

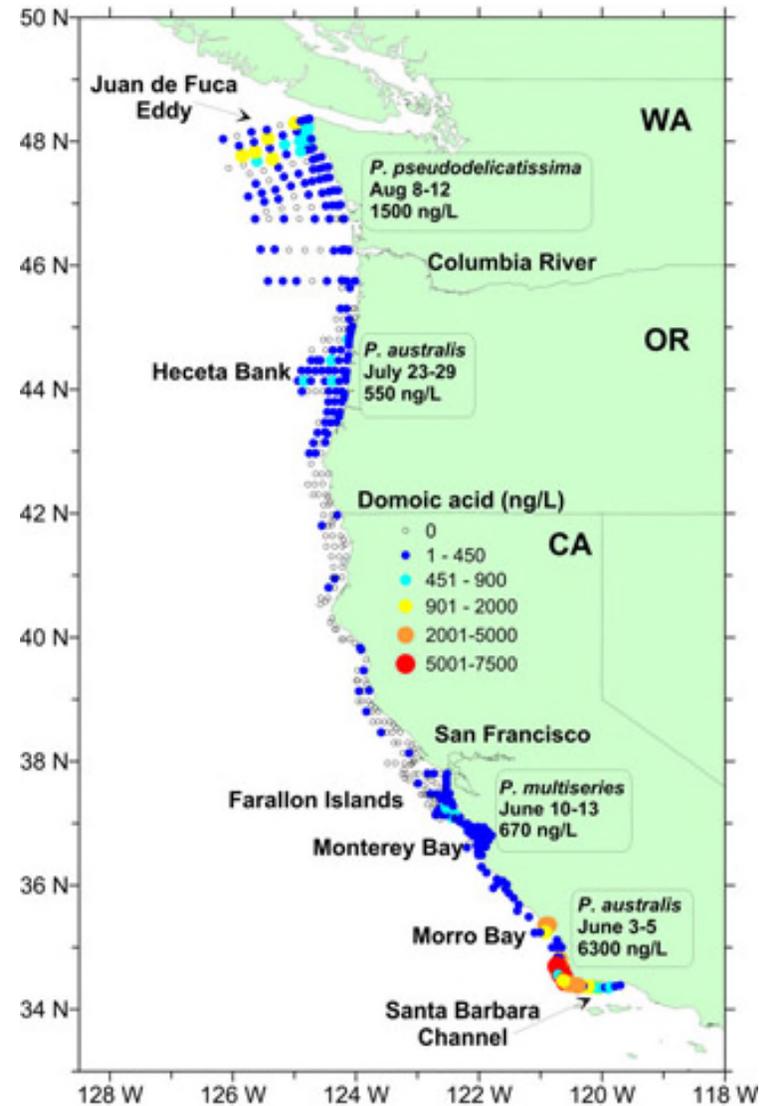
# How to Assess and Mitigate HABs and Hypoxia Challenges



Ellen Gilinsky, Mary Erickson, Donna Myers, Mary Skopec, Nancy Schuldt, Caitlin Gould  
2016 National Monitoring Conference  
Panel E8  
May 3, 2016

# Discussion Points

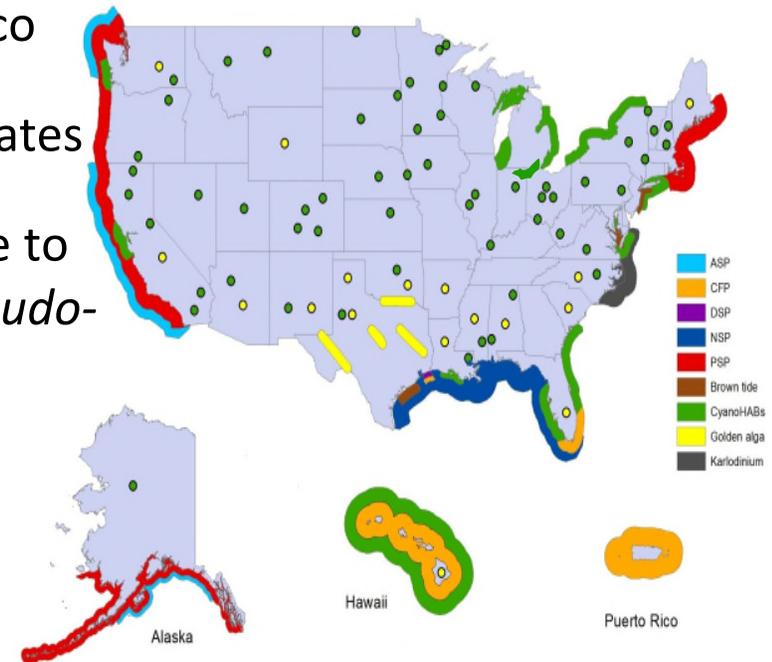
- *How can we better integrate data collected by federal partners to be of use to the states and tribes in decision-making?*
- *What kinds of leading indicators of HABs and hypoxia should we be measuring?*
- *How can we better communicate/interact with the public? What works in your jurisdiction?*



# HABs and Hypoxia: Critical, Nationwide Issues

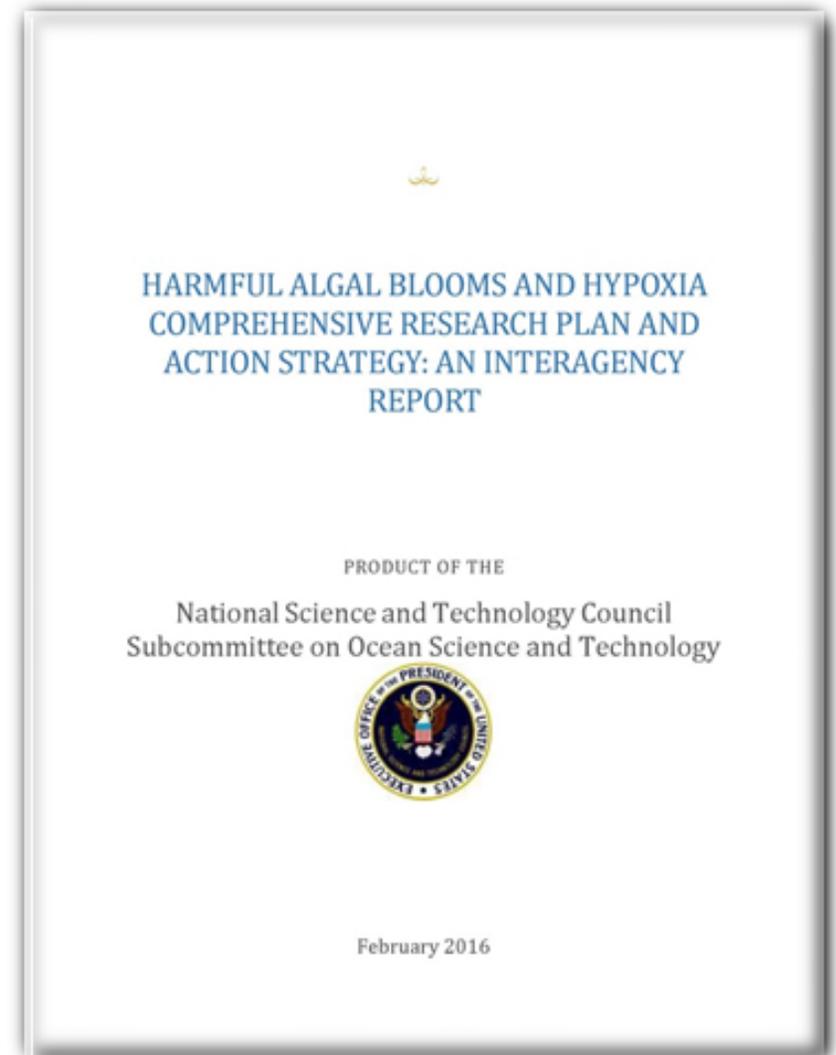
## What is at stake? *Consider the numbers:*

- **\$2.8B/ year** – Est. annual value of fisheries in Gulf of Mexico
- **\$82M** – Est. annual cost of coastal HAB events in United States
- **\$22.7M** – Loss in 2015 tourism-related spending in WA due to closure of recreational razor clam harvest alone due to *Pseudo-nitzschia* bloom
- **11M** – People who get drinking water from Lake Erie
- **\$70,000** – Approx. daily cost to surrounding counties from closing Huntington State Beach, CA
- **>\$1,000/day** – Sampling and water treatment costs during cyanotoxin bloom



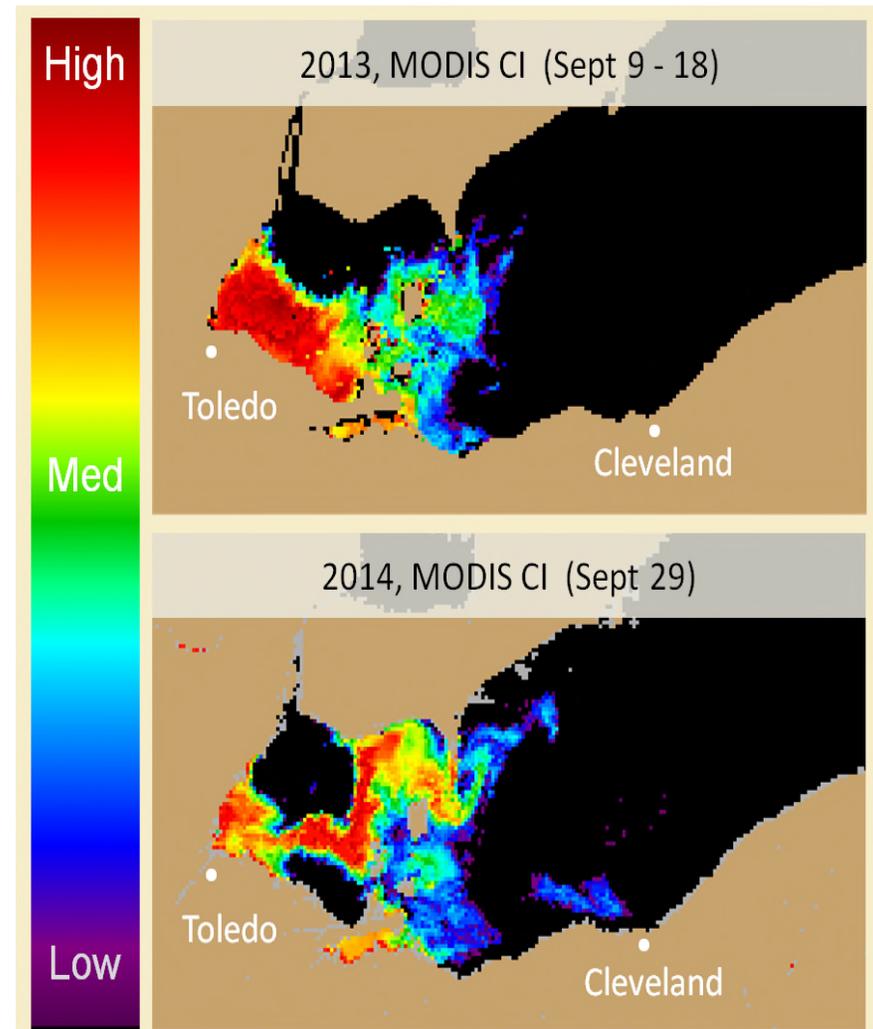
# HABs and Hypoxia Comprehensive Research Plan & Action Strategy

- Recognizes increasing intensity, frequency of HAB, hypoxia events
- Outlines progress made since the 2008 reports
- Acknowledges increased demand for information by managers, public



# Addressing HAB and Hypoxia Impacts: Federal Accomplishments

- Guidelines for freshwater toxins, health advisories
- HAB and hypoxia forecast products
- Lower-cost, easy-to-use, real-time sensors
- Understanding effects of HAB toxins on human, animal health



# What did stakeholders ask for?

- Better understand roles of climate, nutrients
- Early predictions and warnings of food and water toxicity
- Socioeconomic impacts
- Communications – trusted sources, easy to act on



# Action Strategy – Recommended research priorities

- Predict the onset of toxicity
- Rapidly ID HABs
- Understand roles of climate, nutrients
- Toxins in foods and water
- Methods for HAB suppression, control

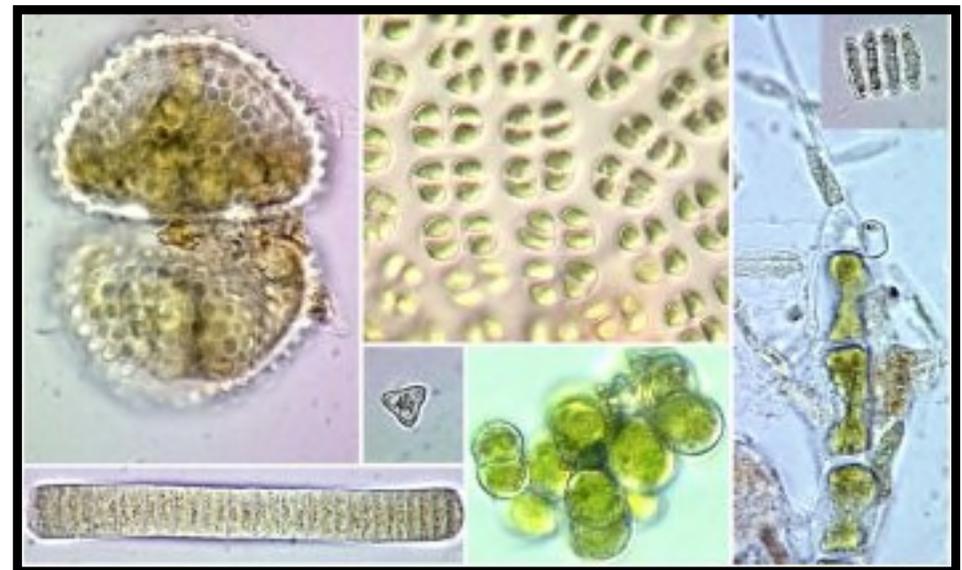
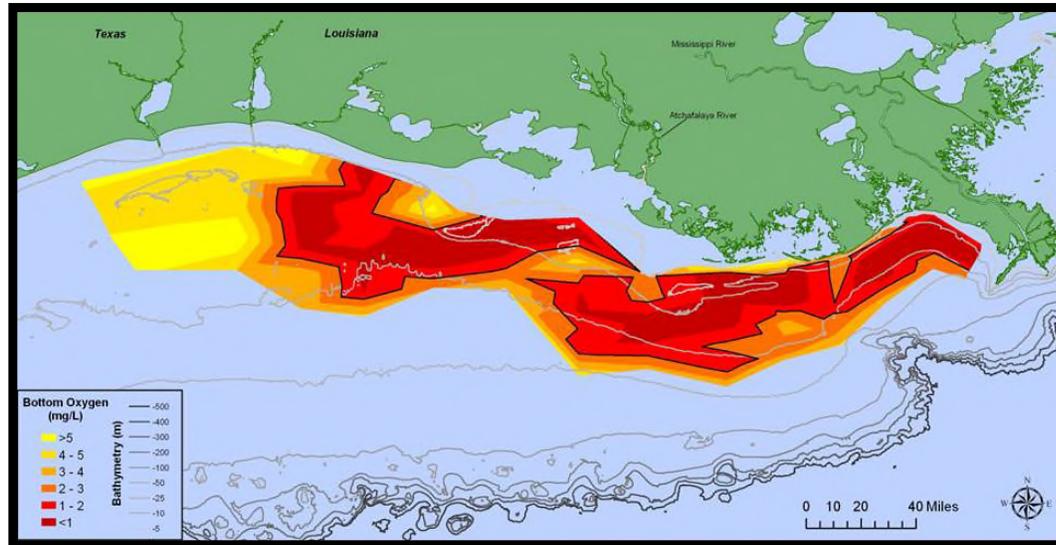


# Action Strategy – Recommendations, Cont.

- Long-term records
  - Environmental conditions
  - Disease surveillance
- Improve public understanding of risk
- Continue, expand collaborations

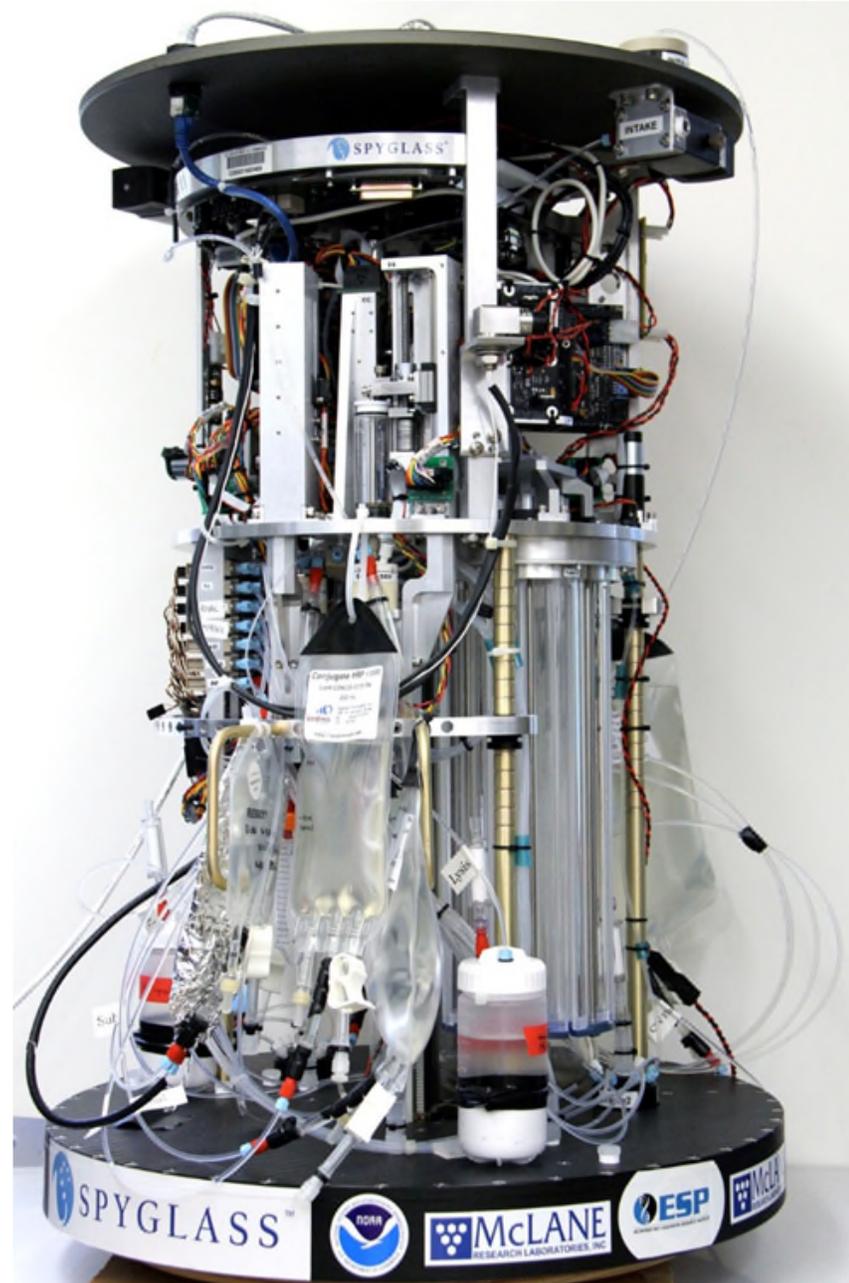


# Examples of HABs and Hypoxia Monitoring and Forecasting



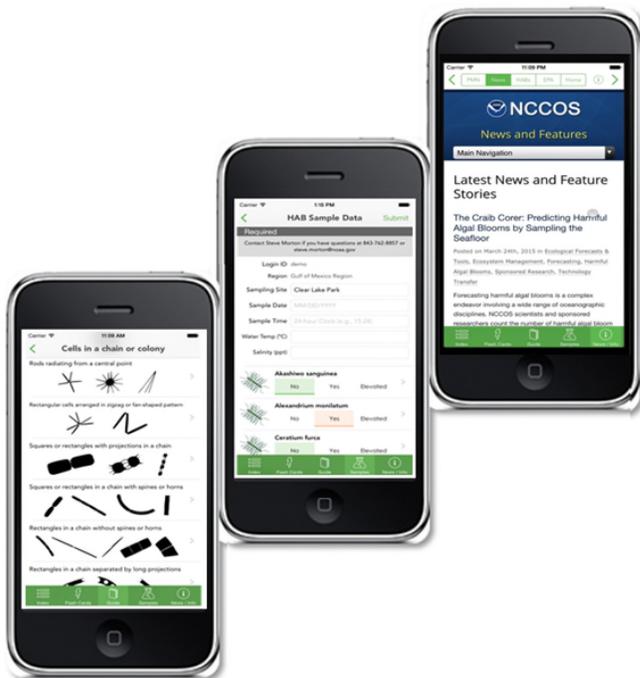
# Lab in a Can = Daily Detection

- Daily bloom and toxin measures for a more complete picture
- Complements other data (field monitoring, private, cities)
- Coordinated with Great Lakes Observing System (IOOS)
- Expanded deployment in 2016 in Pacific NW & California
- Data supports regional & national HAB forecasts



# Phytoplankton Monitoring Network (PMN)

- Marine and estuarine HAB species
- Over 250 coastal sites
- Partnership with EPA
- Southeast Alaska Tribal Monitoring Network
- Reach multiple users

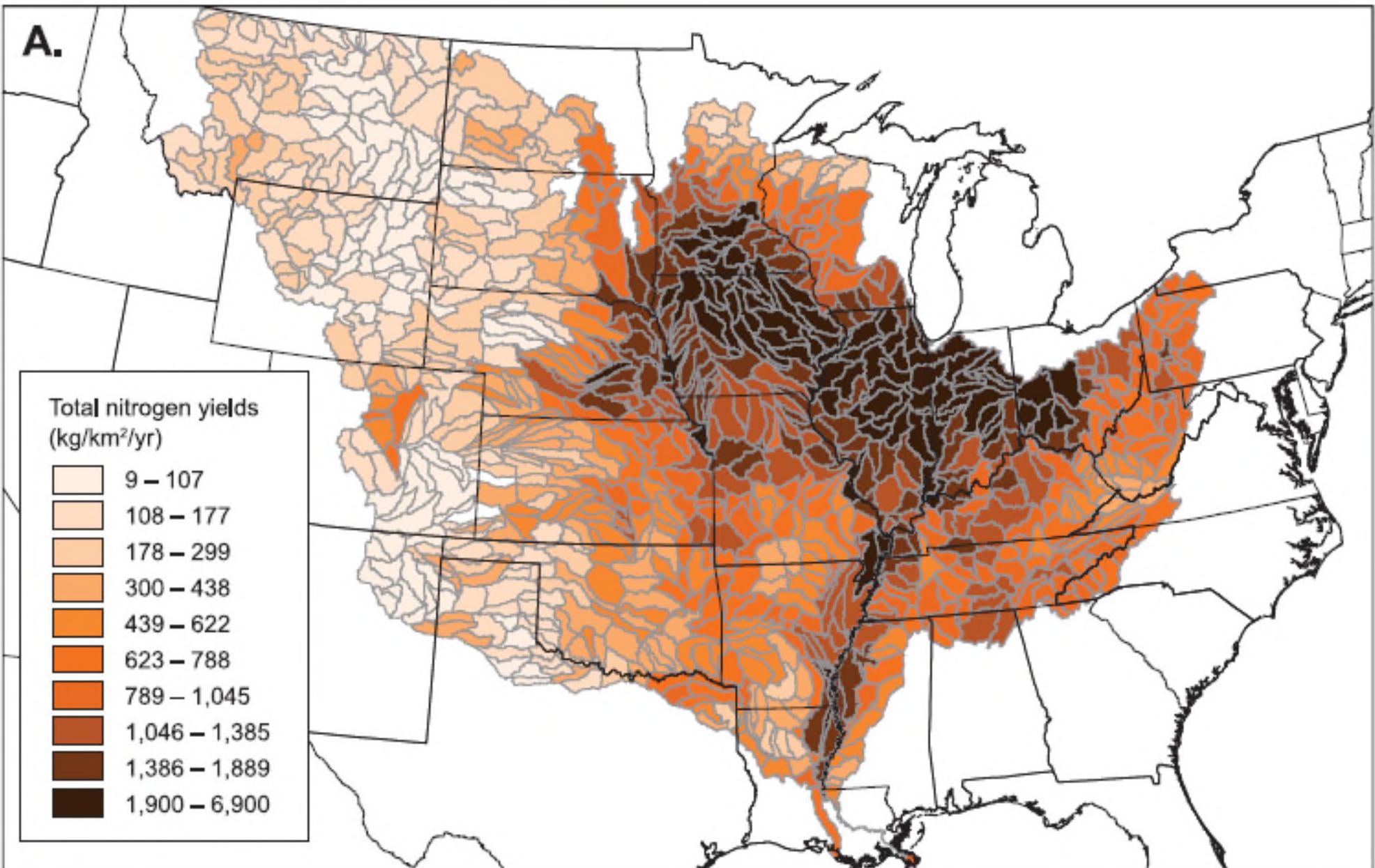


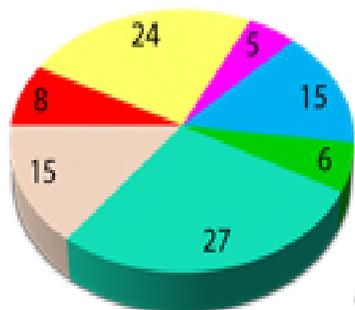
# Cyanobacteria Assessment Network

- Satellite remote-sensing for HABs
  - OLCI sensor
  - MERIS spectrometer
  - LANDSAT satellite
- Freshwater monitoring:
  - Smaller lakes, reservoirs
- Estimate human exposure to cyanotoxins

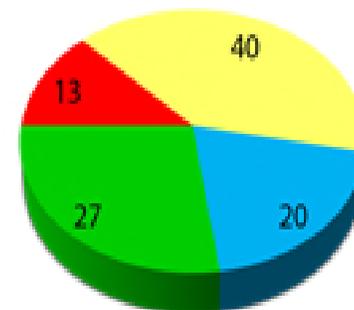


# Monitoring Capabilities and Needs

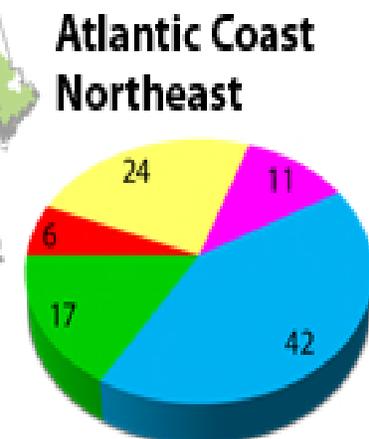




**Pacific Northwest Coast**

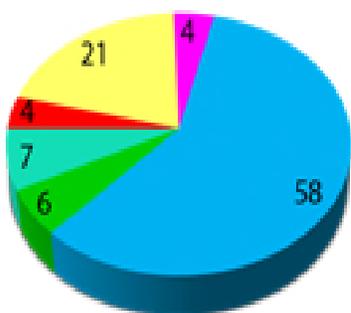


**Great Lakes**

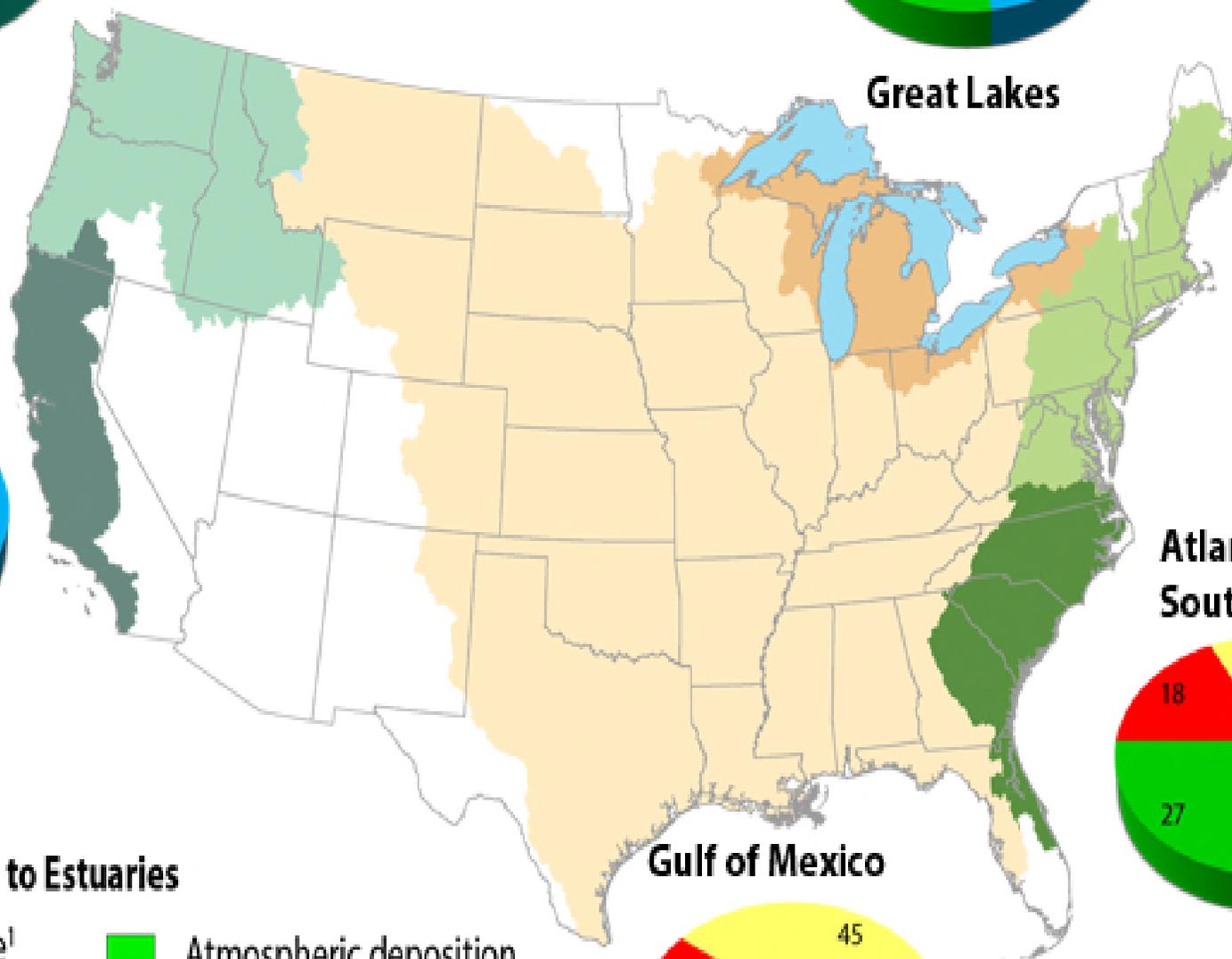
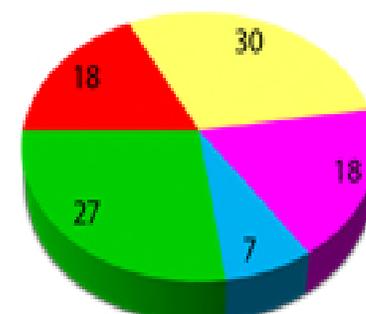


**Atlantic Coast Northeast**

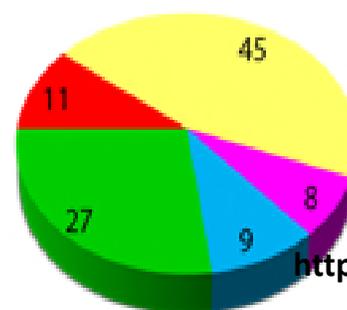
**California Coast**



**Atlantic Coast Southeast**

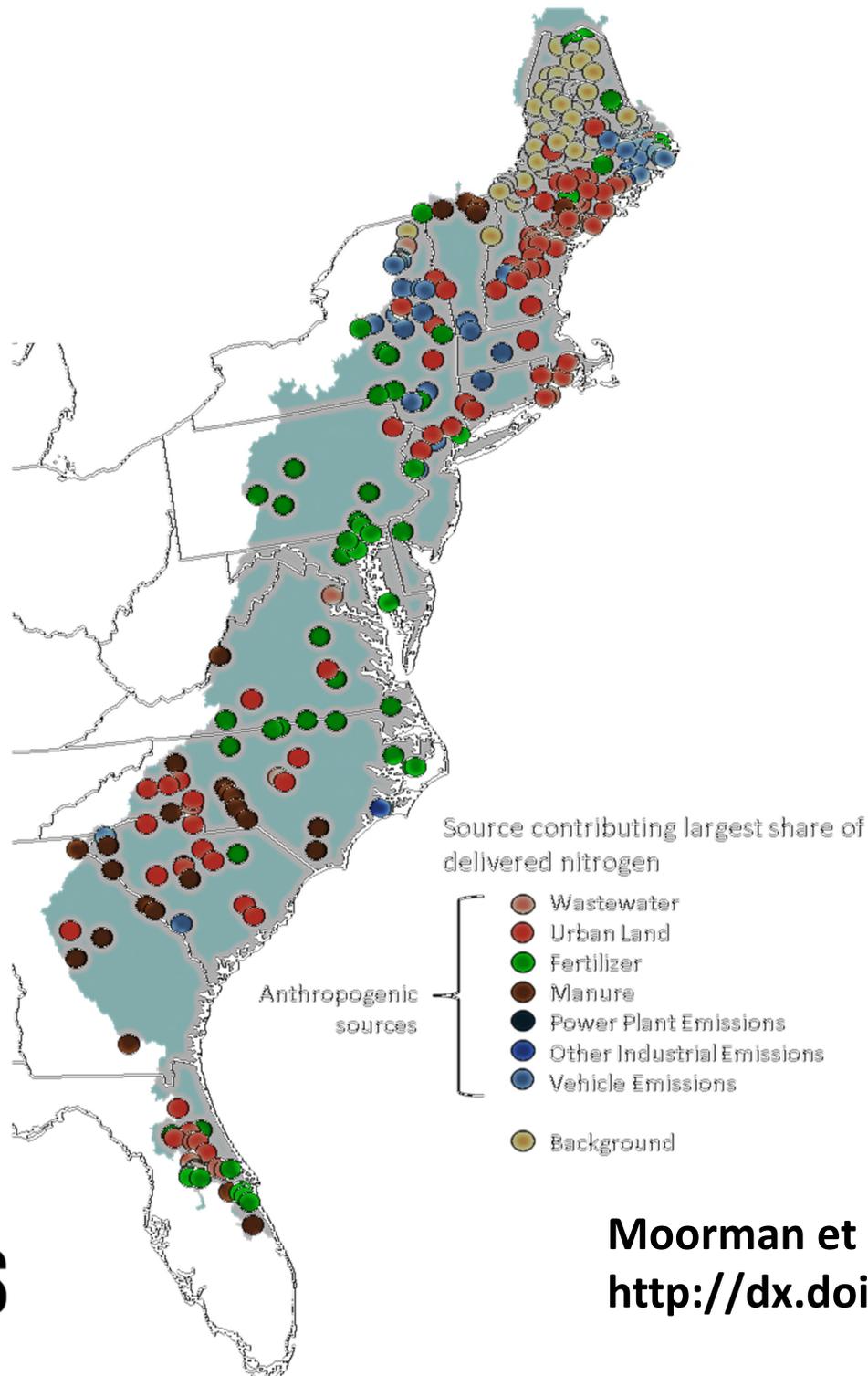


**Gulf of Mexico**



**Sources of Nitrogen to Estuaries**

- Livestock waste<sup>1</sup>
- Farmland fertilizer<sup>2</sup>
- Developed land<sup>3</sup>
- Wastewater discharge
- Atmospheric deposition
- Forested land<sup>4</sup>
- Imported<sup>5</sup>



**The largest human-derived sources of nitrogen to Eastern lakes:**

- **Fertilizer in the mid-Atlantic**
- **Urban land in New England**
- **Manure in the Southeast**

# HAB Monitoring Surveys at Regional and National Scales

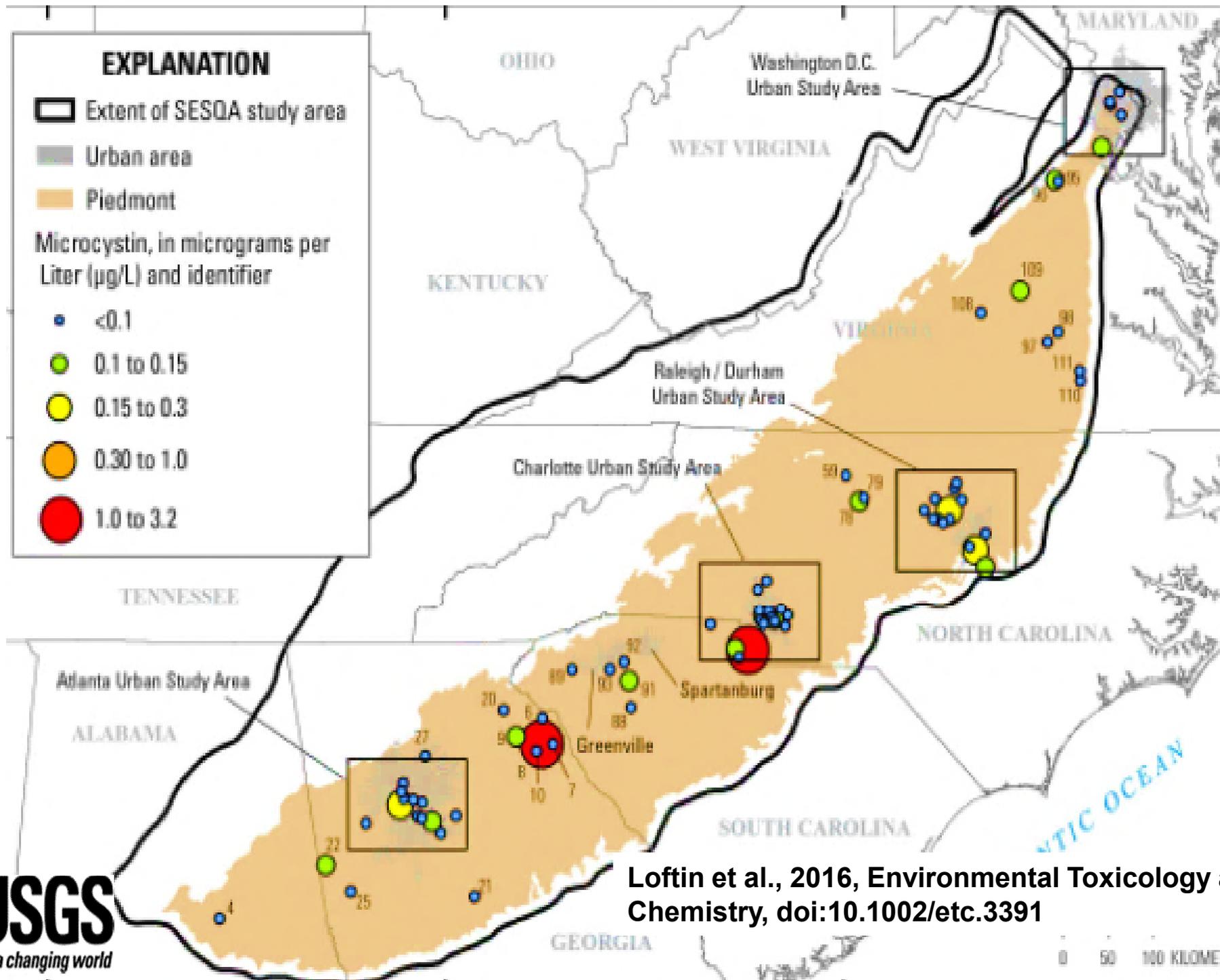
## U.S. EPA

- 2007 and 2012 National Lakes Assessment
- 2011 and 2016 National Wetlands Assessments
- 2015 National Coastal Assessment

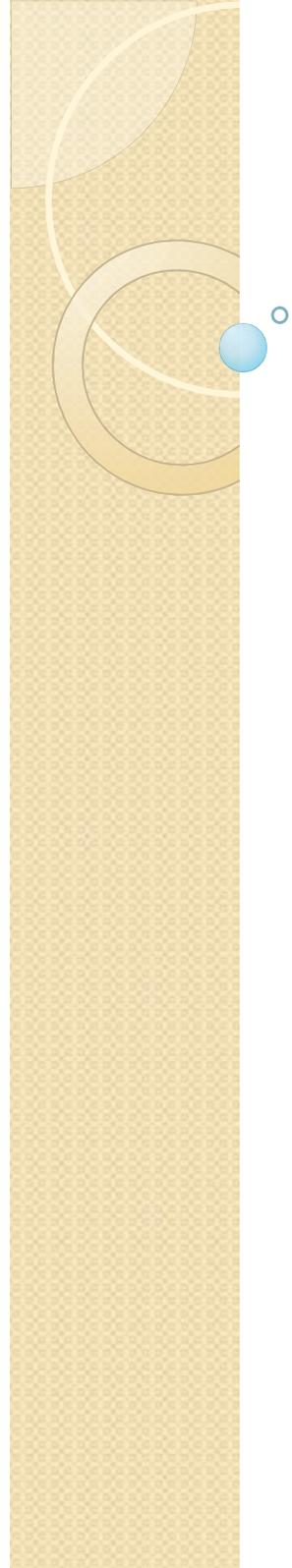
## USGS

- 2006 Midwest Lakes
- 2014-2016 Lake Erie
- 2014 Southeast Stream Quality Assessment (SQA)
- 2015 Pacific Northwest SQA
- 2016 Northeast SQA
- 2017 California SQA

# Algal Toxins Detected in One-Third of Assessed SE Streams



Loftin et al., 2016, Environmental Toxicology and Chemistry, doi:10.1002/etc.3391

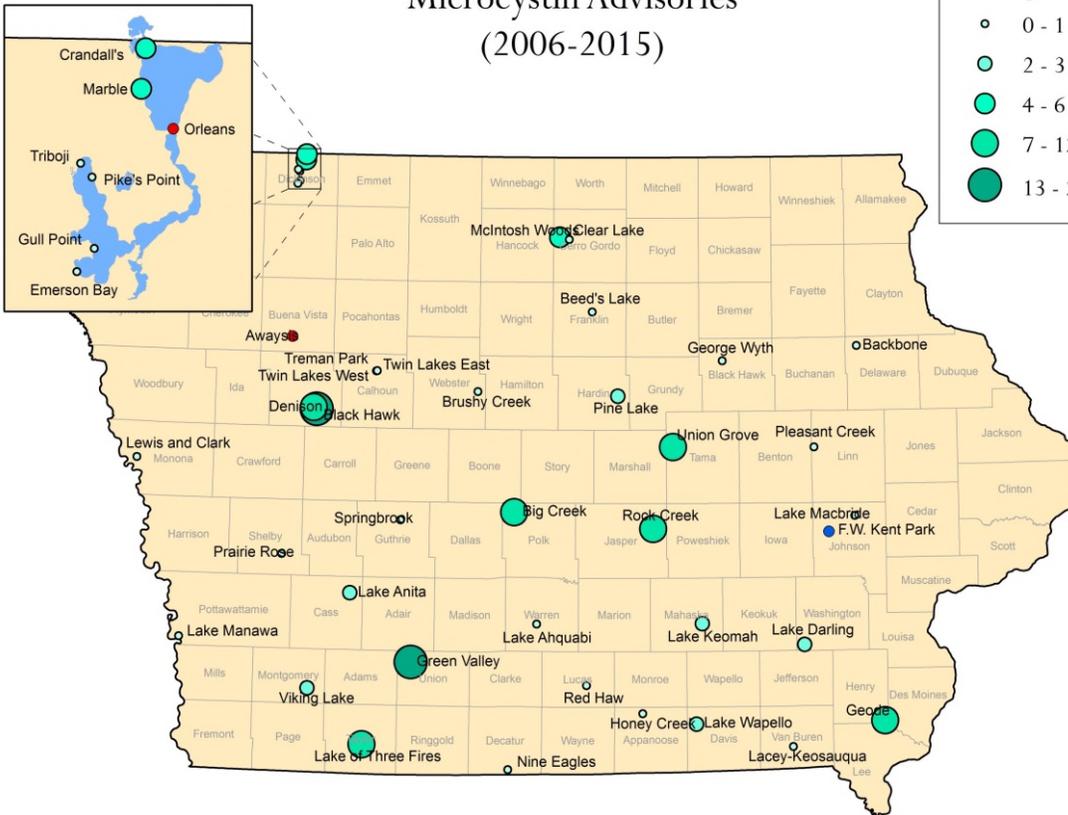


# State Perspectives

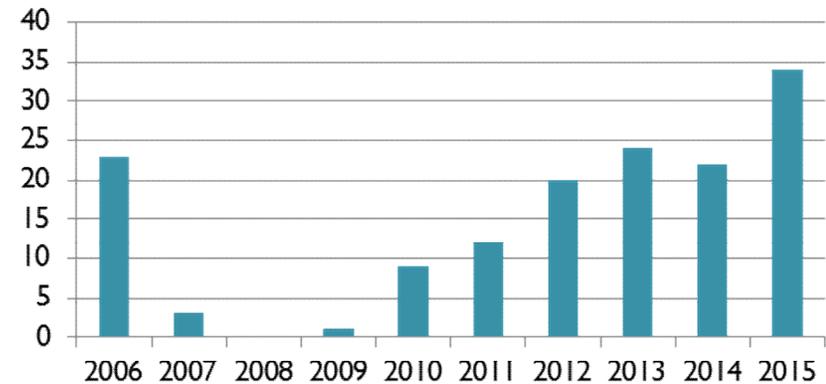
Mary Skopec, Ph.D.

Iowa Department of Natural Resources

## Microcystin Advisories (2006-2015)



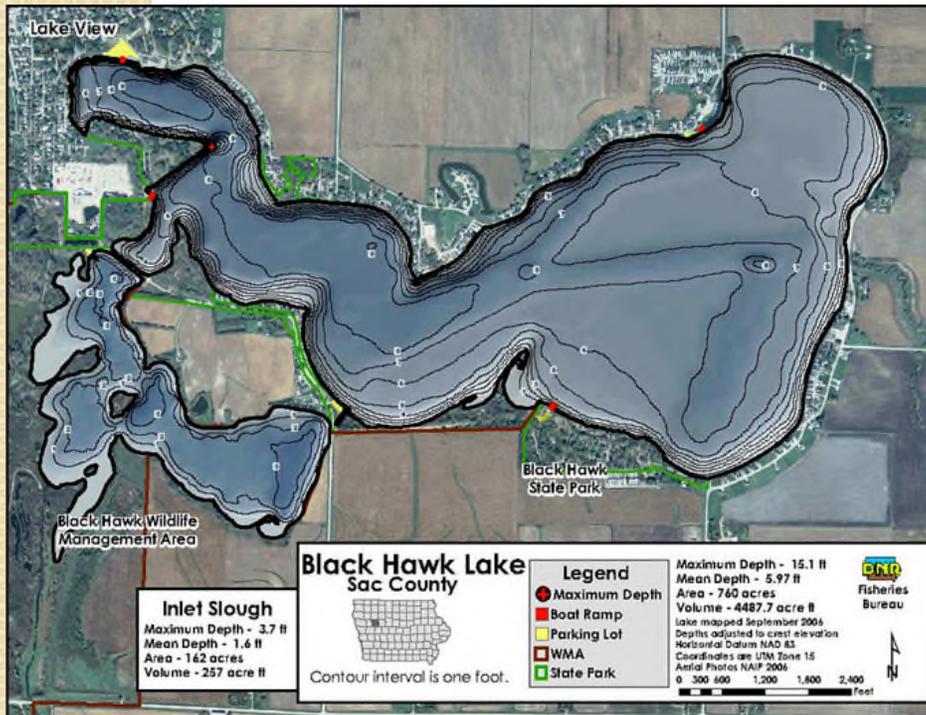
## Number of Advisories at Iowa Beaches



### Issues:

1. Monitor 40 State Owned Beaches Out of 1,000 potential waterbodies
2. Sampling on Monday/Tuesday for reporting on Friday
3. Sampling Memorial Day through Labor Day – off season impacts?
4. Why are the number of advisories increasing?
5. Co-occurrence of microcystin with other toxins?

# Example: Black Hawk Lake



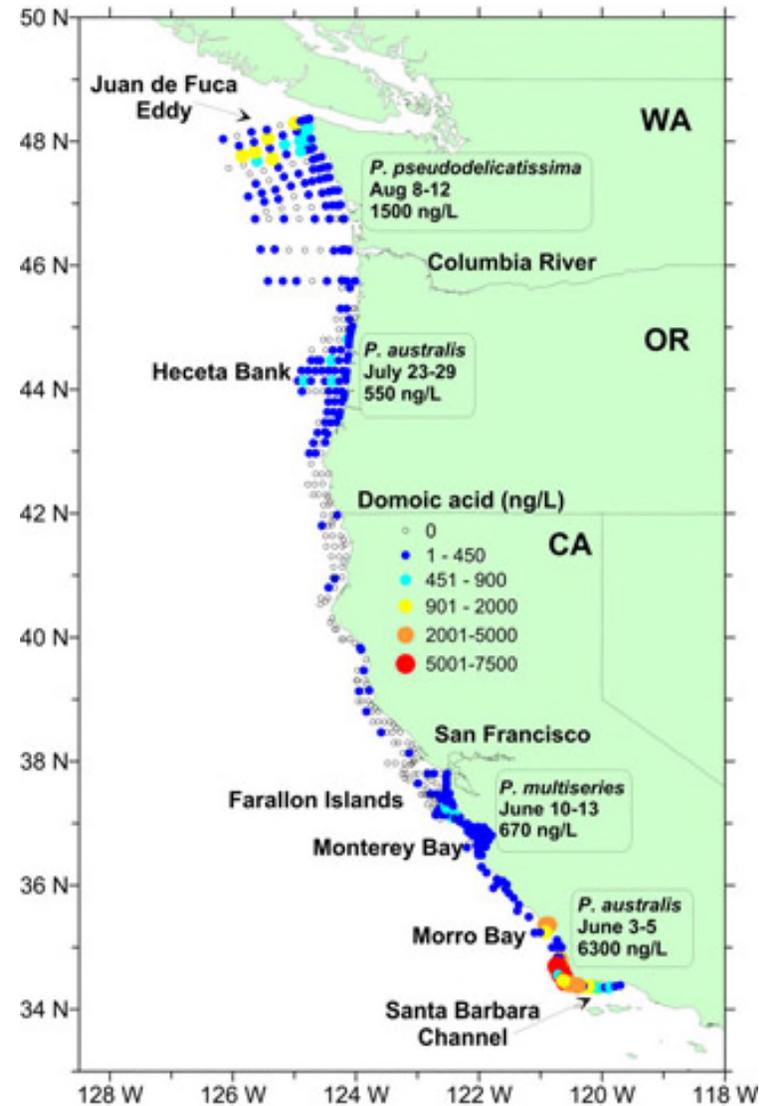
**Black Hawk Lake, Iowa, IDNR photo**

## Black Hawk Lake Watershed:

- Drainage Area: 13,156 acres (excluding lake)
- Designated Use: Primary Contact Recreation (A1)
- 2004: Added to 303(d) Impaired Waters list for algae & turbidity
- ~ \$3 M investment in BMPs

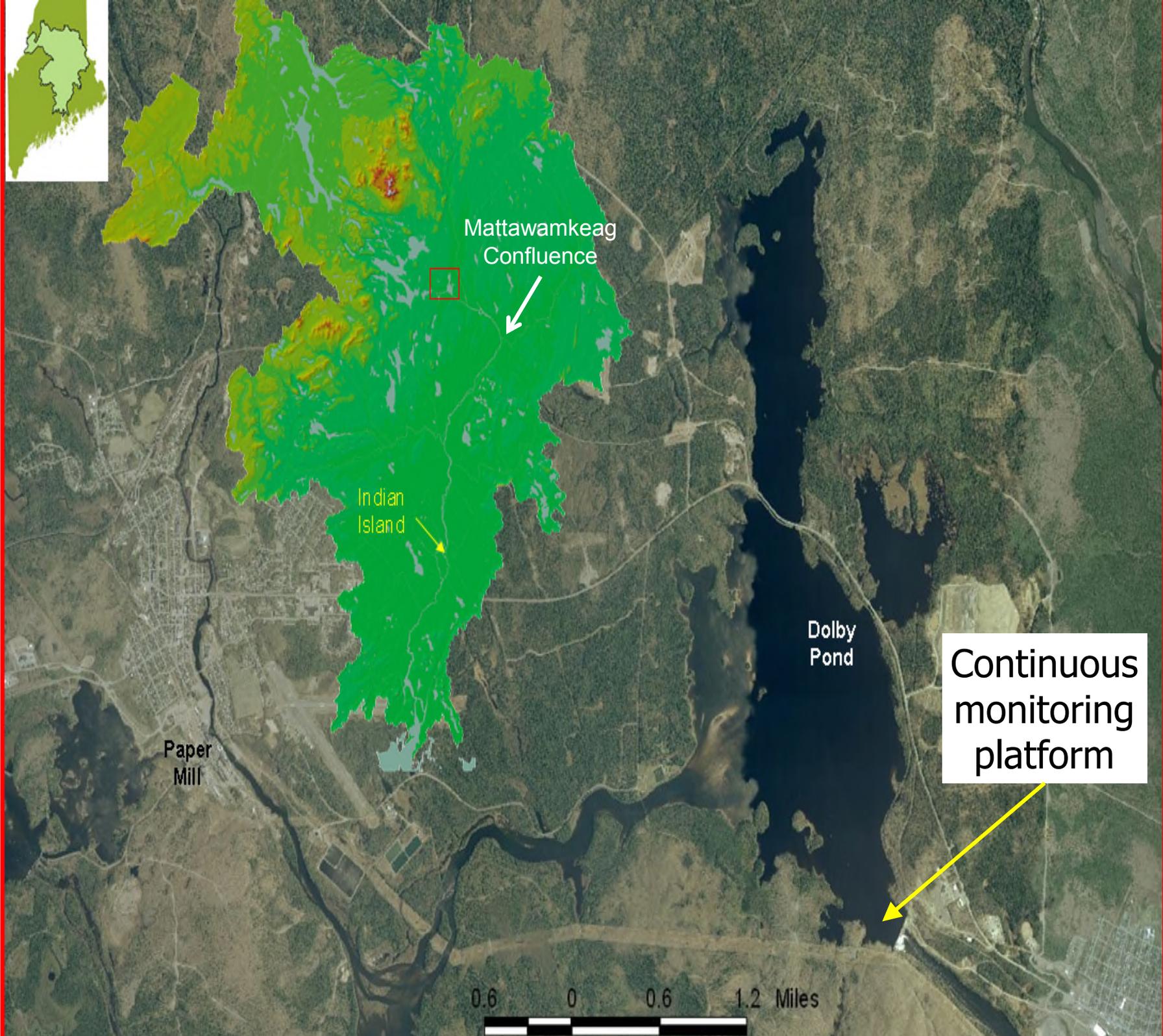
# Discussion Points

- *What are examples of HABs and hypoxia work in your jurisdictions?*
- *How can we better integrate data collected by federal partners to be of use to the states and tribes in decision-making?*
- *What kinds of leading indicators of HABs and hypoxia should we be measuring?*
- *How can we better communicate/interact with the public? What works in your jurisdiction?*



A decorative border surrounds the text, featuring a repeating pattern of stylized fish and turtles. The fish are depicted in profile, facing right, with vertical stripes on their bodies. The turtles are shown from a top-down perspective, also with vertical stripes. The border is composed of these elements connected by small, dark, teardrop-shaped motifs.

Water Quality  
Indicator:  
Harmful Algal Blooms  
(HABs) in the  
Penobscot River



Mattawamkeag  
Confluence

Indian  
Island

Paper  
Mill

Dolby  
Pond

Continuous  
monitoring  
platform

0.6 0 0.6 1.2 Miles



Vaisala WXT520:

windspeed & direction  
liquid precipitation  
barometric pressure  
temperature  
relative humidity



LI-COR 190  
photosynthetically active radiation

Solar panel charges battery

Battery

Logs data and sends it to office and web

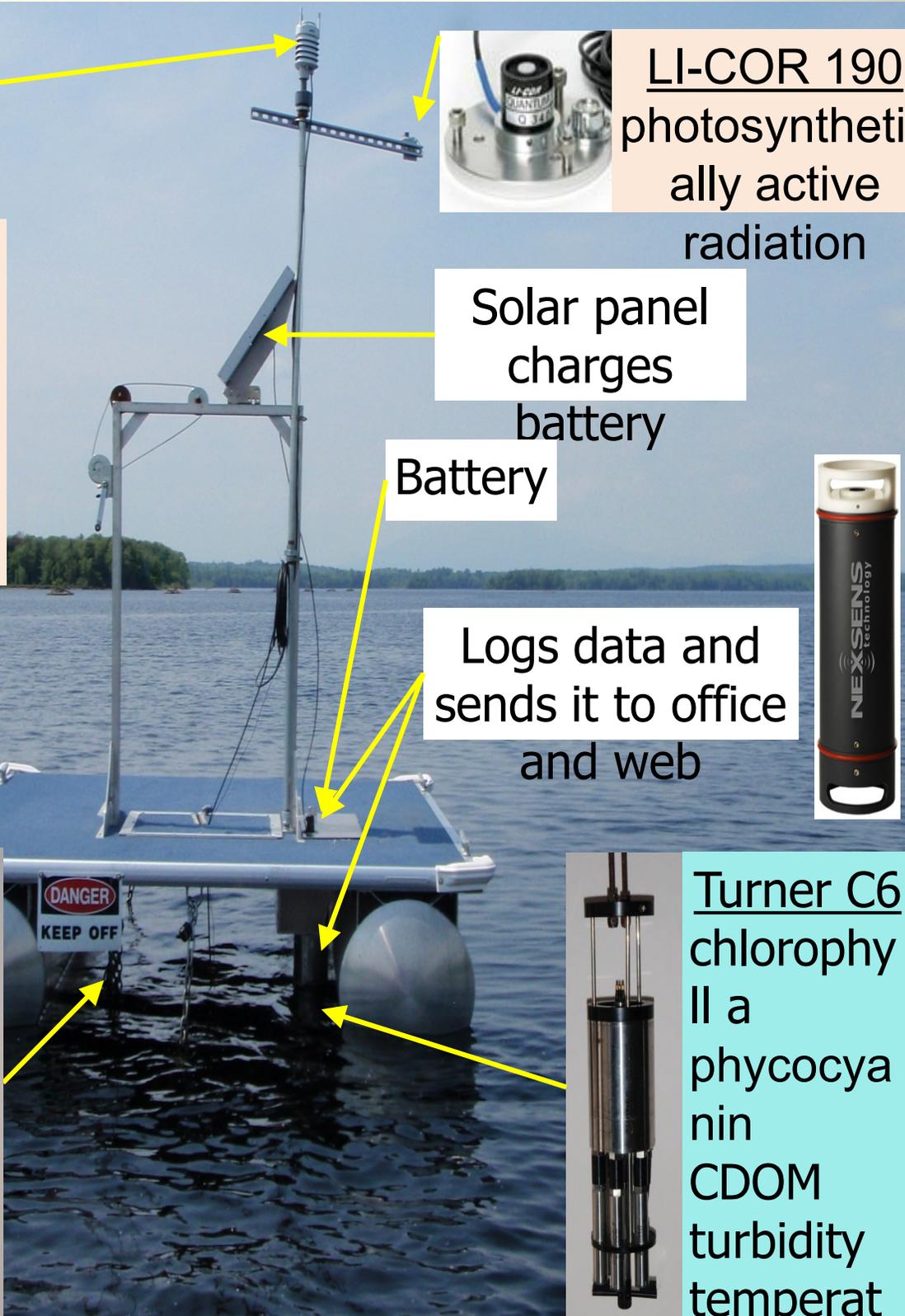


YSI 6920

temperature  
DO  
pH  
conductivity  
turbidity  
depth



Turner C6  
chlorophyll a  
phycocyanin  
CDOM  
turbidity  
temperature



# News Headlines:

*Ada Evening News: July 21, 2011*

## Heat wave fosters toxic algae in touristy lakes

OKLAHOMA CITY (AP) — A prolonged heat wave in the central U.S. has fostered the growth of a dangerous form of algae in lakes and ponds, threatening swimmers and livestock and scaring away tourists during the busy summer season.

Blue-green algae are actually bacteria that produce toxins

harmful to humans and livestock. It flourishes in warm, stagnant, sunlit water, and this year's heat wave combined with Oklahoma's worst drought since the Dust Bowl have created what one water official called a "perfect storm" for its growth.

Officials have issued a series of warnings, telling boaters and

swimmers at lakes in northeast Oklahoma, southern Kansas and Nebraska to avoid contact with the toxic gunk. The issue attracted national attention earlier this month when Oklahoma Sen. James Inhofe blamed a respiratory illness on a swim in **Grand Lake** in Ketchum Hollow.

The bad publicity has had dire

consequences for some businesses in Oklahoma where tourism is the third largest industry with an estimated annual impact of \$6.2 billion. Oklahoma's numerous lakes are a "huge economic engine" driving that industry, said Leslie Blair, a spokeswoman for the Department of Tourism and Recreation.

Problems on **Grand Lake** have subsided, the **Grand River Dam Authority** said. Advisories remained in effect Wednesday for portions of Keystone, Fort Gibson and Eufaula lakes in Oklahoma, Marion and Big Hill lakes in Kansas, and Willow Creek Lake in northeast Nebraska.

## Dangerous algae plague Oklahoma's lakes, ponds

By Sean Murphy  
Associated Press

OKLAHOMA CITY — A prolonged heat wave in the central U.S. has fostered the growth of a dangerous form of algae in lakes and ponds, threatening swimmers and livestock and scaring away tourists during the busy summer season.

Blue-green algae are actually bacteria that produce toxins

**"My friends at the marinas say their shops are full to the ceiling with beer that they haven't sold ... all because a senator went into a bad area in a cove and got a rash."**

— Sam Williams

consequences for some businesses in Oklahoma, where tourism is the third largest industry with an estimated annual impact of \$6.2 billion. Oklahoma's numerous lakes are a "huge economic engine" driving that industry, said Leslie Blair, a spokeswoman for the Department of Tourism and Recreation.

"We took a beating from hell," said Sam Williams, who sells everything from water

*Durant Daily Democrat: July 3, 2011*

## Inhofe says swimming in **Grand Lake** made him ill

TULSA (AP) — Sen. James Inhofe says he believes a swim earlier this week in algae-laden **Grand Lake** made him ill.

Inhofe told the Tulsa World that he took a routine dive into the lake Monday morning and

that night he was "deathly sick."

Oklahoma authorities warned people Friday against swimming in the lake, saying potentially toxic blue-green algae had been detected. They've also advised

against water skiing and other activities that would bring people or pets in contact with the water.

Inhofe has had a home on the lake in Ketchum Hollow for decades.

He says he's never

seen that kind of algae in the water before.

The 76-year-old Republican says he believes he's turned the corner on the respiratory illness and plans to return to Washington next week.

*Enid News and Eagle: July 21, 2011*



# Financial Impacts

## TULSA WORLD

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### Sales tax numbers show algae had little effect on Grand Lake revenue

by: RHETT MORGAN World Staff Writer  
Monday, August 29, 2011  
8/29/2011 7:34:46 AM

KETCHUM - Municipal sales tax numbers that coincide with Grand Lake difference in lake town revenues compared to the same period a year ago.

Noting the algae outbreak, the Grand River Dam Authority on July 4th is chilling those who typically flock there over the Fourth of July week.

With the main part of the lake testing negative for the toxins, the Grand Lake is expected to see a return to normal.

The city of Grove's sales tax deposit letter for August, which reflected \$554,364, roughly a 6 percent increase over the same period in 2010.

Other lake cities showed negligible change as well. The town of Langley saw a slight increase, the same month a year ago, and the city of Ketchum dipped slightly, while Bernice and Disney, however, rose slightly.

*Tulsa World: August 29, 2011*

## Sales tax revenues at selected Grand Lake towns

Key: 2010 2011

Grand Lake Towns	July*		August**	
	2010	2011	2010	2011
Grove	\$515,075	\$516,462	\$523,754	\$554,364
Disney	\$6,702	\$6,297	\$5,806	\$5,932
Langley	\$81,026	\$79,842	\$79,581	\$77,439
Ketchum	\$11,291	\$17,005	\$20,510	\$19,928
Bernice	\$17,077	\$17,605	\$16,734	\$17,731

\* Reflects collections from May 16 to June 15

\*\* Reflects collections from June 16 to July 15

# Turtle Mountain Band of Chippewa Belcourt, North Dakota



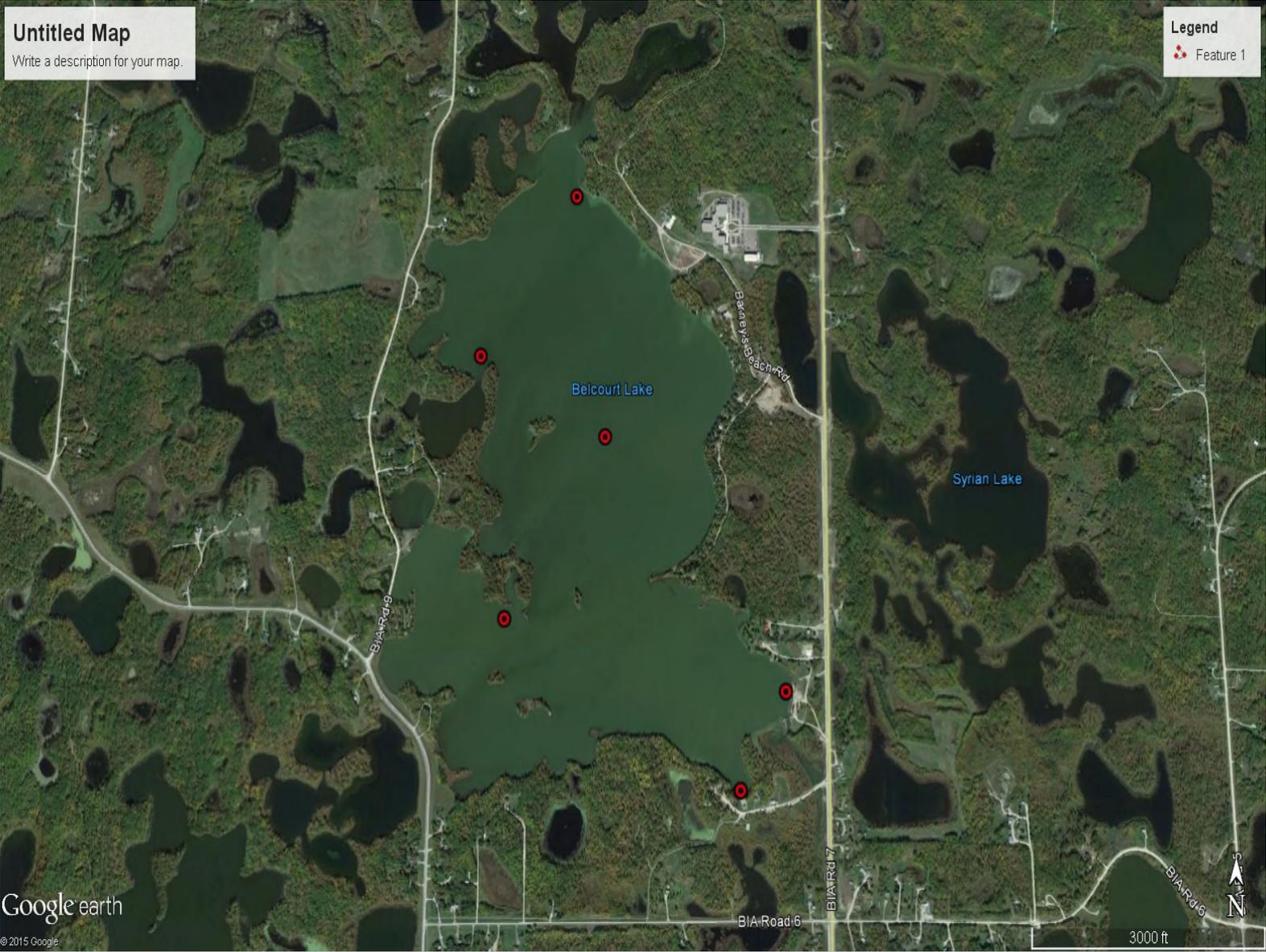
# Belcourt Lake Designated Uses:

- Recreation: boating, water skiing, jet skiing, swimming, canoeing and picnics
- Fisheries: Excellent year-round fishing with multiple fish species, several fishing derbies during summer, winter.

(Note: several fish kills; NDG&F fish stocking)

- **Tribal Endurance Race:** In July, a competitive race is held that requires swimming, foot race, canoeing and rafting in and around the watershed
- **Cultural:** picking rocks, willow trees, education and outreach

# Belcourt Lake Sub-watershed Sept 2014





08/28/2015

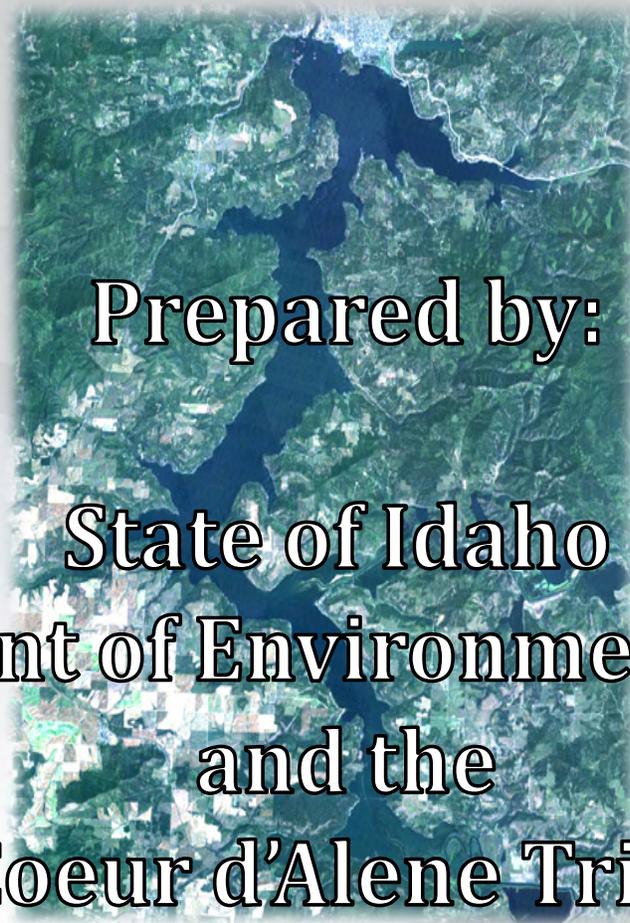
**LAKE CLOSED**  
**DUE TO HIGH LEVELS OF ALGAE IN BELCOURT LAKE**  
**NO RECREATIONAL ACTIVITY IS ADVISED WHICH**  
**INCLUDES: SWIMMING, BOATING, WATER SKIING, ETC.**  
**UNTIL FURTHER NOTICE**  
**ANY QUESTIONS PLEASE CONTACT**  
**THE TURTLE MOUNTAIN EPA OFFICE**  
**AT 477-8328 OR 477-8332**

09/16/2015

# Toxic Algae Bloom/Actions Taken

- Belcourt Lake spillway discharged 2 weeks after first algae samples taken; however, water was discharged into Ox Creek
- Signage was posted around the lake
- Harmful Algae Bloom literature was distributed to lake residents (home to home visits)
- Harmful Algae Bloom advisory posted on local radio station
- Follow-up Algae samples
- Conference call with EPA Region 8 contact (Tina Laidlaw), BIA, Natural Resource and Ohio Lab to discuss lab results
- Develop Harmful Algae Bloom monitoring plan

# Invisible Danger: Regulation of Metals and Nutrients in Coeur d'Alene Lake



Prepared by:

State of Idaho

Department of Environmental Quality

and the

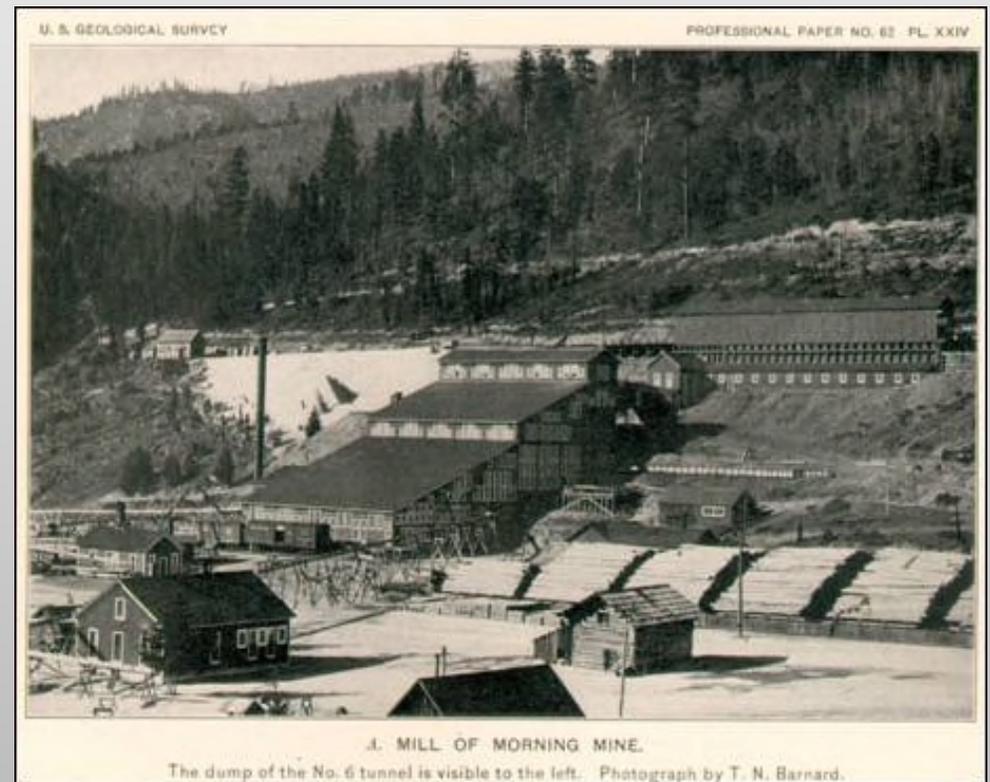
Coeur d'Alene Tribe



[www.facebook.com/CdA.LMP](http://www.facebook.com/CdA.LMP)

# Silver Valley/Bunker Hill Mining District & Complex – a Superfund Site since 1983

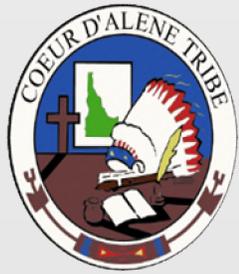
For a century, millions of tons of mine tailings, slurries, and sediments enriched with metals transported down the Coeur d'Alene River and settled in the bottom of Coeur d'Alene Lake





# Coeur d'Alene Lake Management Plan Background

- **Bottom sediments of Coeur d'Alene Lake have high concentrations of trace metals (e.g. lead, zinc, cadmium).**
- **The EPA 2002 Record of Decision (ROD) deferred a CERCLA clean-up remedy for the lake, and instead advised a Lake Management Plan to be developed by DEQ, Tribe, and stakeholders.**



# Coeur d'Alene Lake Management Plan Idaho DEQ and Coeur d'Alene Tribe Finalized March 2009 Stated Goal:

*“To protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments.”*

# Dissolved Zinc Concentrations

Idaho WQS for Dissolved Metals (hardness dependent)

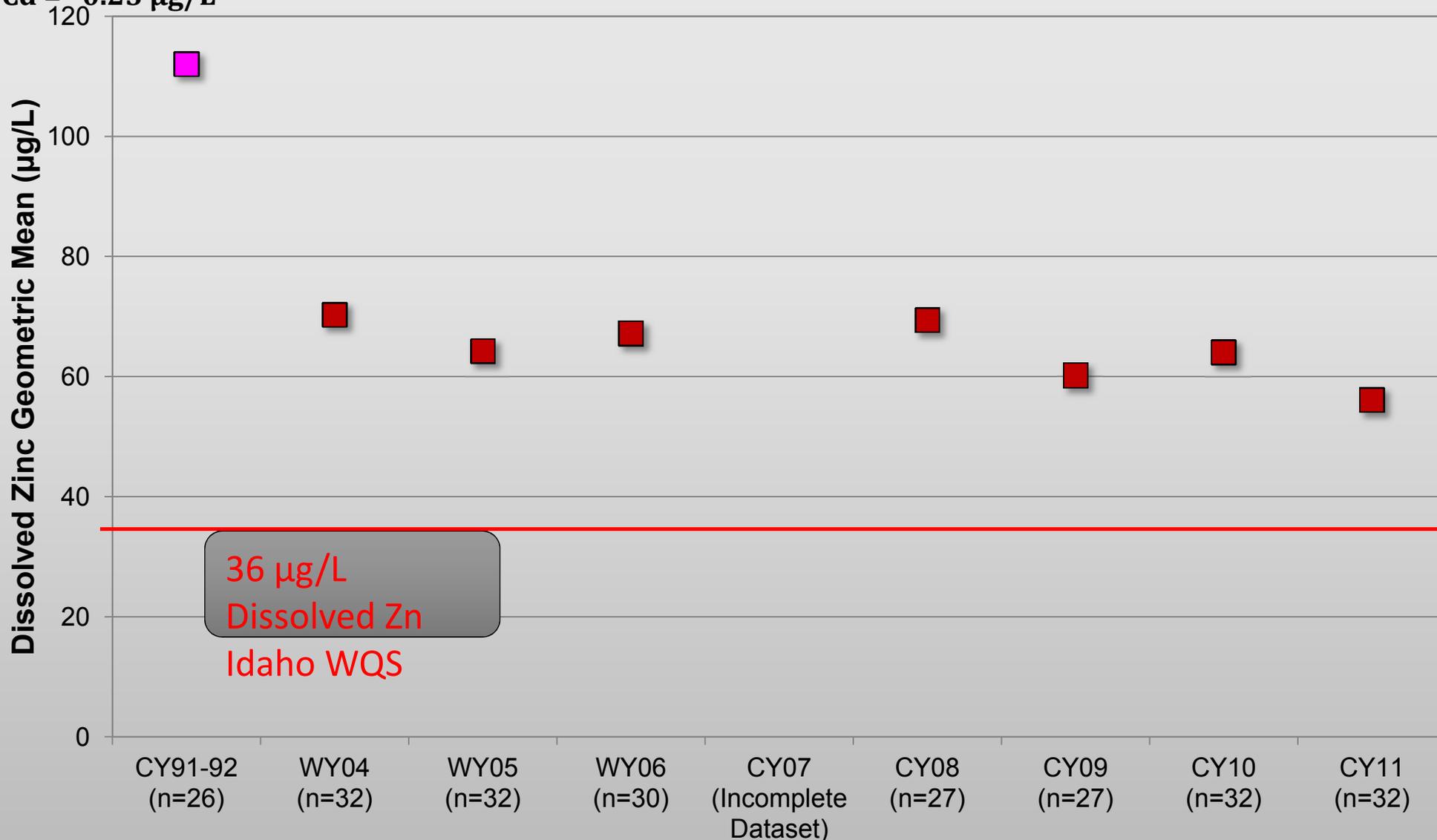
Zn = 36  $\mu\text{g/L}$

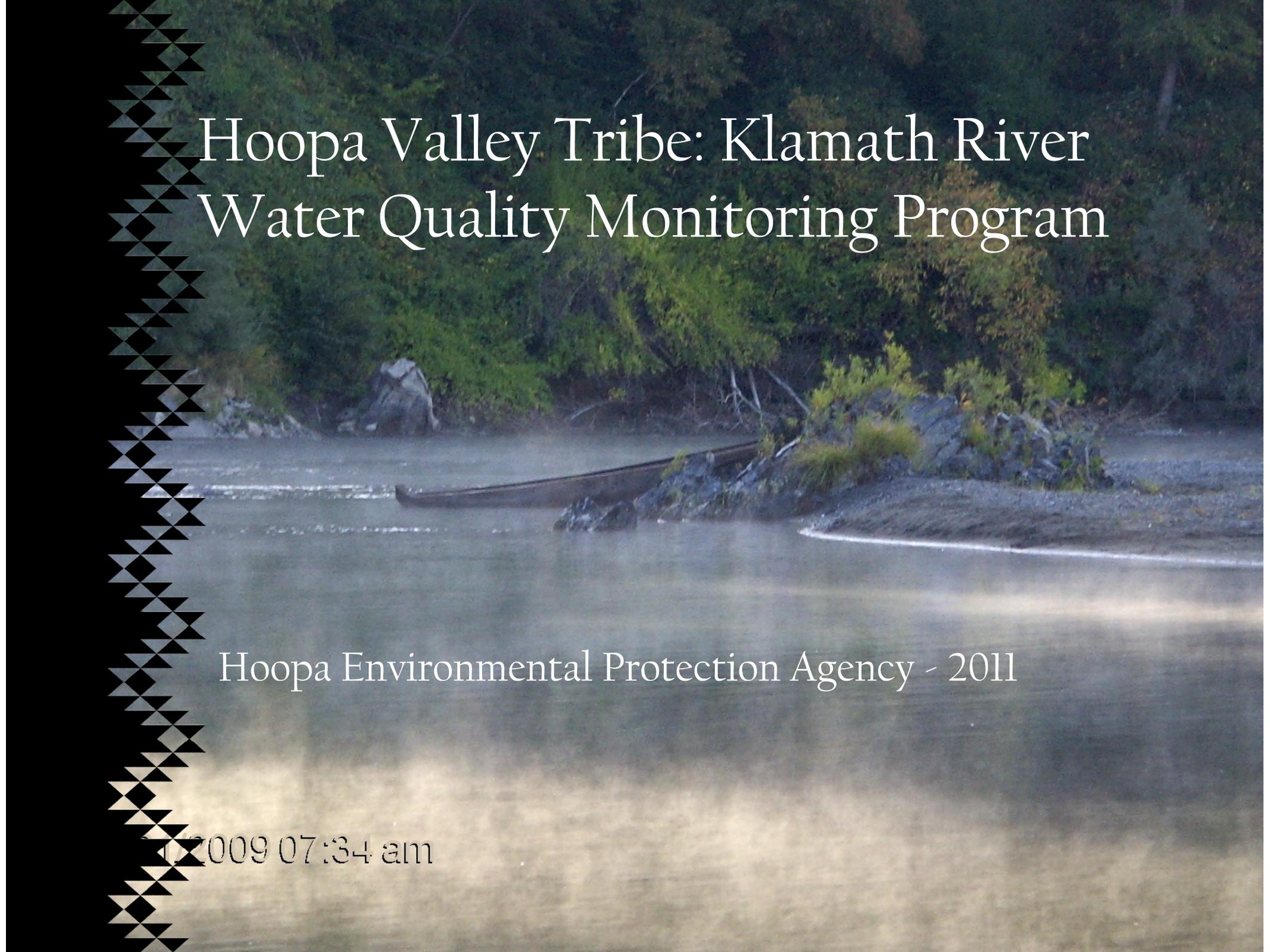
Pb = 0.54  $\mu\text{g/L}$

Cd = 0.25  $\mu\text{g/L}$

High concentrations of zinc inhibit phytoplankton growth

## University Point

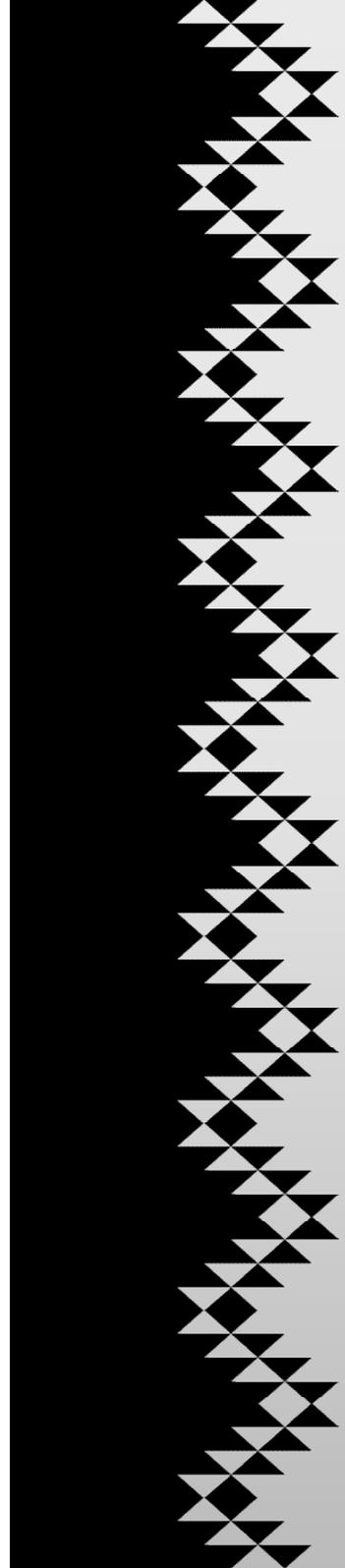




# Hoopa Valley Tribe: Klamath River Water Quality Monitoring Program

Hoopa Environmental Protection Agency - 2011

7/2009 07:34 am

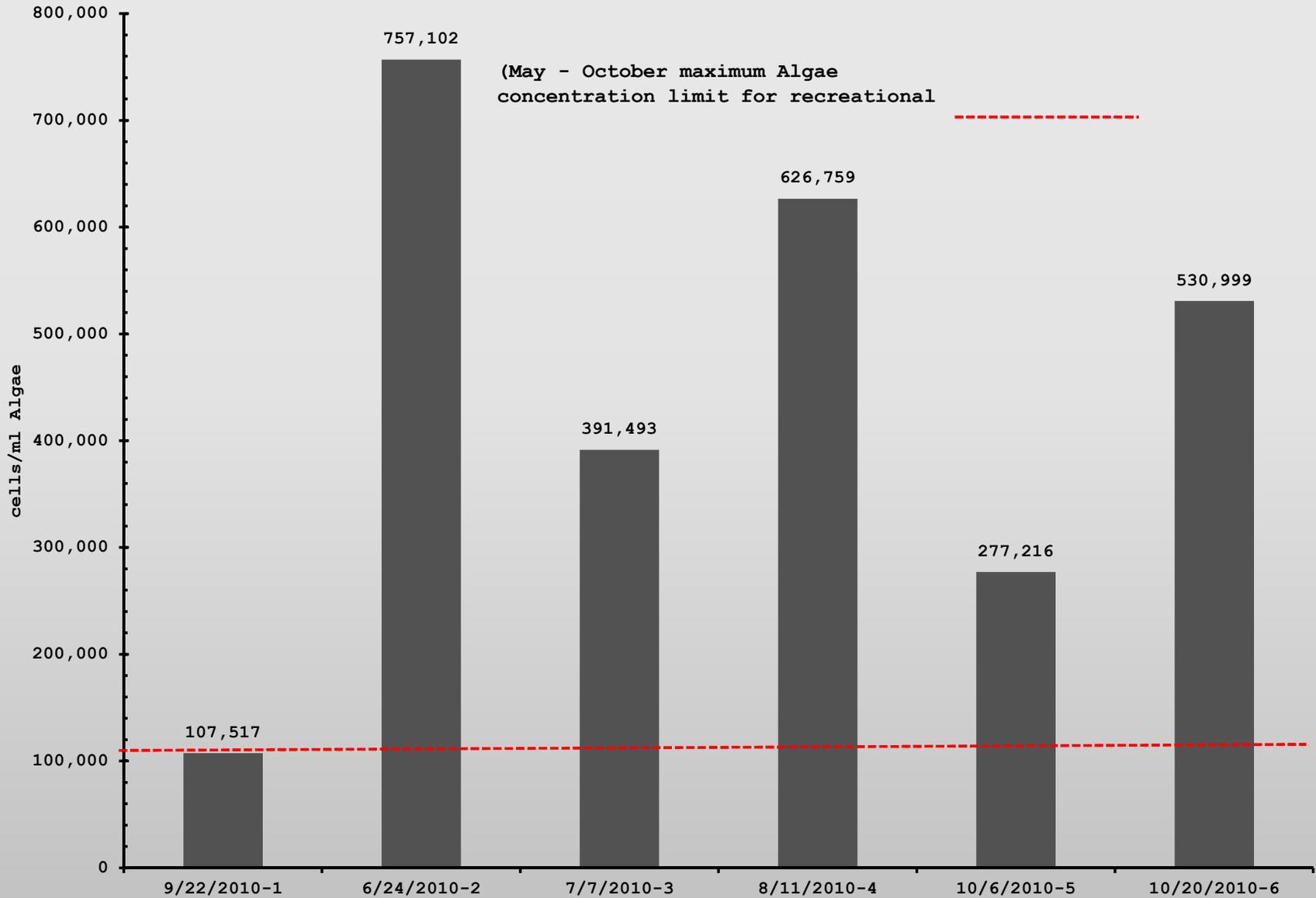


# Tribal Water Quality Goals for Klamath River

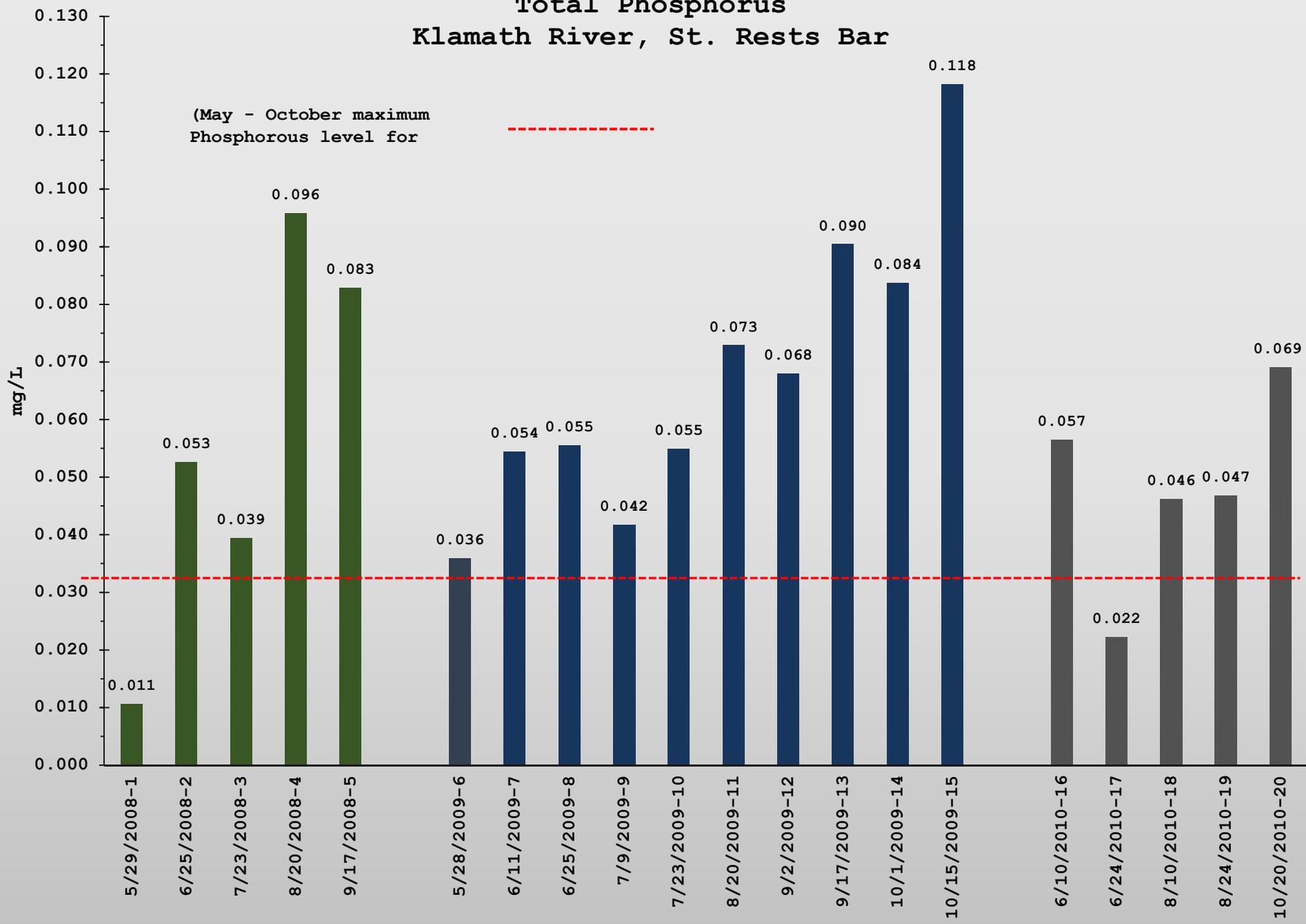
Hoopa Tribe's impetus for developing WQS for Klamath River:

- Protect & maintain healthy “Salmon Runs”
- Establish a Comprehensive Water Quality Protection program
- Affirm tribal jurisdiction to enforce WQS on tribal lands
- Establish Cultural Beneficial Uses
- Address Water Quality Impacts from Dams & Water Diversions within Klamath River Basin
- Restore the natural river system to a level where its ecosystem processes cleans the water.

# Blue/Green Algae Concentrations Klamath River, St. Rests Bar



# Total Phosphorus Klamath River, St. Rests Bar



## Tribal Participation in State 401 Certification processes:

- In 2004, the Klamath River was declared impaired by State of California.
- In 2005, Tribe began developing nutrient standards for portion of Klamath River which flows through its reservation.
- In 2008, Tribe obtained EPA approval for its nutrient standards.
- Tribal strategy – adopt more stringent standards than state.
- California as “upstream State” has to insure that Tribe’s standards are not violated when issuing State 401 certifications – CWA Sec.402 (a)(2).



# Thank you!

<http://1.usa.gov/1T9iXuX>

## Contact

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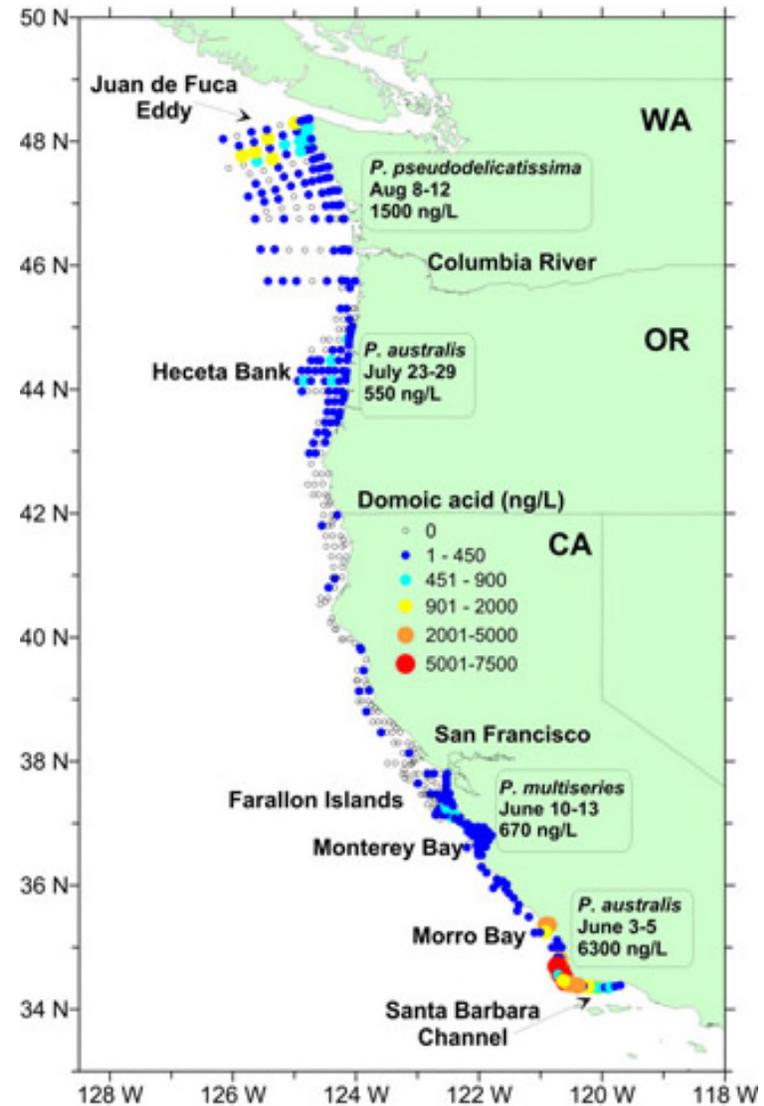
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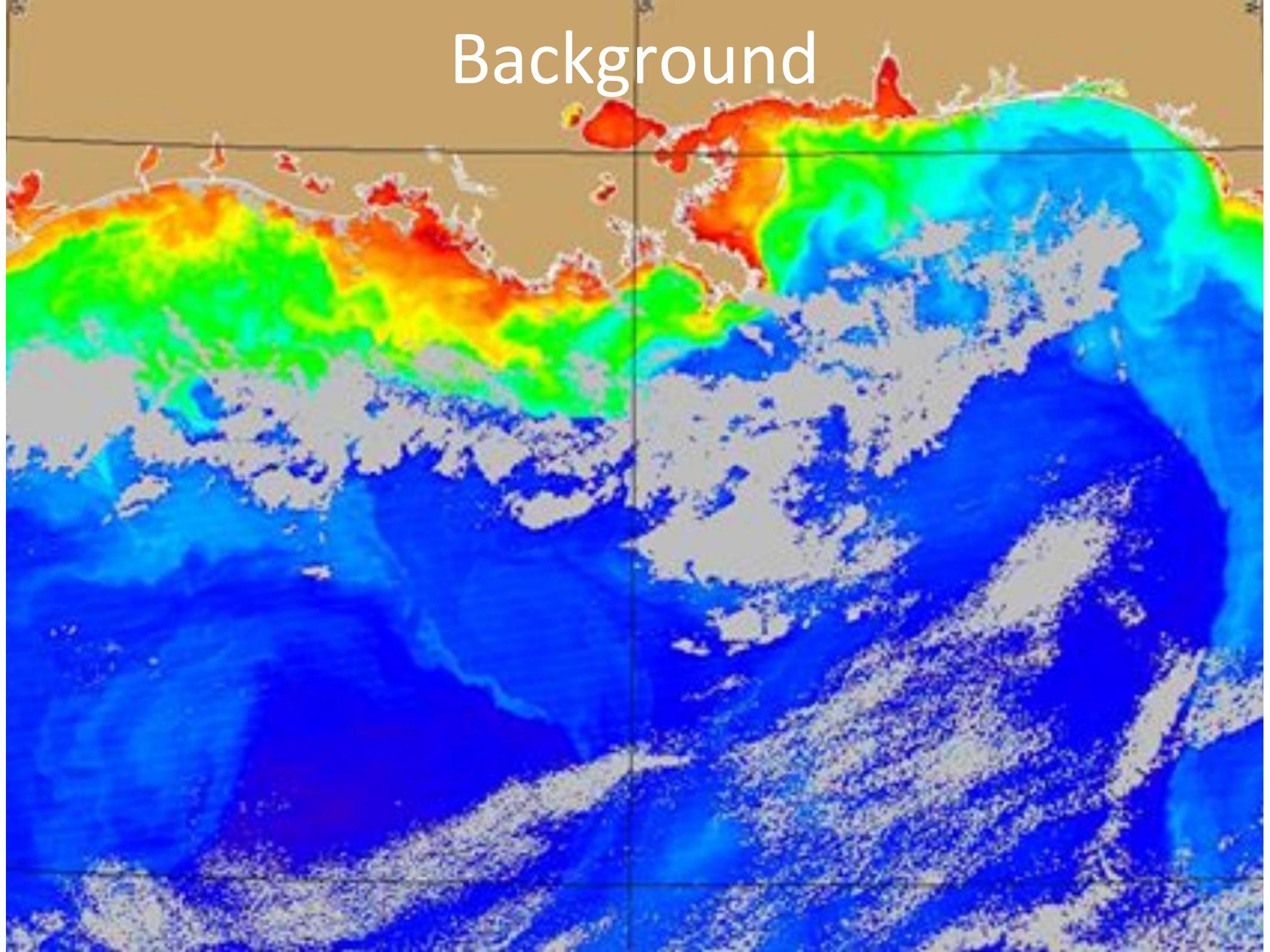
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# Discussion Points

- *How can we better integrate data collected by federal partners to be of use to the states and tribes in decision-making?*
- *What kinds of leading indicators of HABs and hypoxia should we be measuring?*
- *How can we better communicate/interact with the public? What works in your jurisdiction?*



# Background



# HAB Forecasting and Detection

## Accomplishments:

- Lake Erie seasonal & bulletin advances
- Community & Congressional Engagement
- ESP advances and West coast offshore deployment
- Ciguatera: Detection and Climate



## Development and Commitments

- CyAN Project testing
- Gulf of Maine transition planning
- Toxin prediction
- Continued detection technology advances
- Innovation in regional partnerships

