

Lake Erie Harmful Algal Blooms: Why sondes matter!



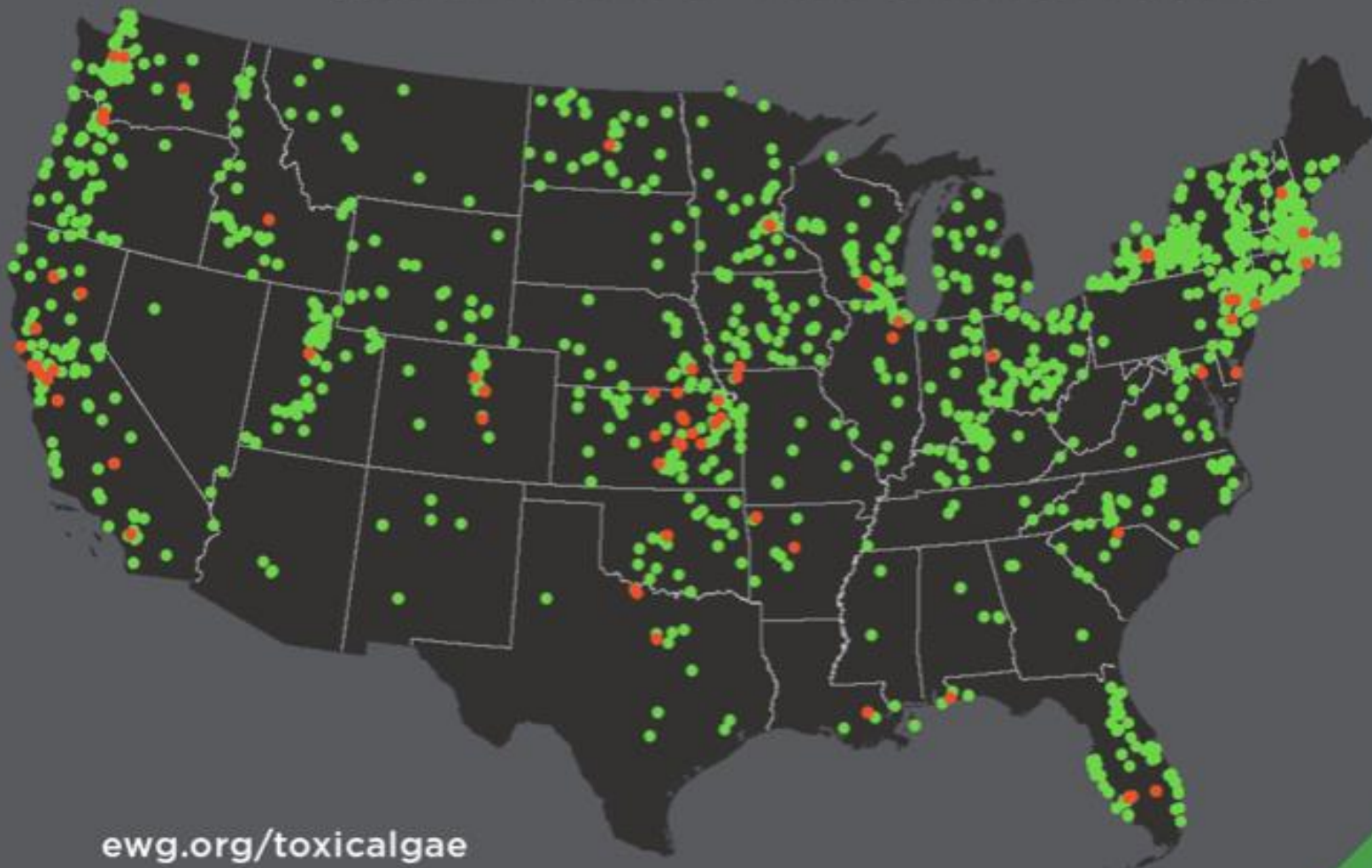
Ed Verhamme
Principal, LimnoTech
President, Freeboard

May 2022



2020

ALGAE BLOOMS IN THE U.S. HAVE SURGED BETWEEN 2010 AND 2020



ewg.org/toxicalgae

- Locations of Algae Blooms 2010-2019
- Locations of 2020 Algae Blooms (through the end of June)

Source: Environmental Working Group. Updated on June 30, 2020.



3+ Million drink water from Lake Erie

5 miles



Toledo

Toledo Water Intake

Cedar Point

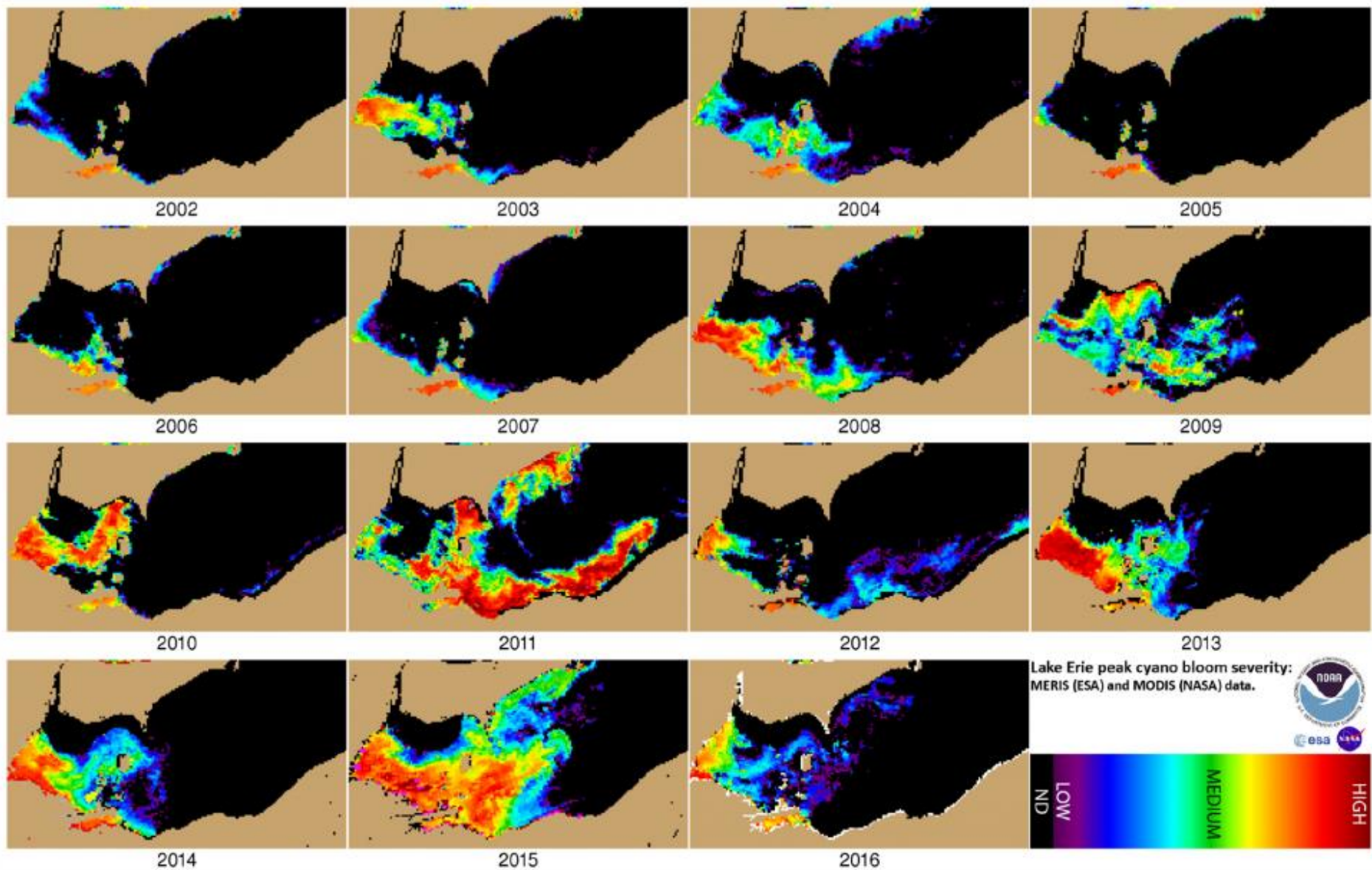


Fig. 1. Maximum bloom each year as determined from satellite imagery. These images from MERIS (medium resolution imaging spectrometer) and MODIS (moderate resolution imaging spectroradiometer) show the extent and concentration of cyanobacteria at the peak of the bloom. Updated from Stumpf et al., 2016. Figure Credit: Richard Stumpf, NOAA.

Wilson et al, 2019

Know your source water!

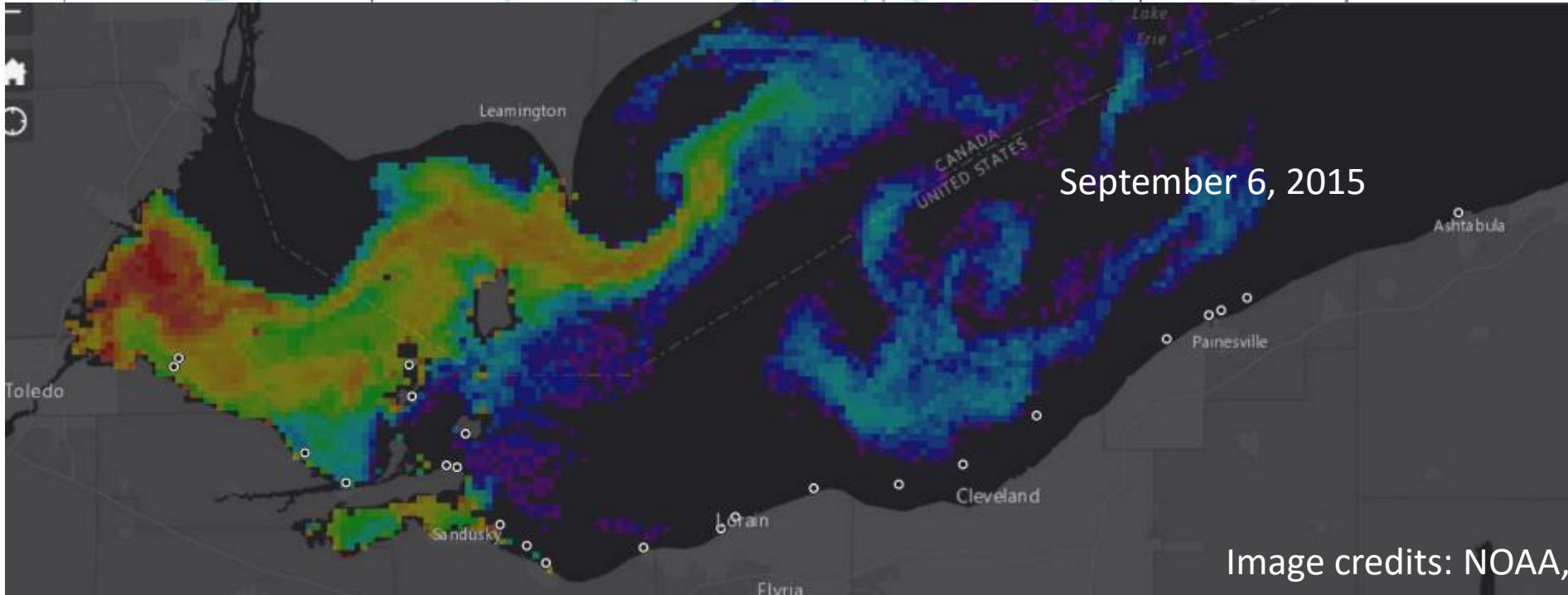
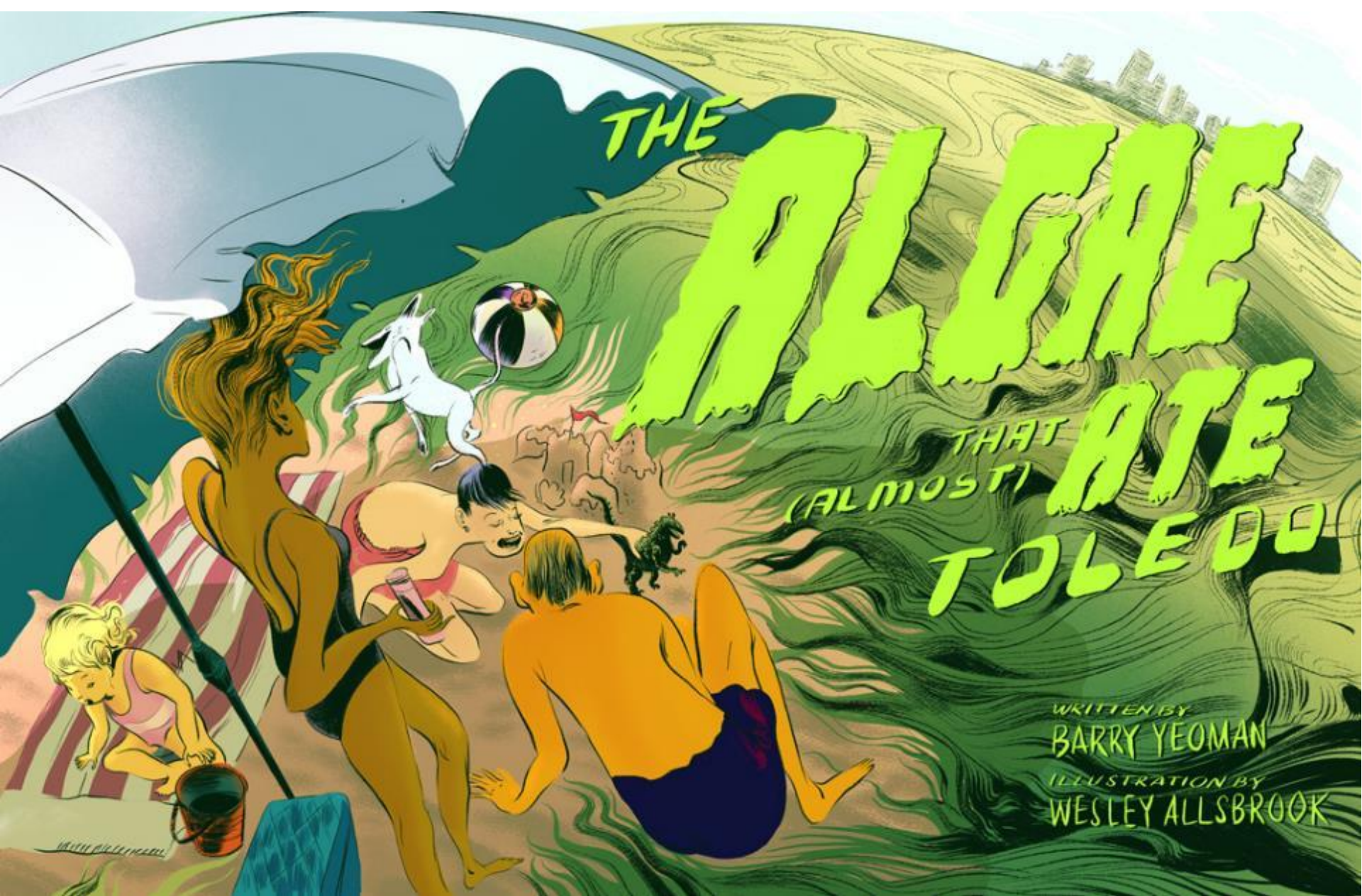


Image credits: NOAA,



<https://www.nrdc.org/onearth/algae-almost-ate-toledo>

Harmful Algal Bloom Quickly Surrounds Toledo Intake Crib



Bloom July 31, 2014

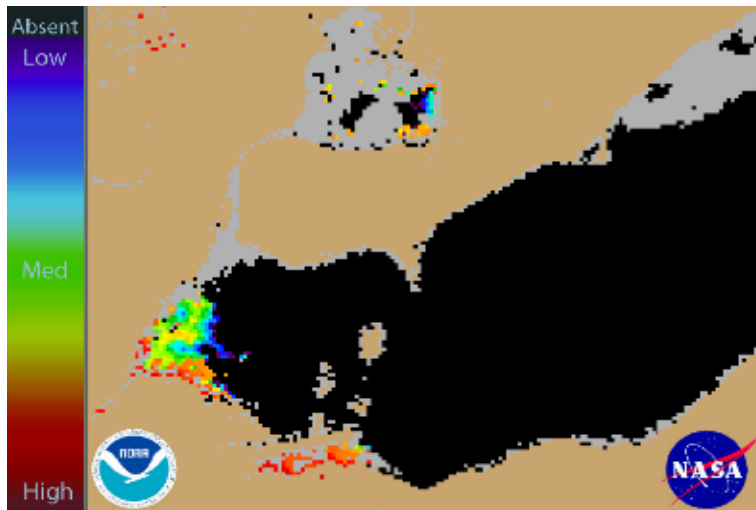


Figure 1. Cyanobacterial Index from NASA's MODIS-Aqua data collected 31 July 2014 at 2:30 pm. Grey indicates clouds or missing data. Black

Bloom August 3, 2014

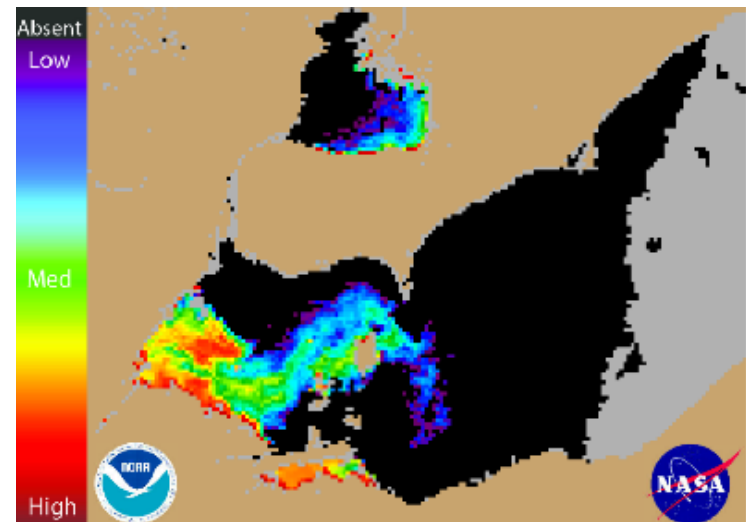


Figure 1. Cyanobacterial Index from NASA's MODIS-Aqua data collected 3 August 2014 at 1:10 pm. Grey indicates clouds or missing data. Black



City of Toledo Water Supply



City of Toledo Sensors

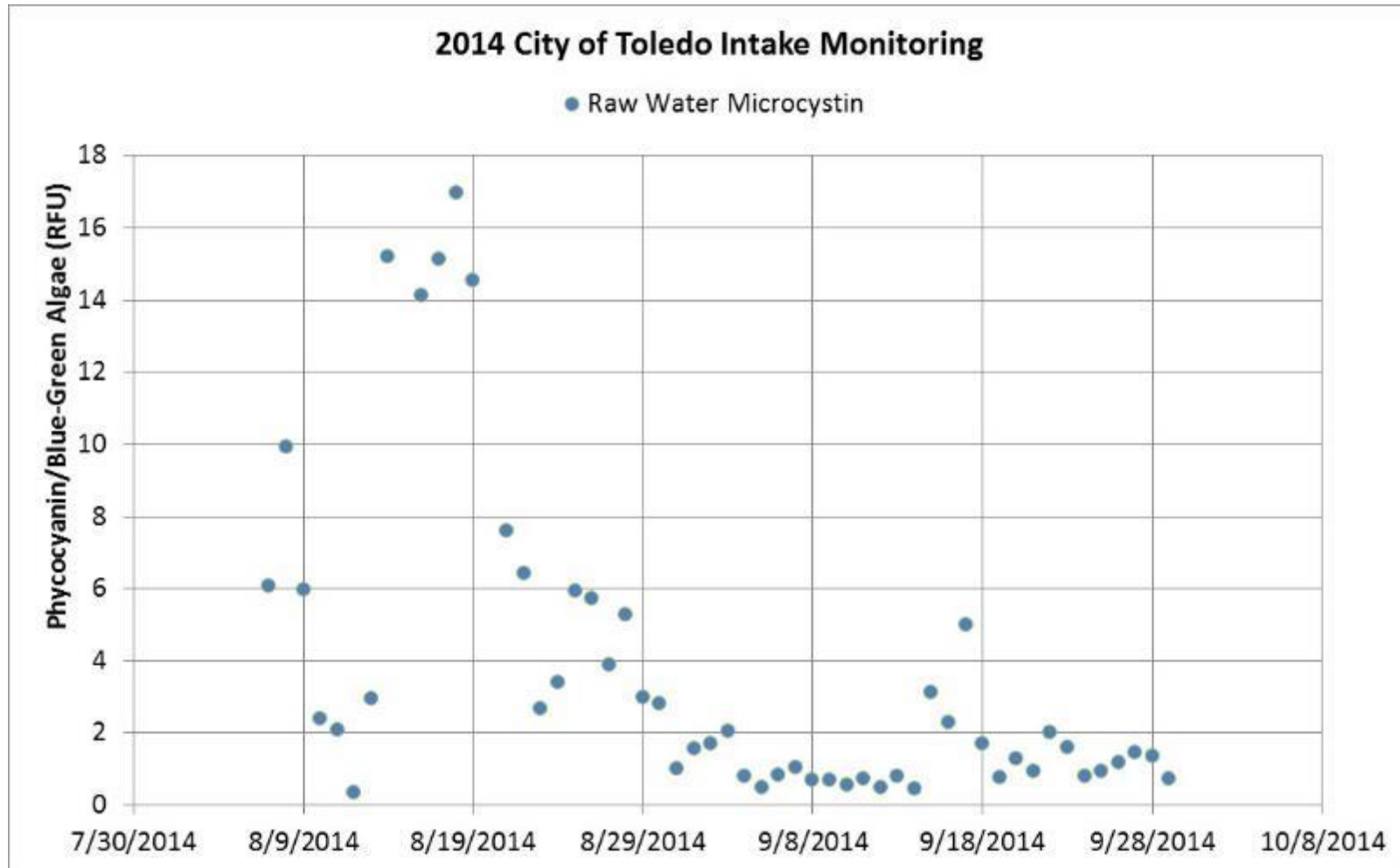
Crib Buoy – wind, waves, current, YSI, webcam

Crib Sensor – YSI & webcam

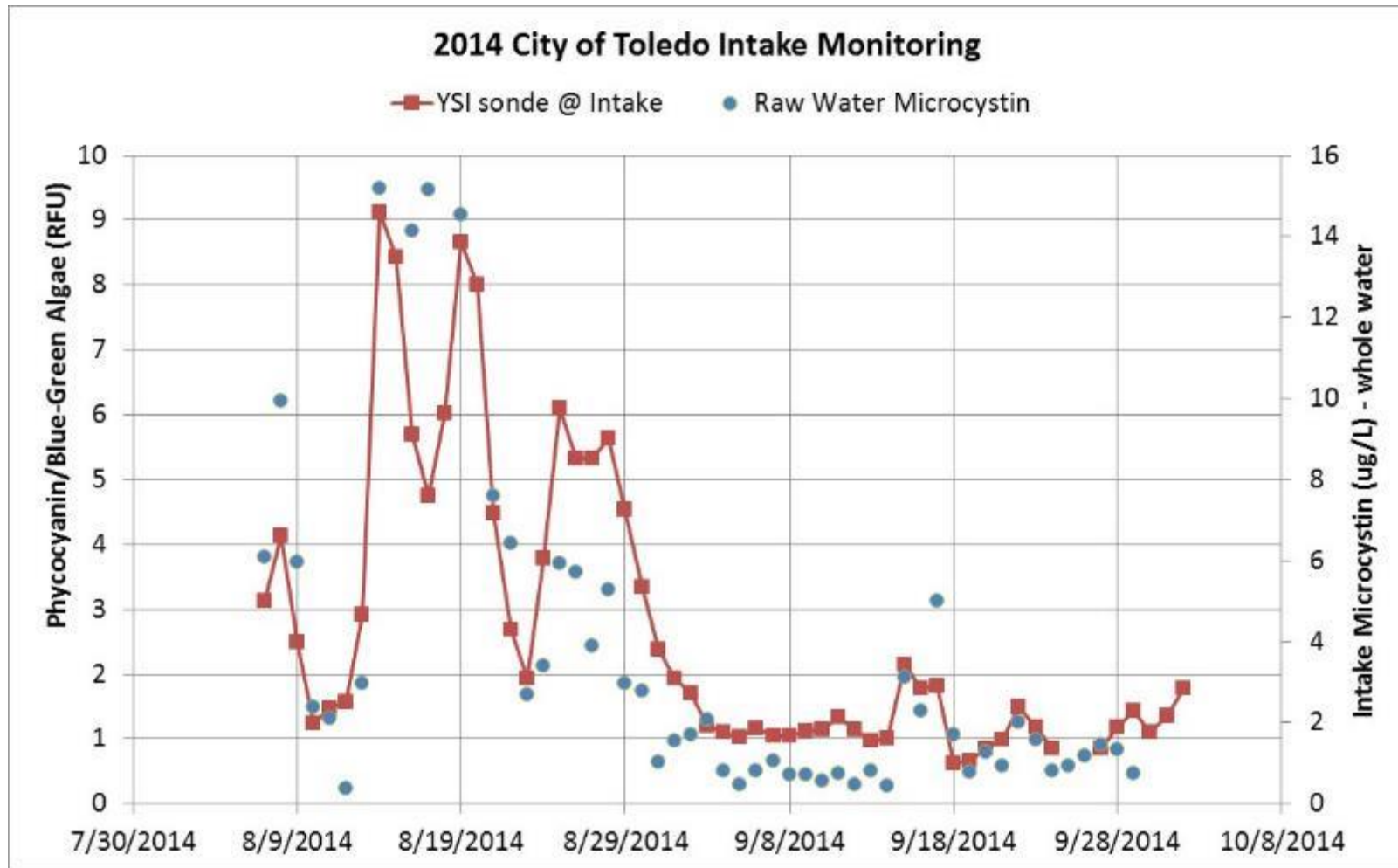
Pump Station - YSI



2014 City of Toledo Lake Monitoring



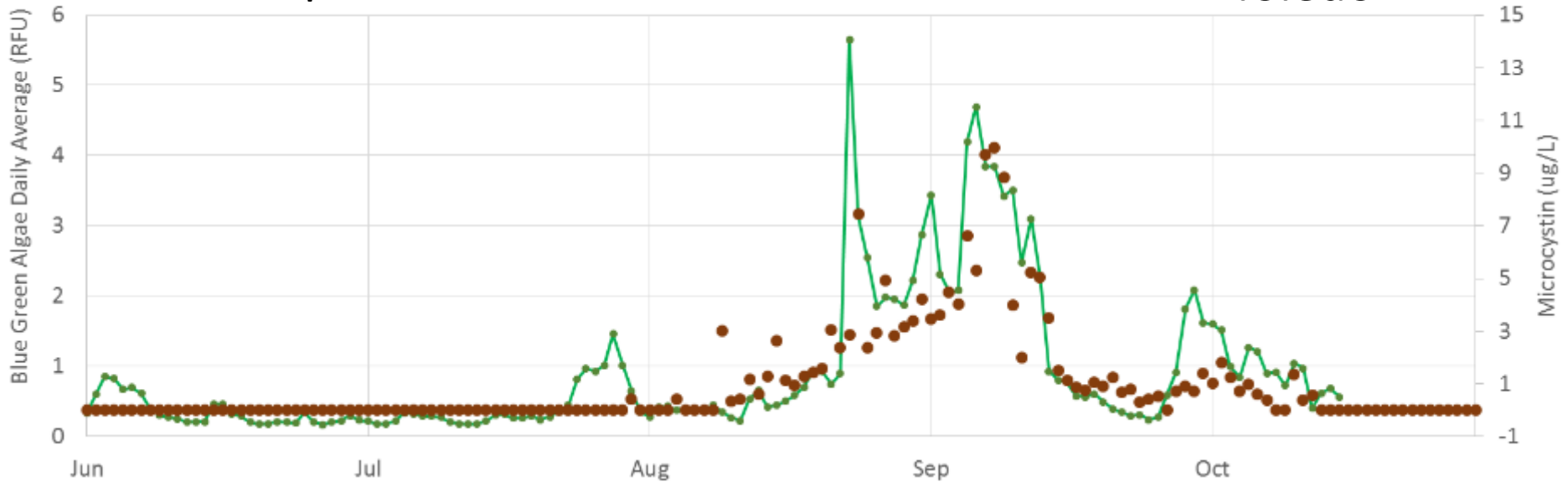
2014 City of Toledo Lake Monitoring



2017 Pump Station

— LSPS BGA ● Microcystin (raw)

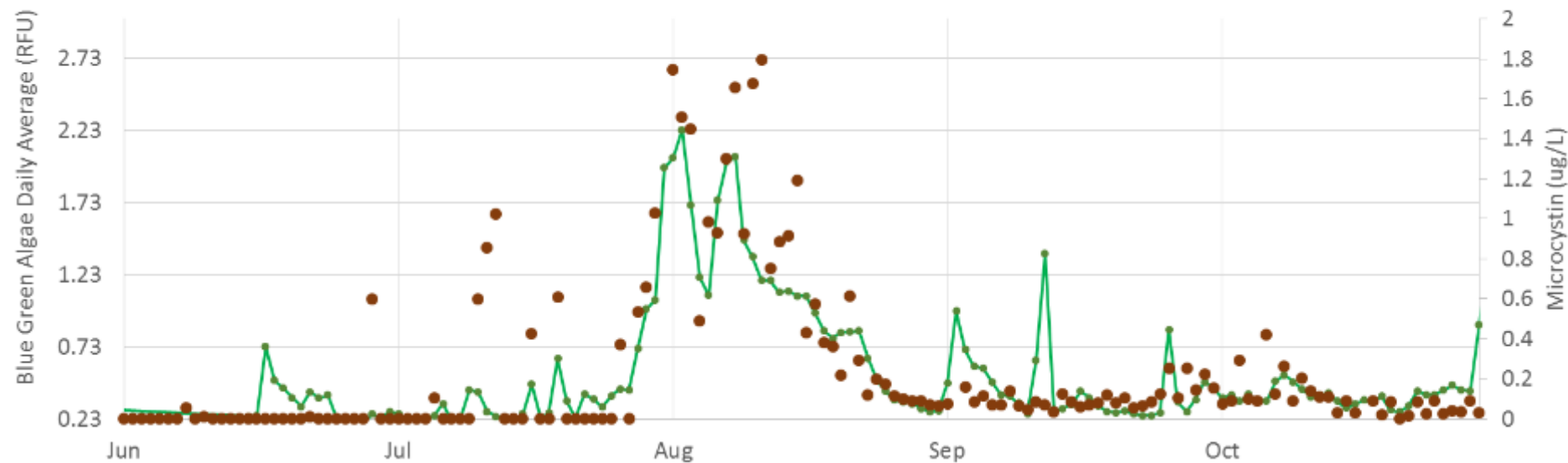
Toledo



2016 Pump Station

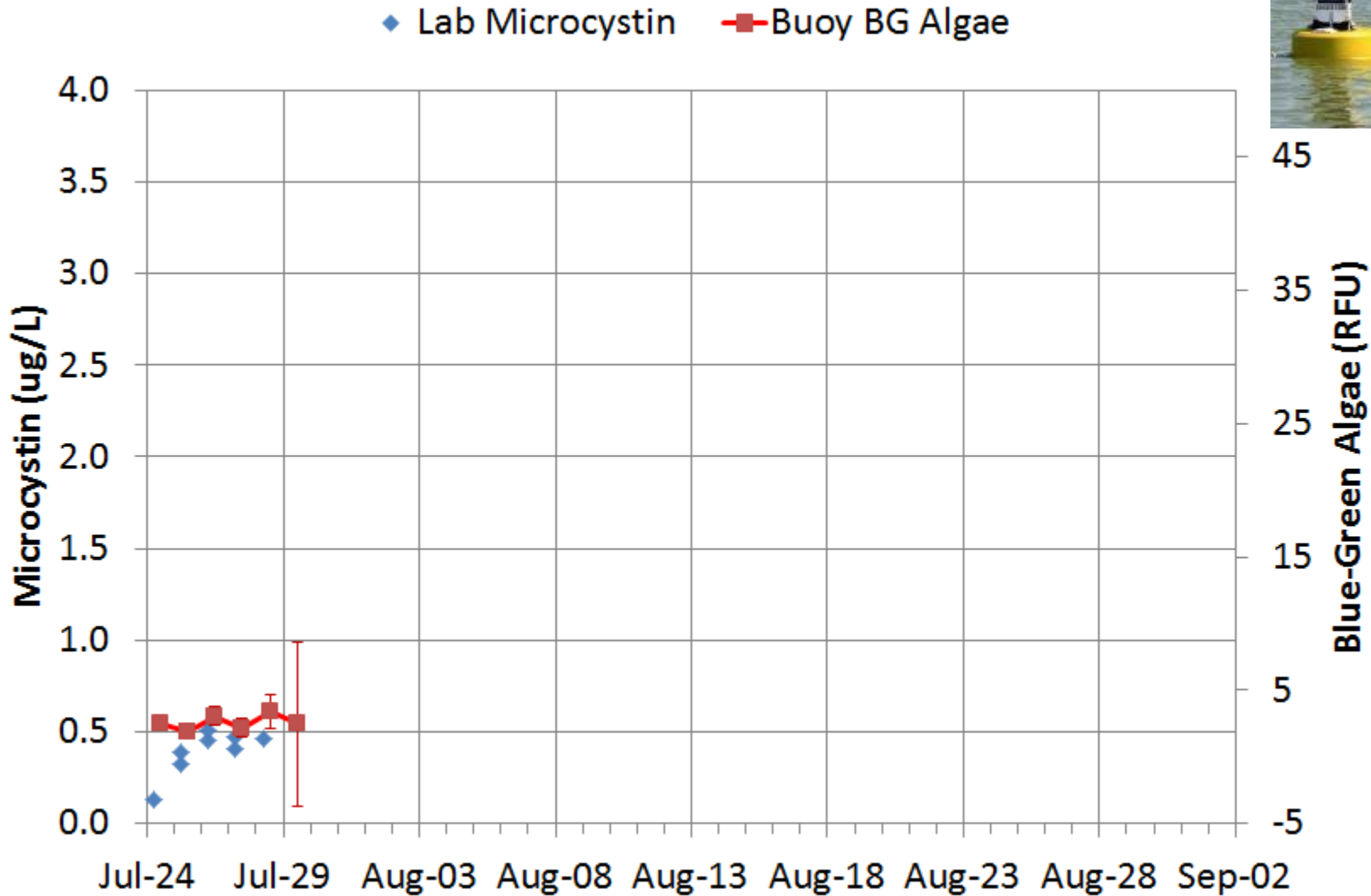
— LSPS BGA ● Microcystin (raw)

Toledo



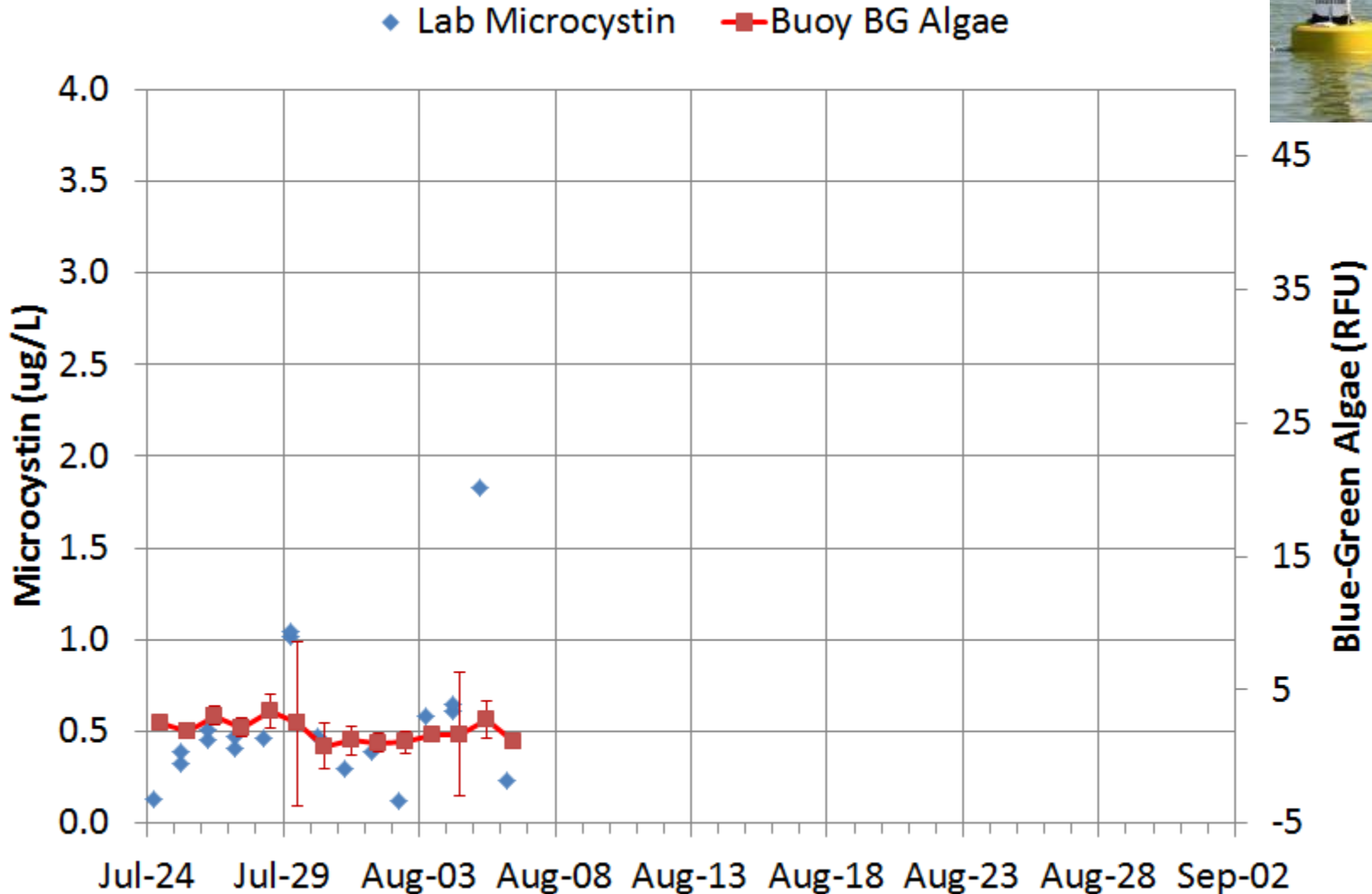
(Near Real-Time) Data → Decision

2015



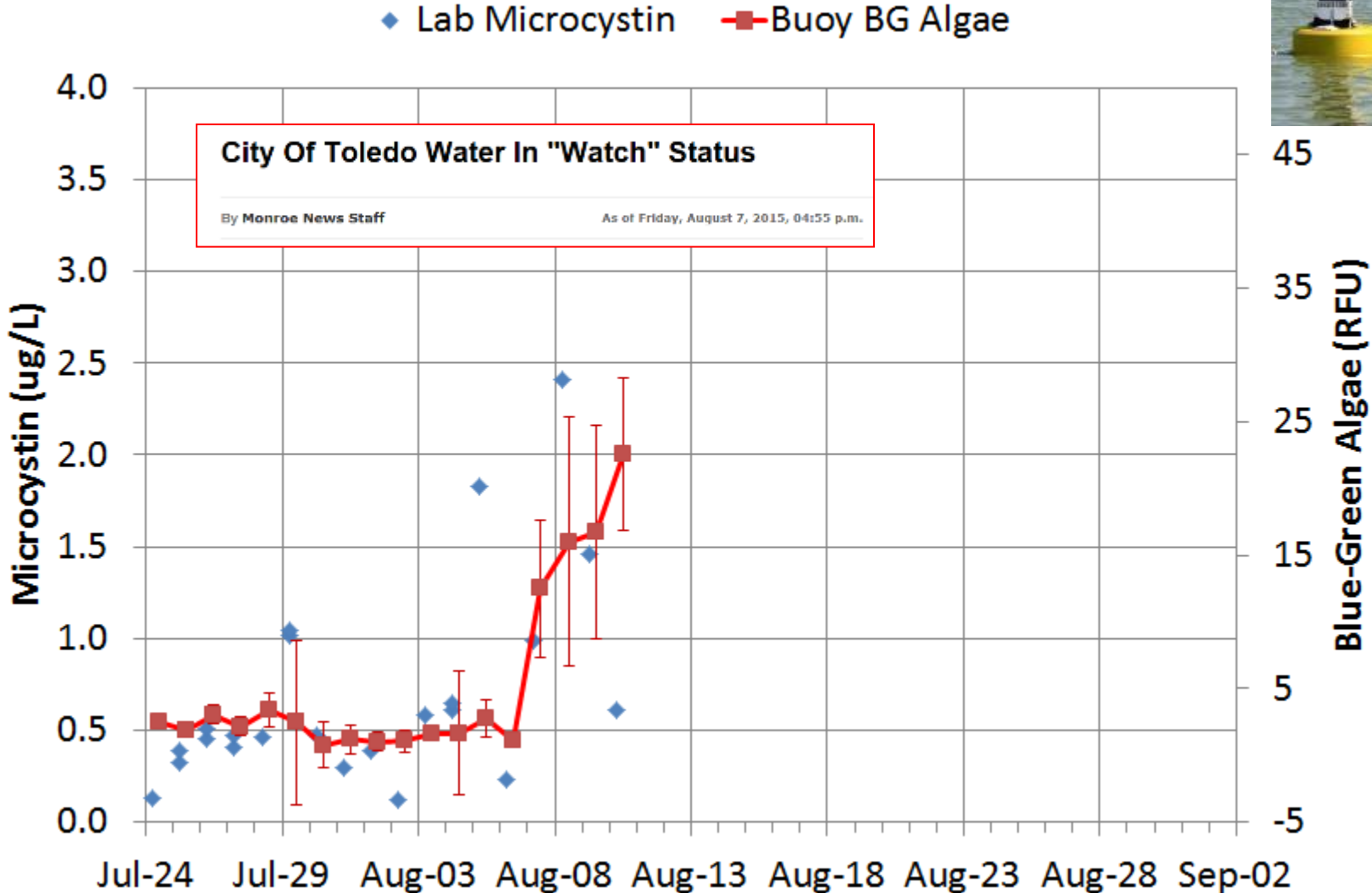
(Near Real-Time) Data → Decision

2015



(Near Real-Time) Data → Decision

2015



(Near Real-Time) Data → Decision

HOME → NEWS → LOCAL

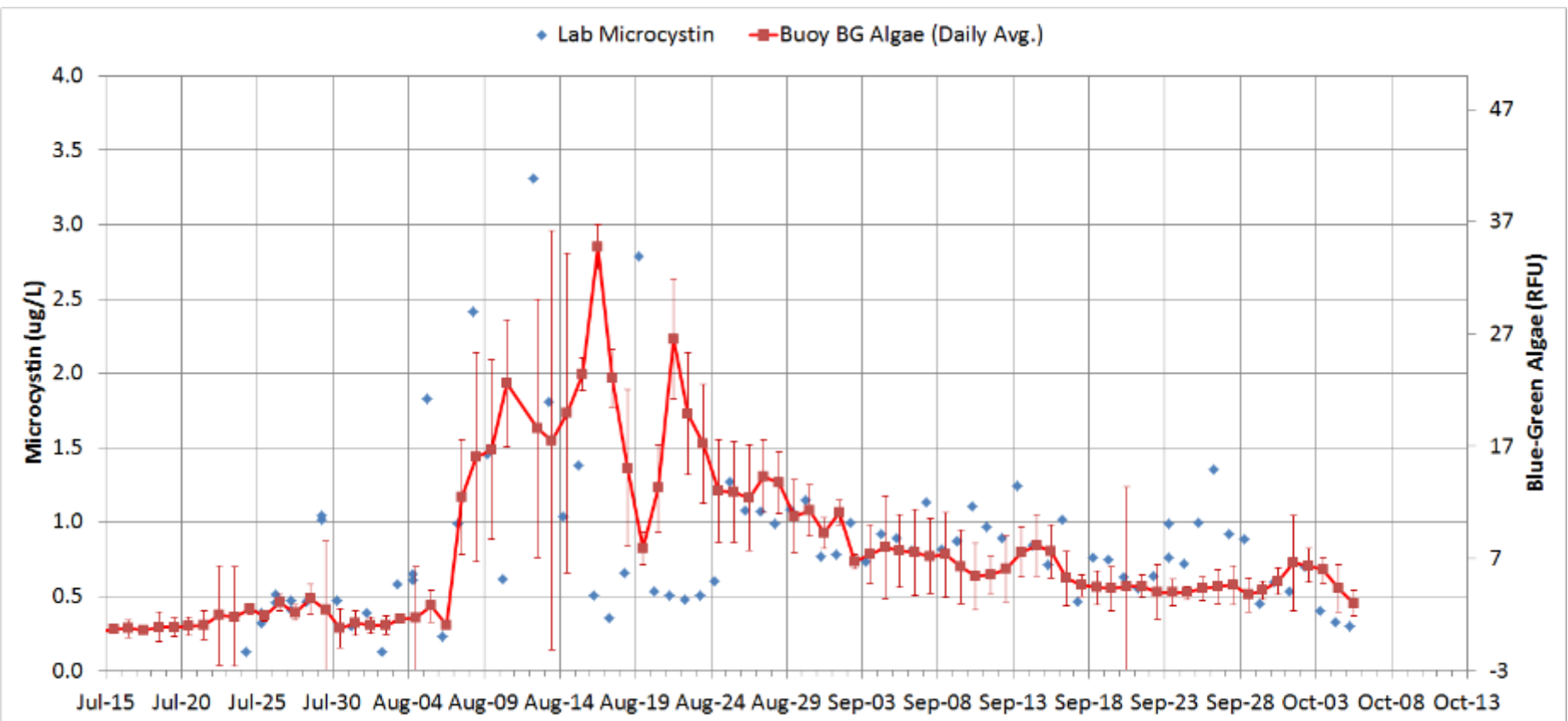
Published: Monday, 10/5/2015

Print Story

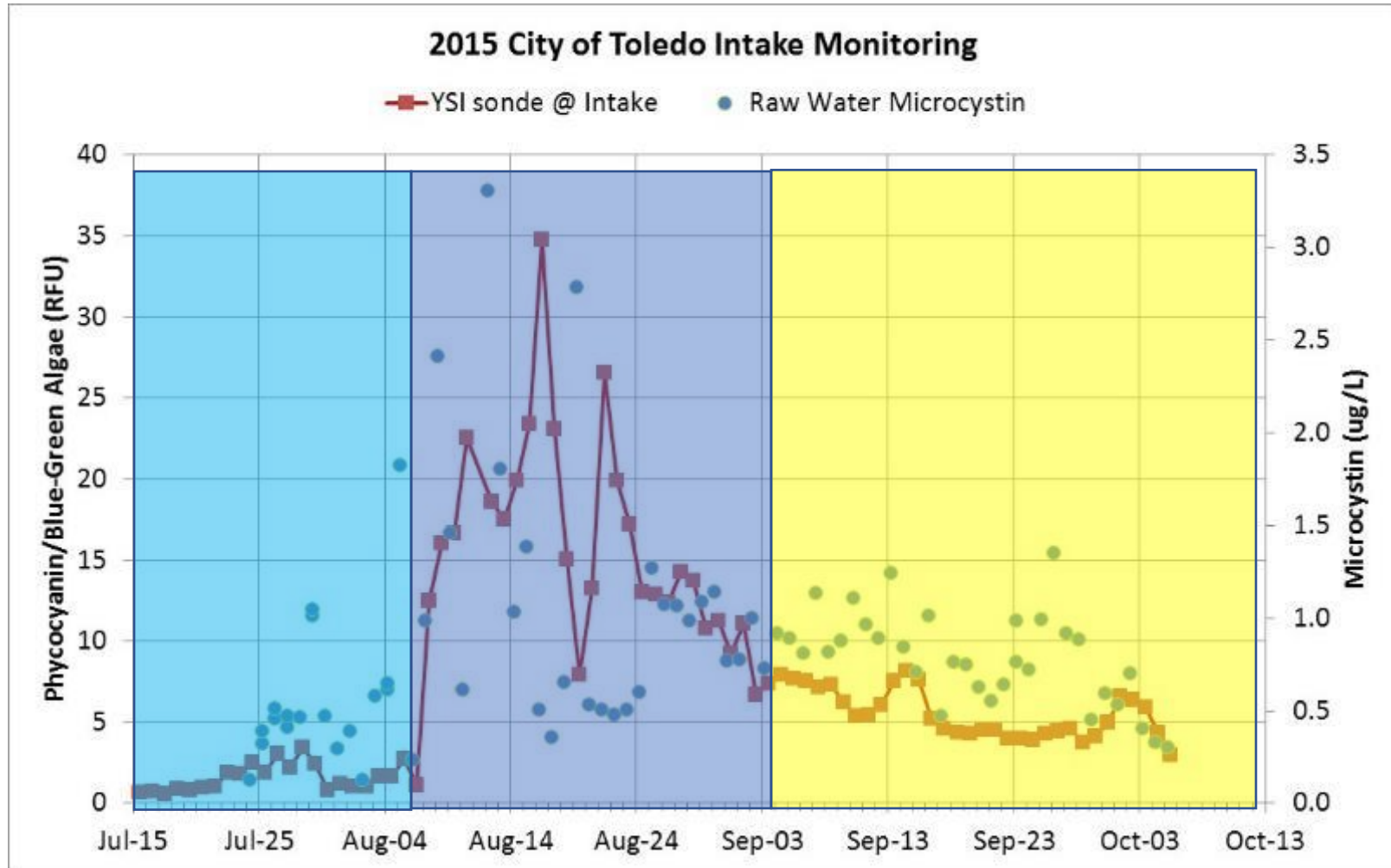
Algae toxin levels in raw Lake Erie water drop Monday

BLADE STAFF

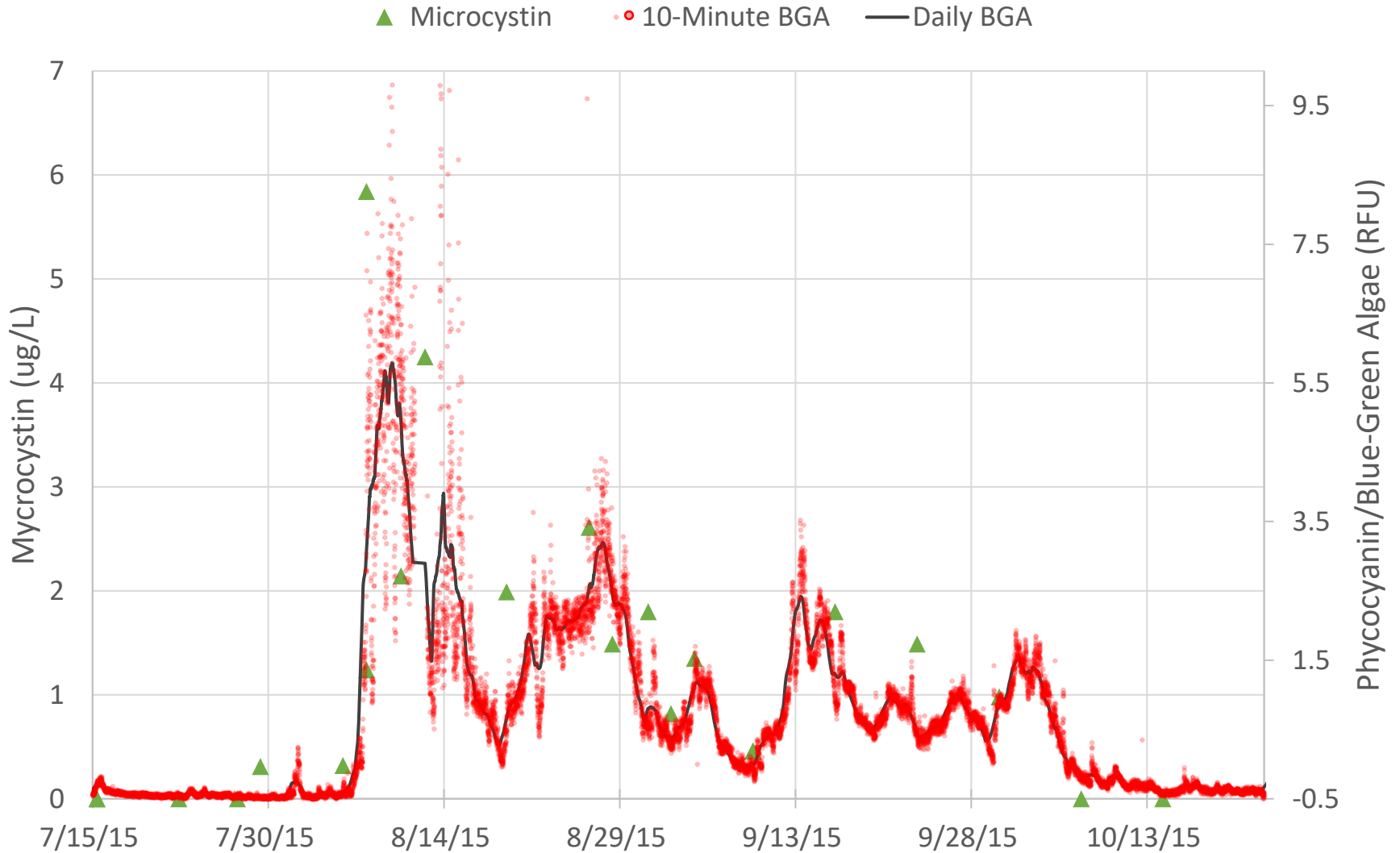
The City of Toledo reported today that the level of algal toxins near its western Lake Erie water-intake crib has dropped since Sunday.

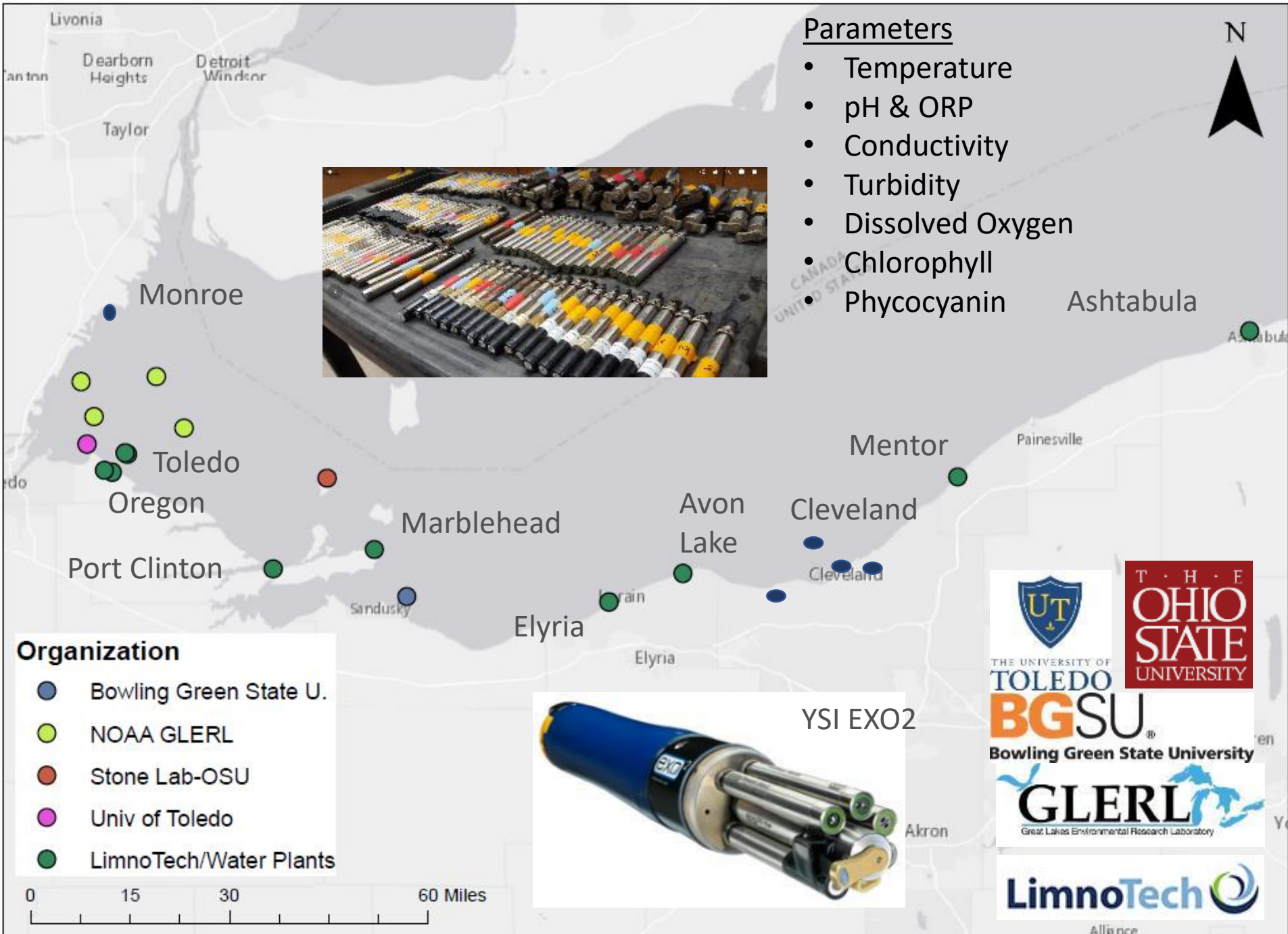


2015 City of Toledo Lake Monitoring



City of Oregon Raw Water





Parameters

- Temperature
- pH & ORP
- Conductivity
- Turbidity
- Dissolved Oxygen
- Chlorophyll
- Phycocyanin

Organization

- Bowling Green State U.
- NOAA GLERL
- Stone Lab-OSU
- Univ of Toledo
- LimnoTech/Water Plants



YSI EXO2

Sonde Inter-calibration

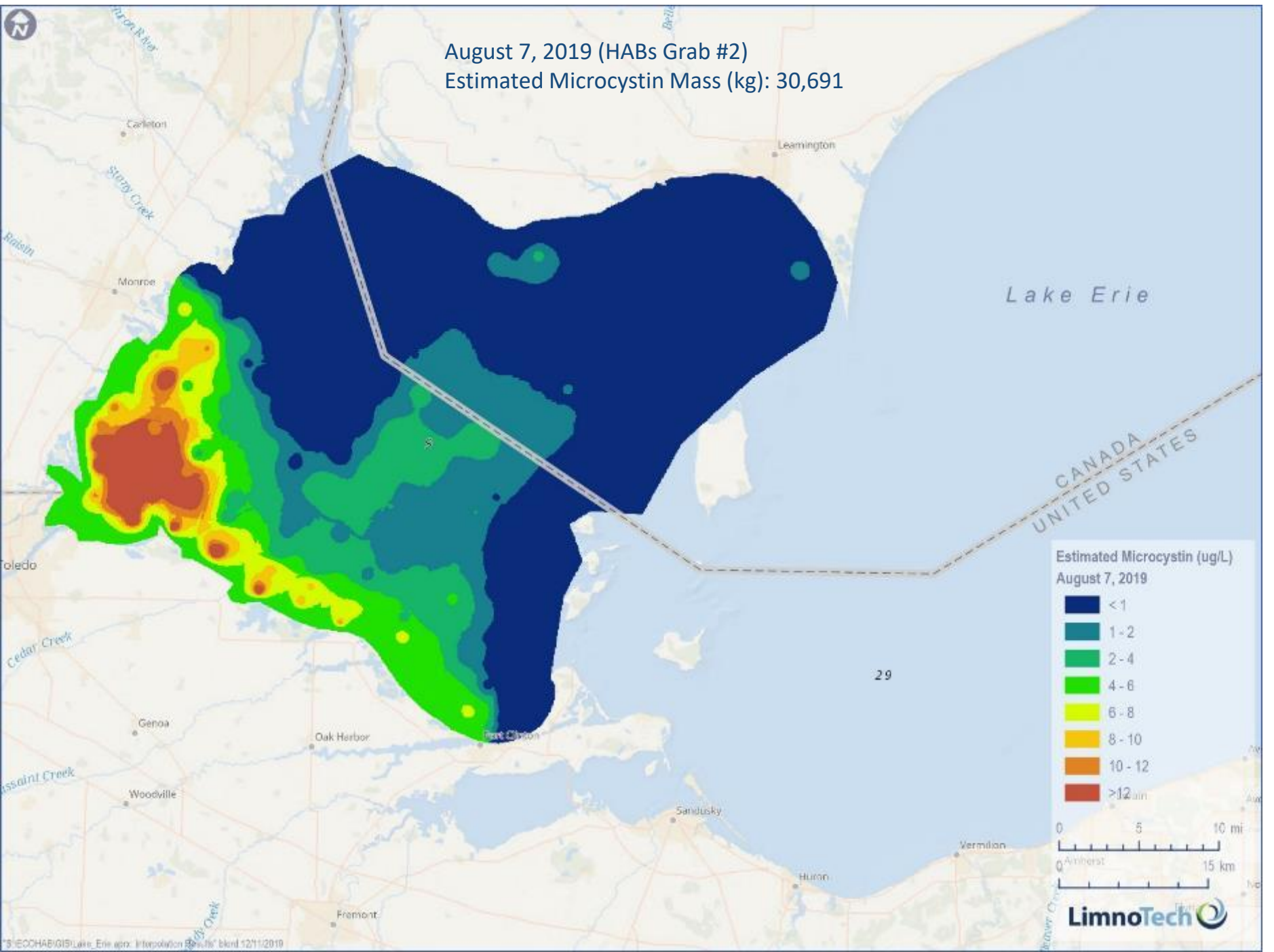
- LimnoTech
- Bowling Green State University
- University of Toledo
- Ohio State University - Stone Lab
- NOAA GLERL
- Fondriest
- Water Treatment Plants
 - Toledo, Oregon, Port Clinton, Marblehead, Elyria, Avon, Cleveland, Mentor, Ashtabula

Meet 2x per year @ UT Lake Erie Center

~ 20-25 EXO2 per event



August 7, 2019 (HABs Grab #2)
Estimated Microcystin Mass (kg): 30,691



Observing Network Design

Sensors

Logger

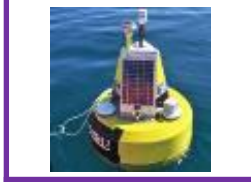
Telemetry

Platform

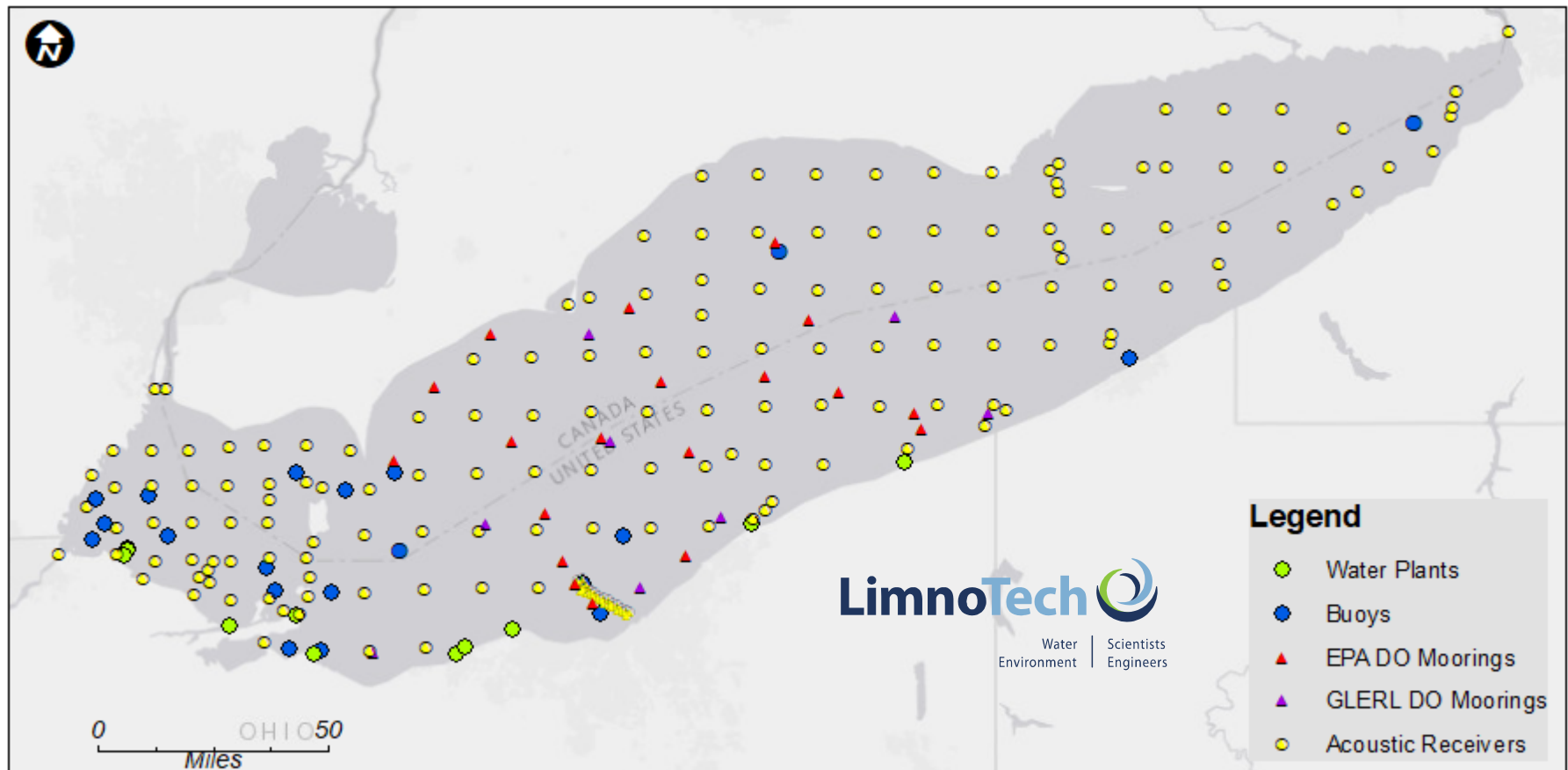
Data System

User Interface

End User



Lake Erie Environmental Sensors: 2019



300+ stations.... 7 years ago there were only 4.... Not all are real-time... but exponential growth is happening given significant advances in technology accessibility for scientists

Toledo Early Warning System

Sensors

Logger

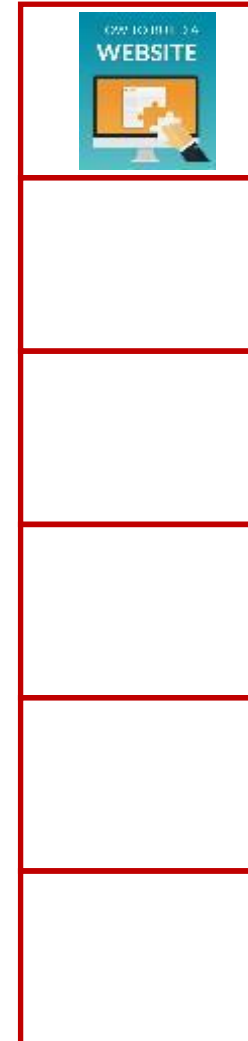
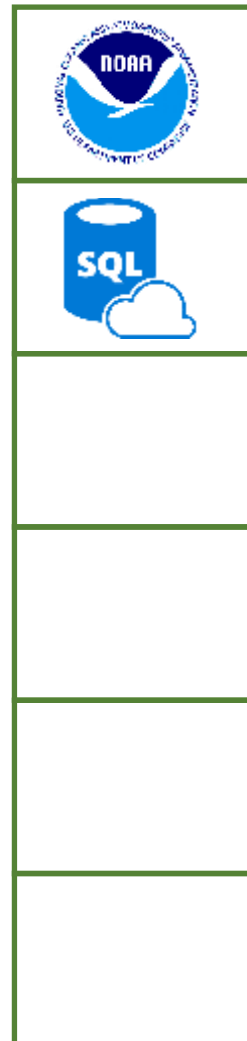
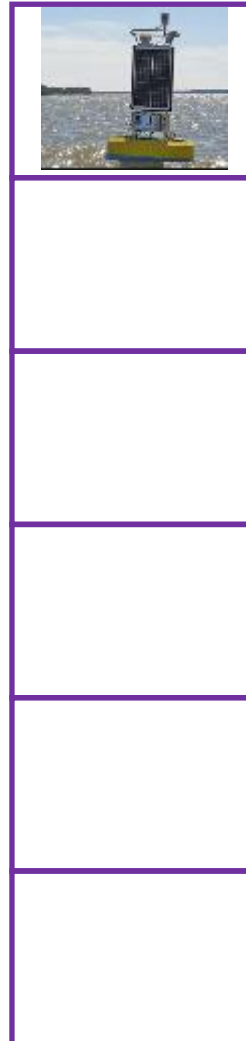
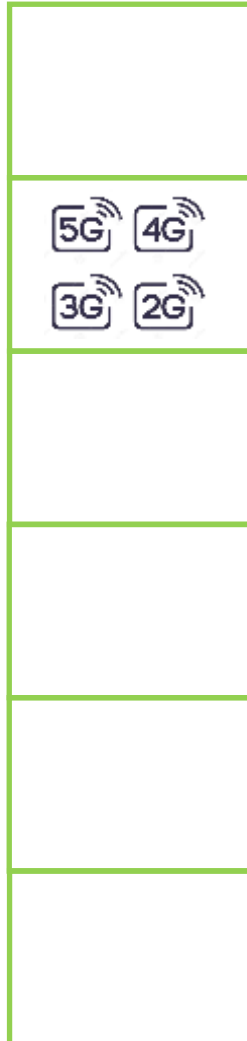
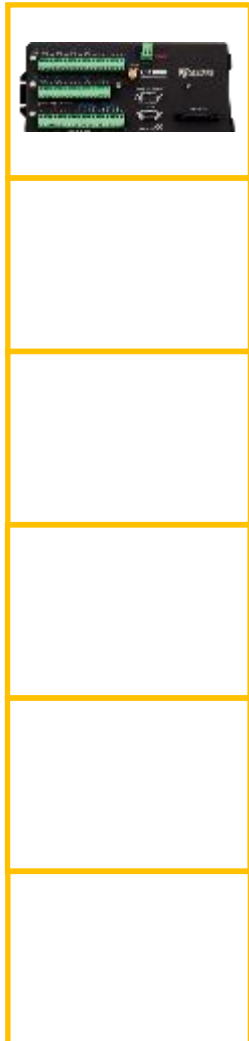
Telemetry

Platform

Data System

User Interface

End User



City of Toledo Sensors

Crib Buoy – wind, waves, current, YSI, webcam

Crib Sensor – YSI & webcam

Pump Station - YSI











**GREAT
LAKES**
OUTREACH MEDIA

Industry Supported Buoys

St. Joseph, Michigan



Toledo, Ohio



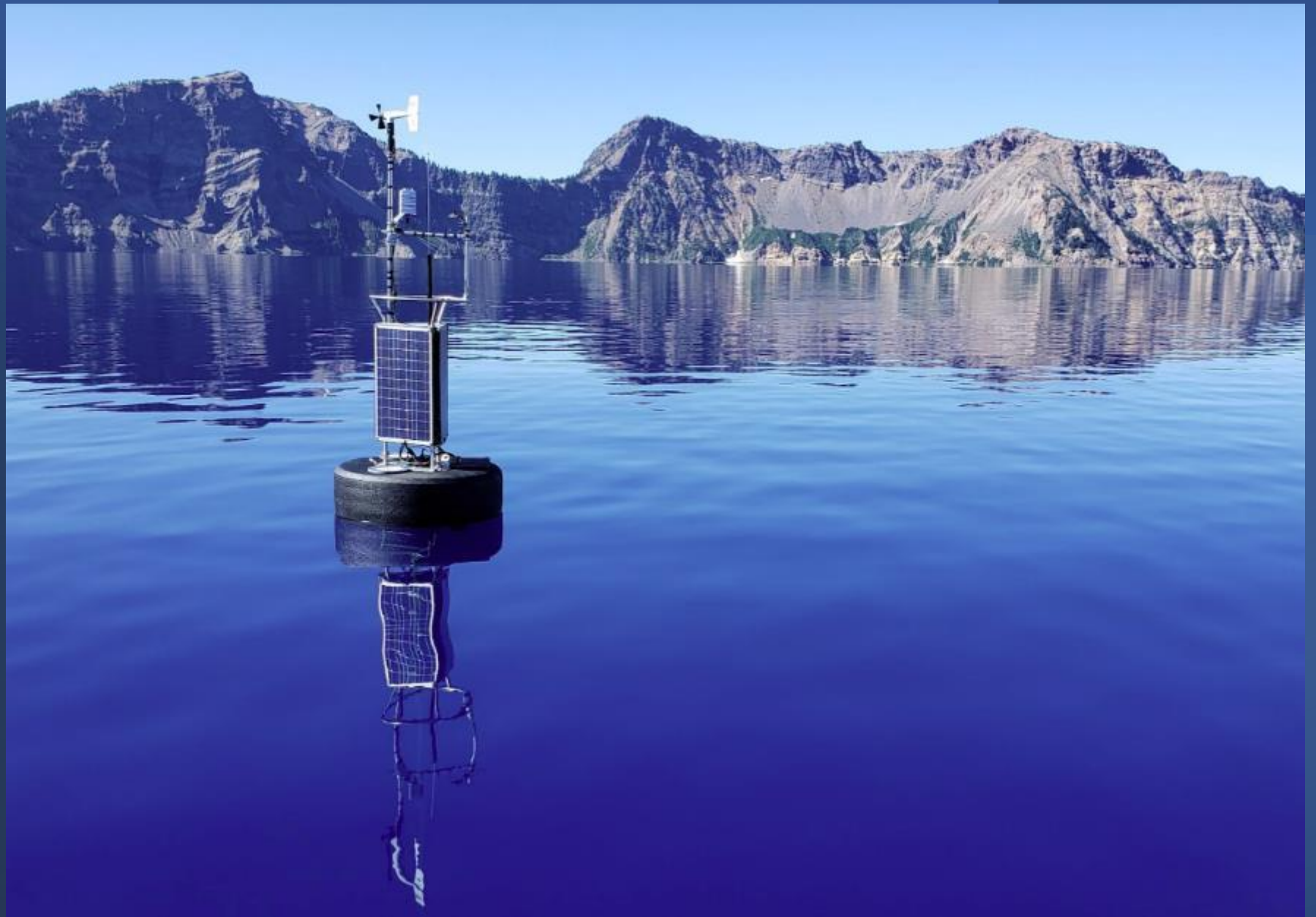
Cleveland, Ohio



Cleveland, Ohio









Nitrate (mg/L)

3.07

Phosphate (mg/L)

0.139

Defiance Water Treatment Plant

Sonde @
12:30 PM
EDT Mon, May 16

Nutrient @
11:03 AM
EDT Mon, May 16

Turbidity (NTU)

87.5

Specific Cond. (uS/cm)

498

Chlorophyll (RFU)

4.47

Ammonia (mg/L)

0.006

Water Temp (°C)

21.30

Monitoring Instrumentation

Water Quality - [YSI EXO3 Sonde](#)

Nutrients - [Green Eyes Science Autonomous Nutrient Analyzer](#)

DO (mg/L)

6.00

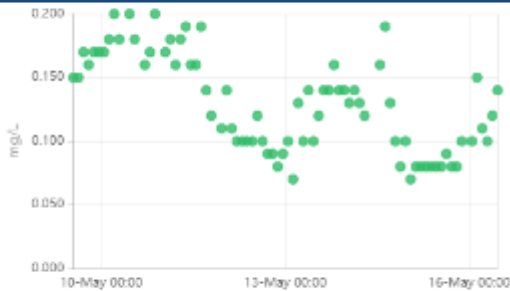
pH

7.84

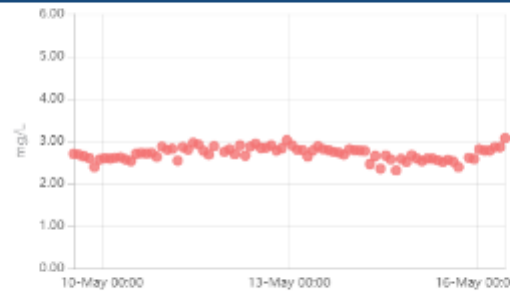
Phycocyanin (RFU)

0.50

Dissolved Phosphate Concentration



Nitrate Concentration



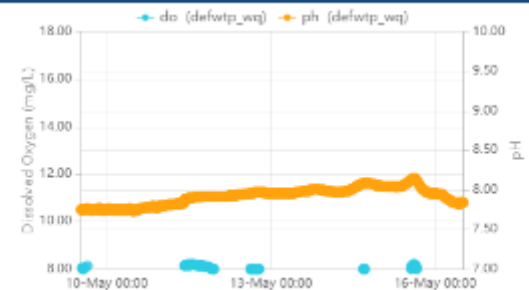
Ammonia Concentration (Data Filtered)



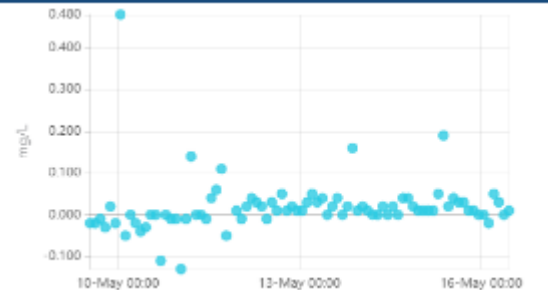
Phycocyanin & Chlorophyll



Dissolved Oxygen & pH



Ammonia Concentration





THE ERIE SITUATION

"A searing look at a Great Lake going bad."

DAN EGAN Journalist and author of *The Death and Life of the Great Lakes*



SUNDAY, JUNE 12 • 5:30PM • MAUMEE,
OH

Plastic Oceans International and Great Lakes Outreach Media cordially invite you to a public screening of THE ERIE SITUATION, presented by Lake Erie Waterkeeper. Filmmakers, protagonists, local experts and local officials will be on hand for a meet and greet at 4:30pm and an in-depth panel discussion to follow the film.

IMPORTANT: Every person attending in your group must be on the RSVP list.

LOCATION

Maumee Indoor Theatre
601 Conant St.
Maumee, OH 43537

Sunday, June 12 @5:30pm (doors open at 4:30pm for a meet and greet)

<https://theeriesituation.com>



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Water | Scientists
Environment | Engineers