Arkansas Harmful Algal Bloom (HABs) Workgroup

December 5, 2017

Beautiful Buffalo River Action Committee meeting

1st Place
Photo by Diana L.
http://neefusa.org/algalbloomcontest

Harmful vs. Nuisance Algal Bloom

- Harmful algal blooms are a major environmental problem in all 50 states. Cyanobacterial harmful algal blooms (cyanoHABs) in inland waters severally impact human health, aquatic ecosystems, and the economy.
- Nuisance algal blooms or algae outbreaks may be used to describe macroalgae, which are large visible free floating, or microalgae which require a microscope to see but in mass are highly visible.

Nuisance

cyanoHAB

What we know

- HABs are becoming more frequent and predictable, especially in nutrient enriched water bodies.
- 2.5 million acres (nationally) of lakes, reservoirs, and ponds have poor water quality due to nitrogen and phosphorus pollution.
- Some algal blooms can produce toxic compounds (cyanotoxins) at levels of concern for human health and the environment.

Ellen Gilinsky, USEPA, Protecting America's Water from HAB's, NALMS' LakeLine, Summer 2015

What we know, cont.

- When HABs are present near drinking water intakes, cyanotoxins can enter the drinking water utility's supply, putting the local population at risk.
- Toxins from HABs are also harmful and can cause death to pets and livestock
- HABs also can pose a risk for swimming and other recreational activities on or in the water.

Ellen Gilinsky, USEPA, Protecting America's Water from HAB's, NALMS' LakeLine, Summer 2015

What we know, cont.

- EPA estimates between 30 and 48 million people use drinking water from lakes and reservoirs that may be vulnerable to cyanotoxin contamination.
- HAB occurrences have diverse and far reaching economic impacts, not just drinking water, but also on tourism and recreation, real estate values, commercial fishing, and recreational businesses.
- Nutrient enrichment and the resulting HABs are one of our most widespread, costly, and challenging environmental problems today.

Ellen Gilinsky, USEPA, Protecting America's Water from HAB's, NALMS' LakeLine, Summer 2015

Table 2. Common cyanobacterial toxins, toxicity (based on intraperitoneal mouse assays), and common effects of exposure.

[Most toxin groups have several variants with a range of toxicities. Although known chronic effects are listed, the chronic effects of exposure to cyanotoxins currently (2008) are not well understood. LD_{50}, lethal dose required to kill half of the members of a tested population; µg/kg, micrograms per kilogram of body weight; -, no data available; >, greater than]

Class	Toxin	Toxicity (LD_{50})	Acute effects	Chronic effects
Neurotoxins	Anatoxins	20 – 250 µg/kg	Seizure, paralysis, respiratory failure, death	unknown
	Saxitoxins[1]	10 µg/kg	Tingling or numbness in extremities, paralysis, respiratory failure, death	unknown
	β-N-methylamino-L-alanine (BMAA)	-	-	neurodegenerative disease
Hepatotoxins	Microcystins	25 – > 1,000 µg/kg	Acute hepatoenteritis, shortness of breath, interhepatic hemorrhage hemorrhagic shock, heart failure, death	chronic liver injury, tumor promoter
	Cylindrospermopsins	200 – 2,100 µg/kg	Acute hepatoenteritis, renal, lung, heart, spleen, thymus, and adrenal damage, death	potential carcinogen, mutagen
	Nodularins[2]	50 µg/kg	Similar to microcystins	tumor promoter
Dermatoxins	Lyngbyatoxins	300 µg/kg	Severe dermatitis, gastroenteritis	tumor promoter
	Aplysiatoxins	300 µg/kg	Severe dermatitis, gastroenteritis	tumor promoter
	Lipopolysaccharides	-	Dermatitis, gastroenteritis	unknown

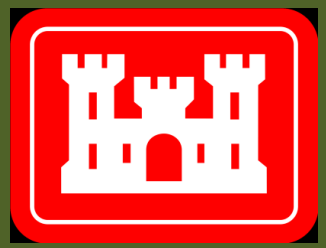
[1]Also known as paralytic shellfish poisons (PSPs).

[2]To date, nodularins have only been detected in brackish waters.

Sources: Chorus and Bartram (1999), Falconer and Humpage (2006), and Stewart and others (2006).

http://pubs.usgs.gov/sir/2008/5038/

Arkansas HAB Workgroup



GRDA: Algae Bloom Like This One Has Never Happened In Oklahoma

July 2011

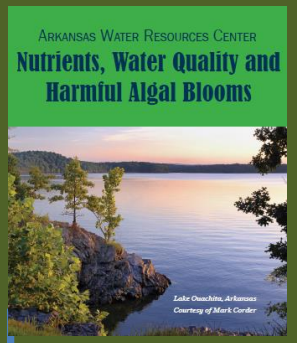
Lake Nimrod closes after possibility of harmful algae discovered

July 2014

1st Arkansas Harmful Algal Bloom Workgroup Meeting

August 2015

AWRC Conference



August 2016

June 2014

Harmful Algal Bloom and Hypoxia Research and Control Amendments Act of 2014

June 2015

Toxin	10-day Health Advisory	
	Bottle-fed infants and pre-school children	School-age children and adults
Microcystins	0.3 µg/L	1.6 µg/L
Cylindrospermopsin	0.7 µg/L	3 µg/L

Arkansas HAB Workgroup

- Goals
  - Develop communications between state agencies and other organizations
  - Develop a monitoring plan for HABs and cyanotoxins
  - Develop a response plan for drinking water and recreational HAB occurrences
  - Develop signage and other communication methods to notify public

Drinking Water vs. Recreation

Drinking Water

- ADH, CAW, & BWD taking the lead, with AWWA and USEPA
- November 2017, USEPA released, Incident Action Checklist for HAB's and water utilities

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Recreation

- ADH - *E. coli* swim beach monitoring
- No agency responsible for cyanotoxins and cyanotoxin closures?
- AHABWG is currently developing a
  - HAB monitoring and
  - recreational HAB response plan

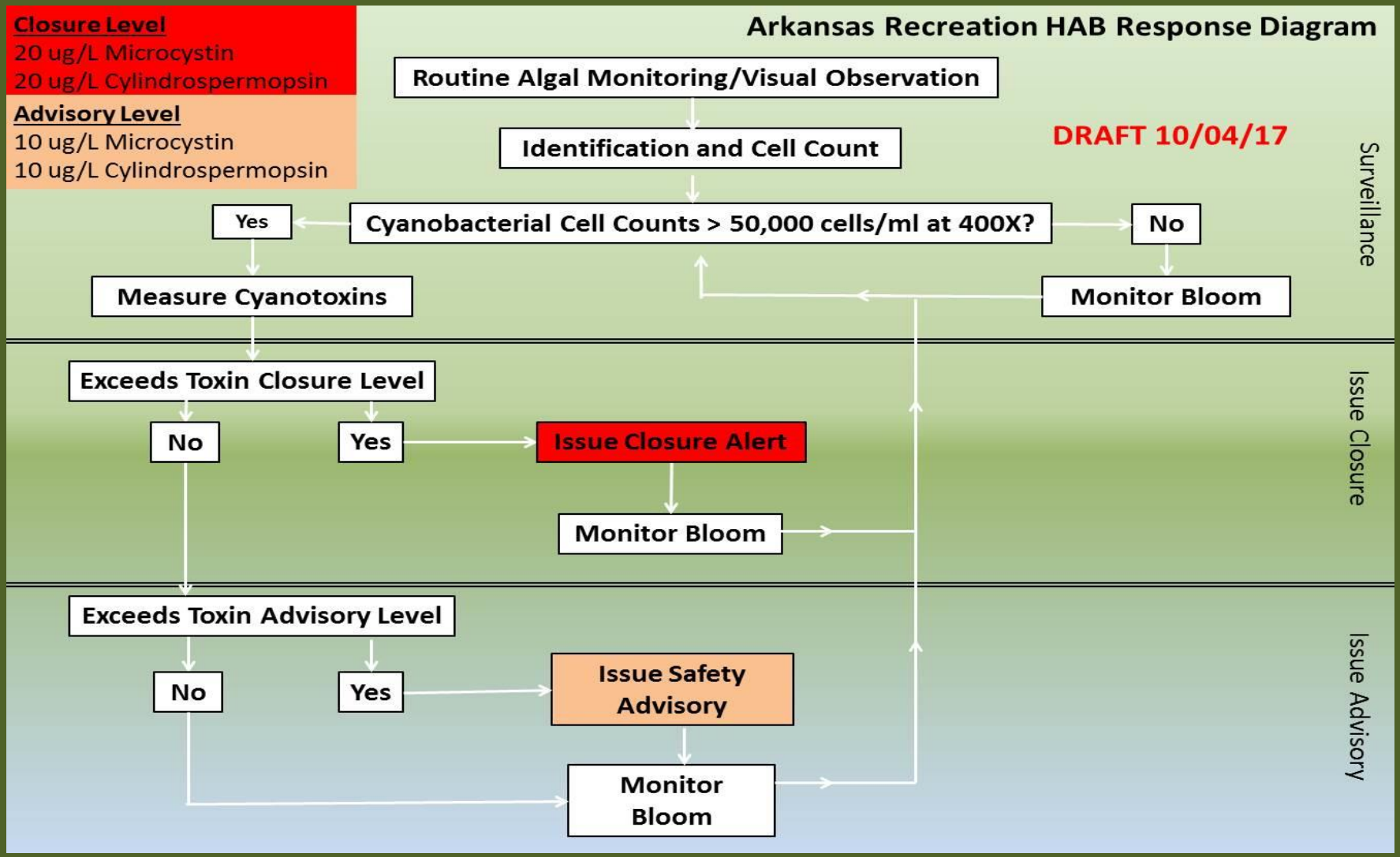
USEPA Suggested Actions for Preparing and Responding to Blooms in Recreational waters

epa.gov/nutrient-policy-data/monitoring-and-responding-cyanobacteria-and-cyanotoxins-recreational-waters

- Prioritize recreational waterbodies based on risk
- Develop a monitoring plan
- Develop a response plan
- Develop signage and other communication methods to notify public

#1 - Identify health advisory and closure levels, and

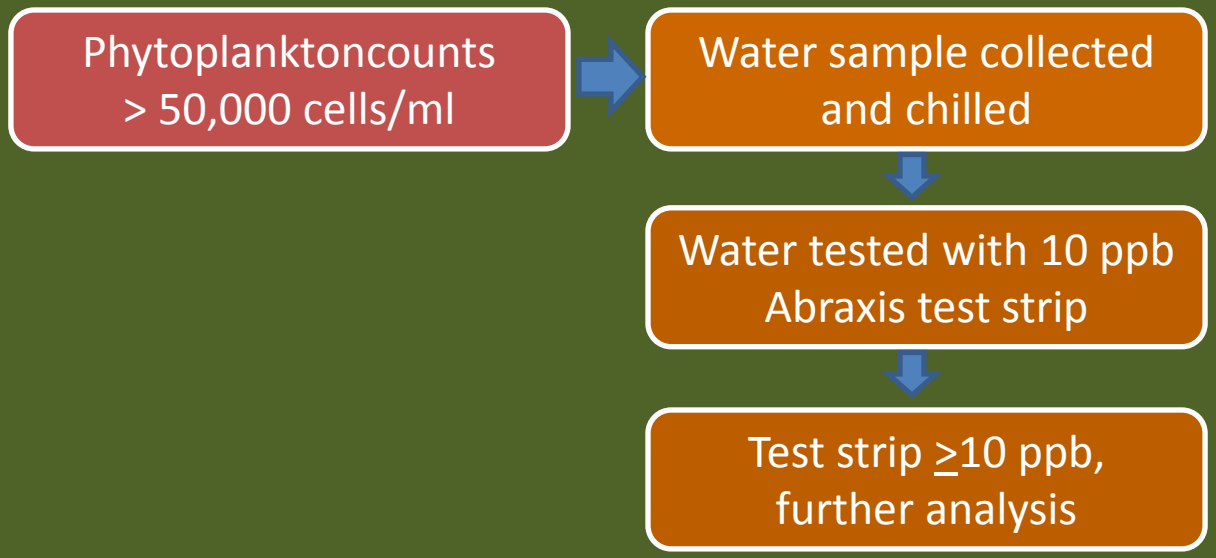
#2 - take specific actions on waterways exceeding levels.



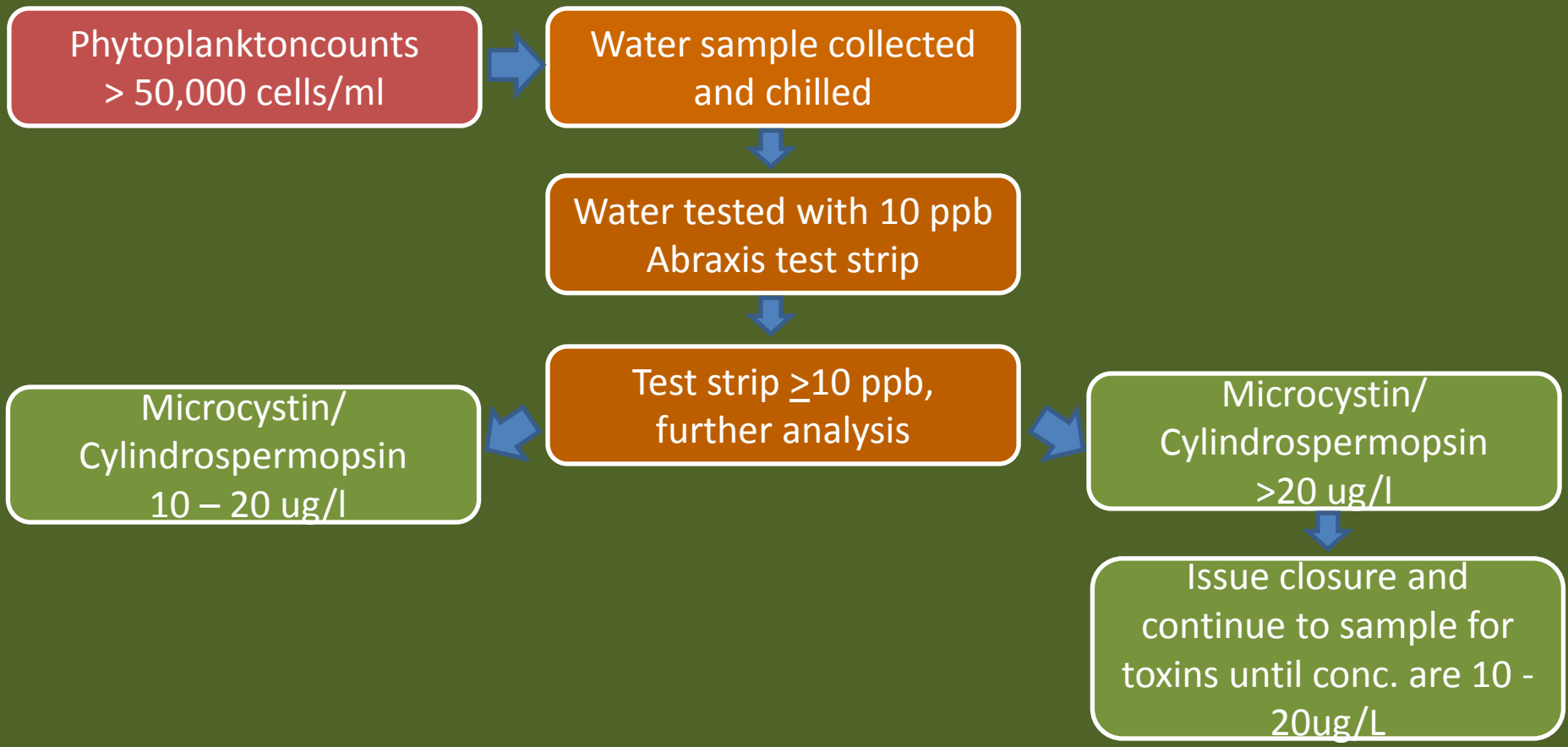
Draft Monitoring Plan for Priority Lakes: Cells and Toxins

Phytoplankton counts
> 50,000 cells/ml

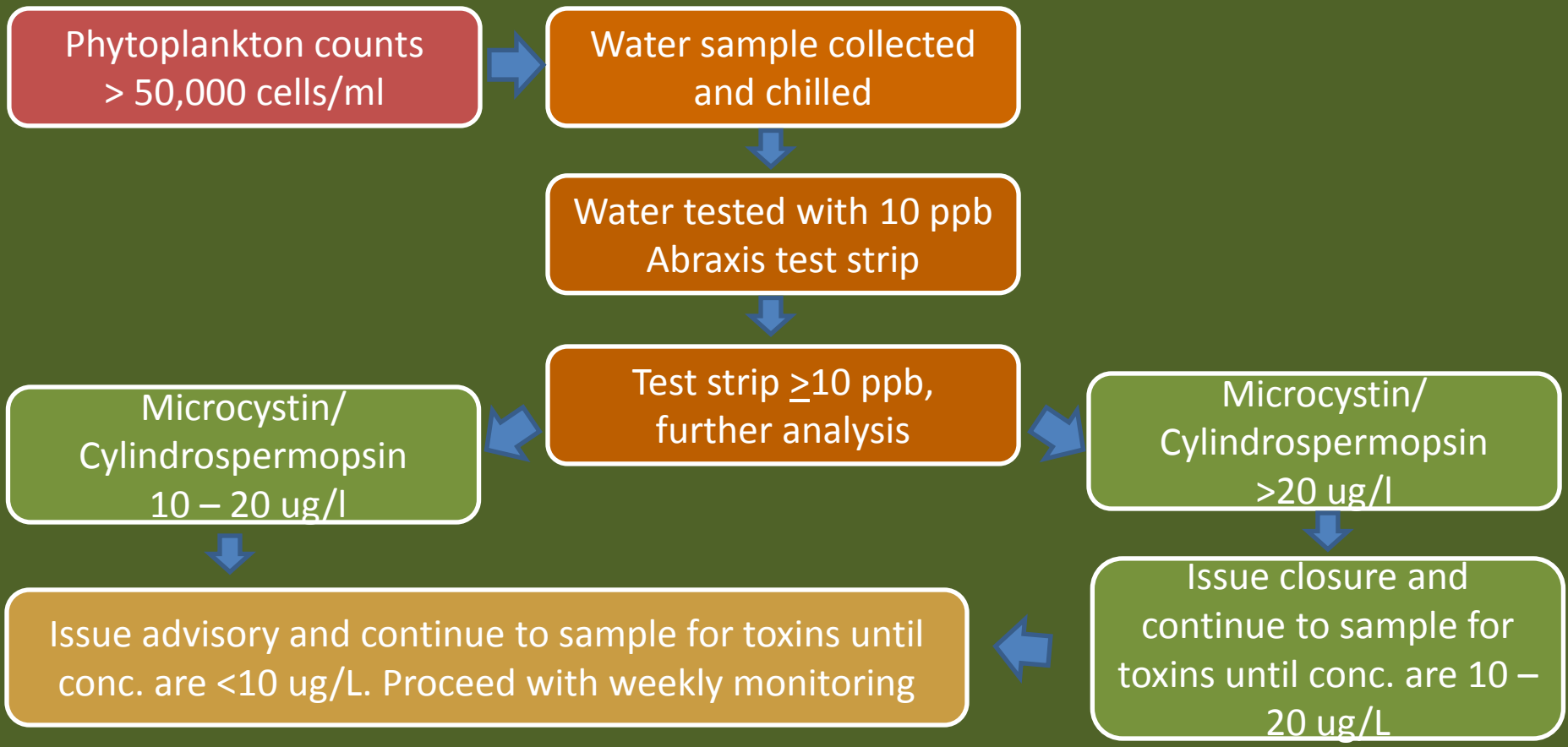
Draft Monitoring Plan for Priority Lakes: Cells and Toxins



Draft Monitoring Plan for Priority Lakes: Cells and Toxins



Draft Monitoring Plan for Priority Lakes: Cells and Toxins

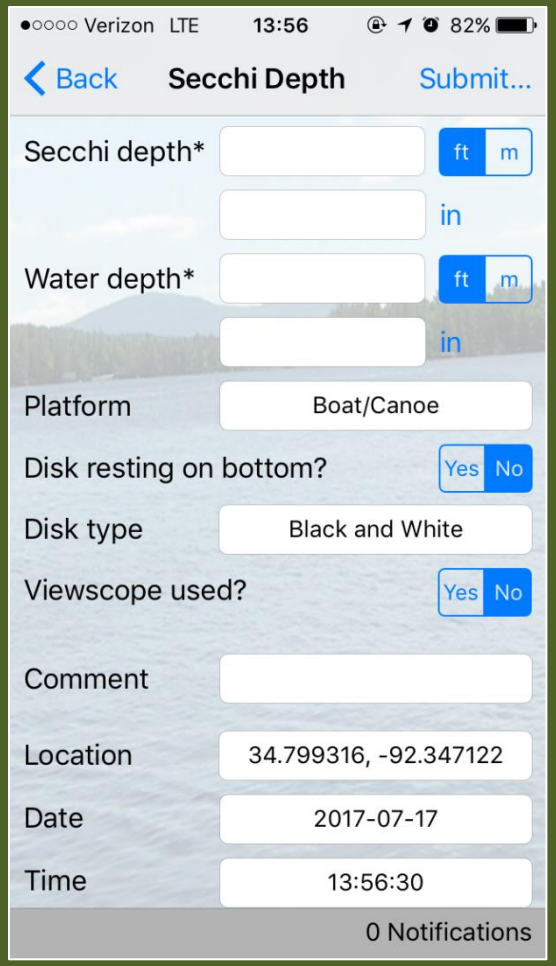


Future Endeavors

- Working together with partners to develop a volunteer, citizen-science, water-quality monitoring pilot project in a local reservoir in central Arkansas.
- You can get a lot done with crowd-sourcing.
- Hopes are to develop a statewide volunteer lake & reservoir water-quality monitoring program.
- Volunteer monitoring guidance document in the works.

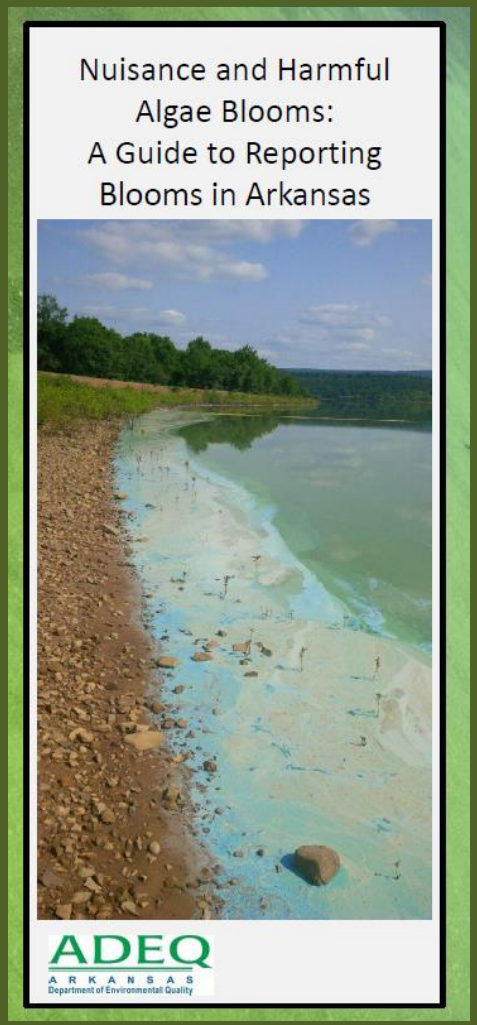
Reporting Tool: *Lake Observer* app

https://www.lakeobserver.org/



Reporting Platforms and Communications

https://www.adeq.state.ar.us/complaints/forms/nuisance_algae_complaint.aspx



Online Harmful Algae Bloom Complaint Reporting Form

** Asterisk indicates item is mandatory; all others are optional*

Owner/Location Information

Instructions

Property Owner (if known):

*** County (if known):** Select County (or Unknown)

*** Location/Driving Directions:**
Provide the exact address, including street, city, and zip and/or location/driving directions.

Description of Problem

Instructions

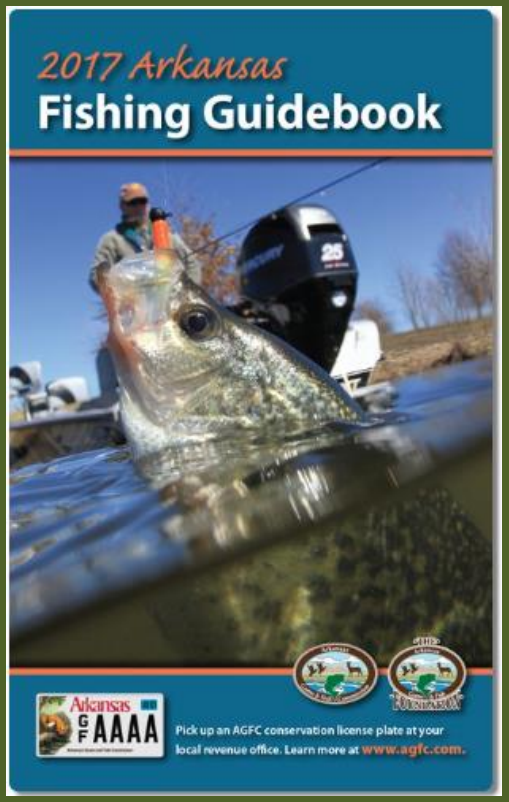
Public Access: Yes / No

*** Size of Bloom:** Select Size (or Unknown) | Unknown | Larger than a football field | Between a football field and a compact car | Less than a compact car

***Description of Problem (in Detail)**

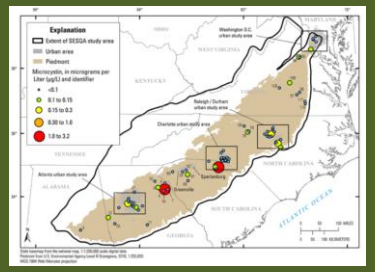
Attach Photos:
Up to six .jpg, .gif, .jpeg, or .tif photos. Photos must be 10 MB or under per file.

Browse... Browse... Browse...



New Developments

- 2016 -- *Spatial and temporal variation in microcystin occurrence in wadeable streams in the southeastern United States*
  http://www.sciencedirect.com/science/article/pii/S0043135417306462



- 2017 -- *Benthic cyanobacteria: A source of cylindrospermopsin and microcystin in Australian drinking water reservoirs*
  http://onlinelibrary.wiley.com/doi/10.1002/etc.3391/full