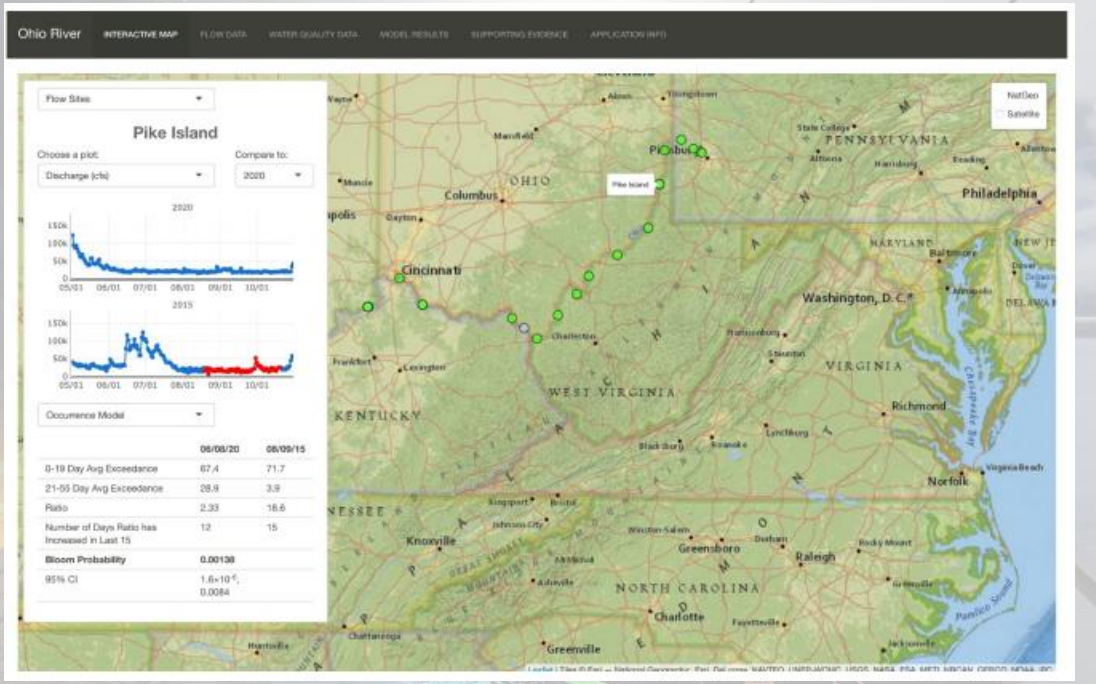
Early Indicators and Risk Characterization

Real-Time Reporting of Risk of HABs on the Ohio River

- Data driven models based on time-lagged average flow exceedances and residence time under low flow conditions.
- Real time prediction probabilities as a component of a risk characterization tool/web application.



From: Development of a Risk Characterization Tool for Harmful Cyanobacteria Blooms on the Ohio River. 2022. Nietch et al. *Water.*

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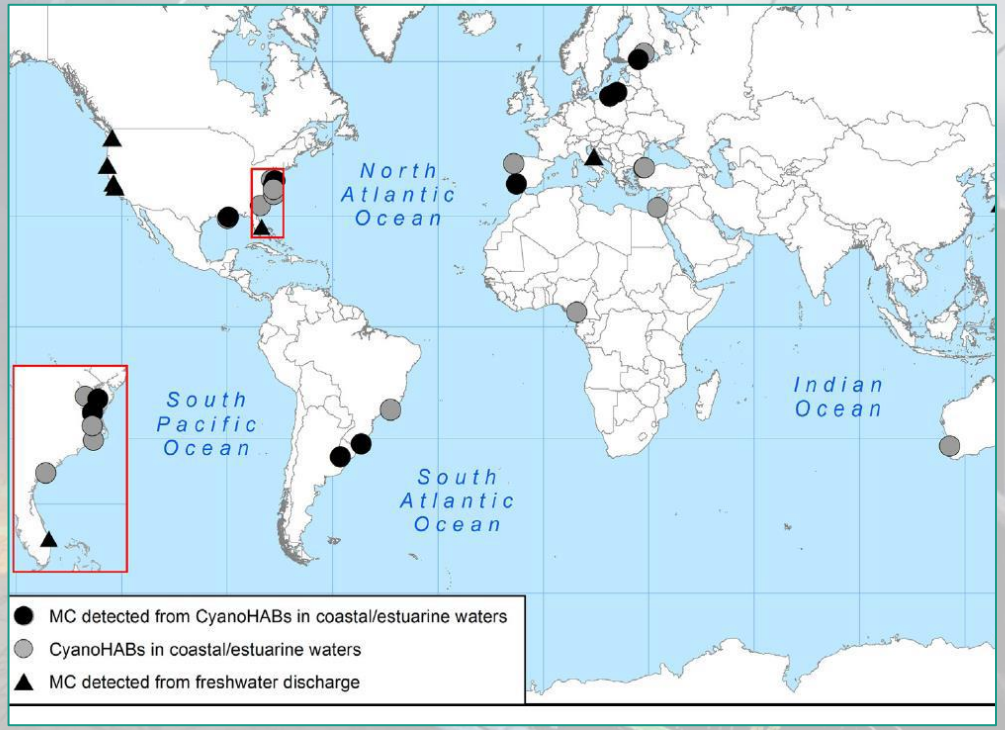
HABs and Cyanotoxins Along the Freshwater to Marine Continuum

- Downstream transport from upstream source areas has been documented but is an understudied phenomena.
- Integrative monitoring strategies across the freshwater-to-marine continuum are needed (e.g., Howard et al, 2022).
- Research and modeling to understand algal and cyanotoxin occurrence and transport are needed.



From Preece et al. 2017: A review of microcystin detections in estuarine and marine waters: Environmental implications and human health risk. *Harmful Algae.*

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Monitoring in the Mississippi River System

- Big Picture: No consistent monitoring approach for HABs in the U.S., especially in rivers.
- Bloom response for Mississippi River is variable, generally event based and state-led, and mostly in the Upper Mississippi River.
- Only 6 sites in Lower Mississippi River have greater than 30 years of water-quality monitoring data.
- USGS Real-Time Water-Quality Monitoring Sites could serve as the backbone of an integrated monitoring network.
    - 7 mainstem stations
    - 6 Mississippi Sound stations

https://maps.waterdata.usgs.gov/mapper

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Paradigm Shifts and Unintended Consequences

Marine Pollution Bulletin 124 (2017) 591–606

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Eutrophication, harmful algae and biodiversity — Challenging paradigms in a world of complex nutrient changes

Patricia M. Glibert

Harmful Algae 73 (2018) 138–147

Contents lists available at ScienceDirect

Harmful Algae

journal homepage: www.elsevier.com/locate/hal

Blurred lines: Multiple freshwater and marine algal toxins at the land-sea interface of San Francisco Bay, California

Melissa B. Peacock[a,b,c,*], Corinne M. Gibble[b,d], David B. Senn[d], James E. Cloern[c], Raphael M. Kudela[b]

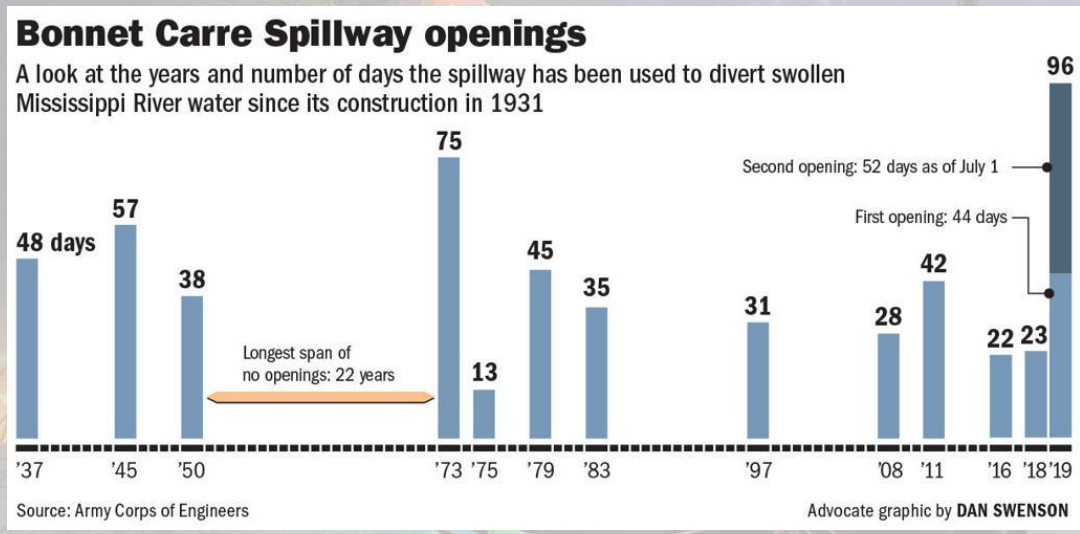
Harmful Algae

Volume 91, January 2020, 101590

Review

Harmful algal blooms: A climate change co-stressor in marine and freshwater ecosystems

Andrew W. Griffith [a b], Christopher J. Gobler [a]



From https://www.nola.com/news/environment/article_5ed1a994-9c32-11e9-9695-bb42b9b7a073.html

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Knowledge Gaps

- There are many knowledge gaps about HABs and associated cyanotoxins, particularly in riverine systems, including:
  - Status and trends
  - Environmental fate and transport
  - Environmental drivers
  - Ecosystem effects
  - Exposure and health effects
  - Drinking water and food impacts
  - Mitigation and management

Jessie Garrett collecting CyanoHAB samples. Photograph by Katherine Summers, U.S. Geological Survey

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Future Directions and Next Steps

- Continued research to address knowledge gaps
- Integrated monitoring strategies
- Better understanding of risk
- Development of early indicators
- Event response preparedness
- Enhanced public outreach and education

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Thank you for the input!

Shawn Giblin, Wisconsin DNR
Kathi Jo Jankowski, USGS
James Larson, USGS
Scott Mize, USGS
Jennifer Murphy, USGS
Lauren Salvato, UMR Basin Association
Sarah Stackpoole, USGS

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