# Cyanobacteria and Citizens in the Eel River

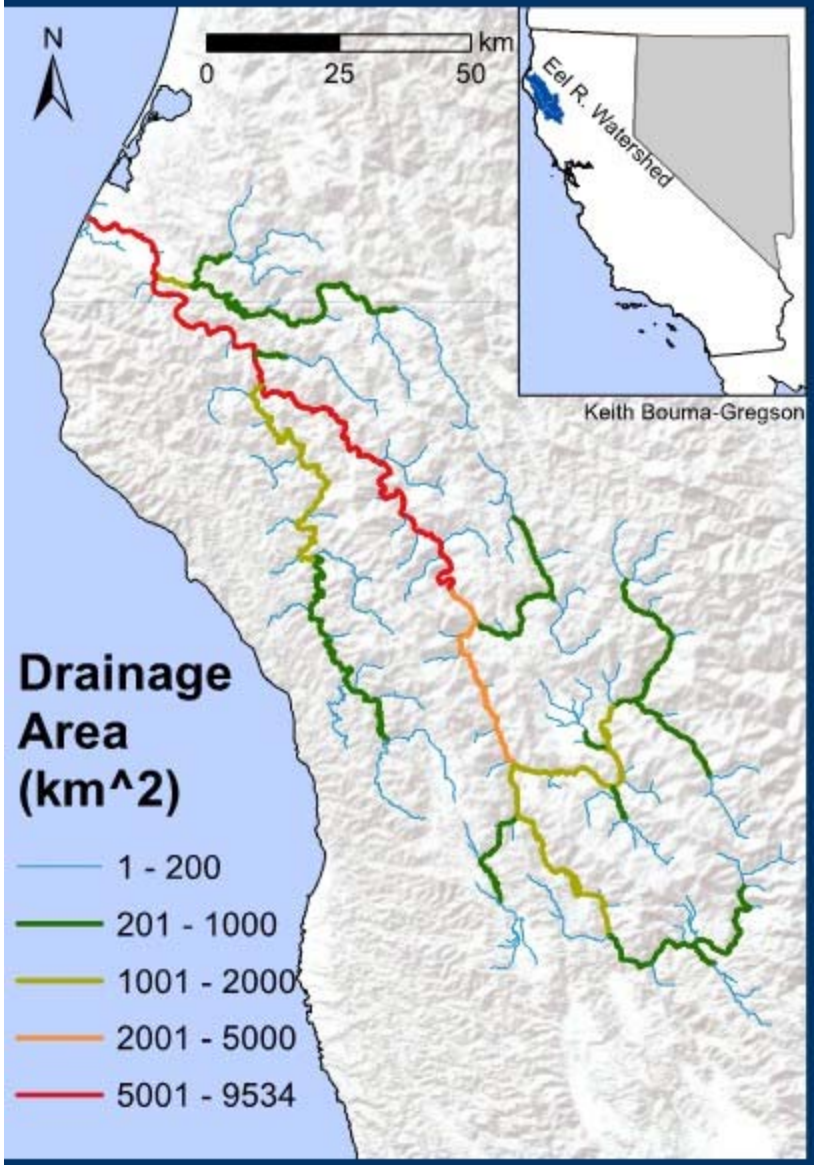
For assistance in accessing this document please send an email to EPACyanoHABs@epa.gov

Keith Bouma-Gregson[1], Raphael Kudela[2], and Mary Power[1]

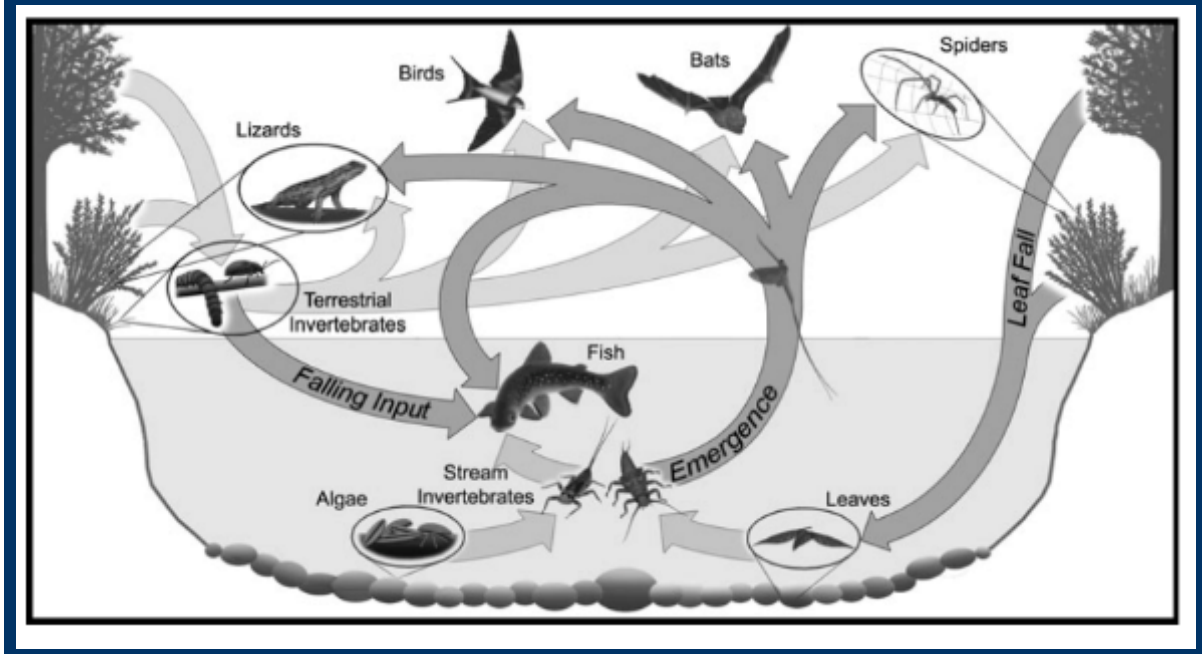
[1]UC Berkeley, [2]UC Santa Cruz

EPA Region 9 HABs | April 26, 2017

# The Eel River




# Algae fuels aquatic summer food webs




Baxter et al. 2005, *FW Bio.*


Power et al. 2009, *FW Bio.*

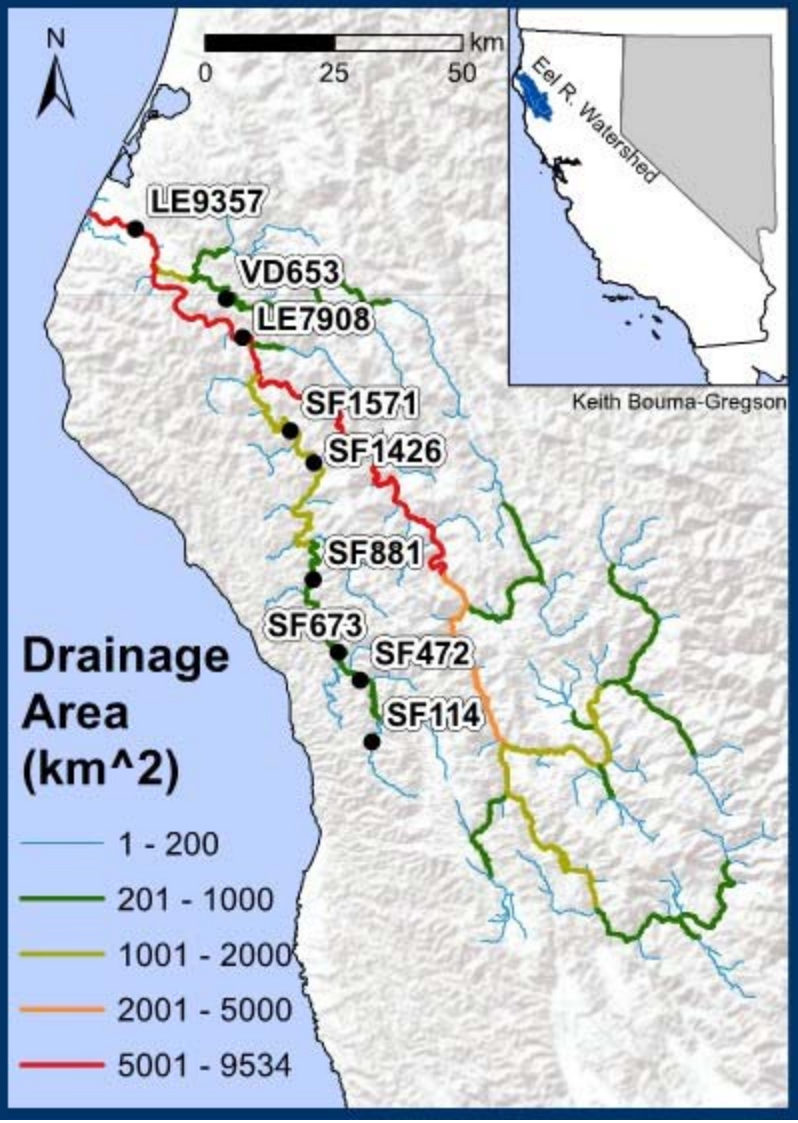
# Algae kill dogs in the Eel river

Puschner et al. 2008, *J. Vet. Diag. Invest.*
Power, Bouma-Gregson, et al. 2015, *Copeia*

# What is the temporal and spatial distribution of cyanobacteria in the Eel River?

Monitoring sites:

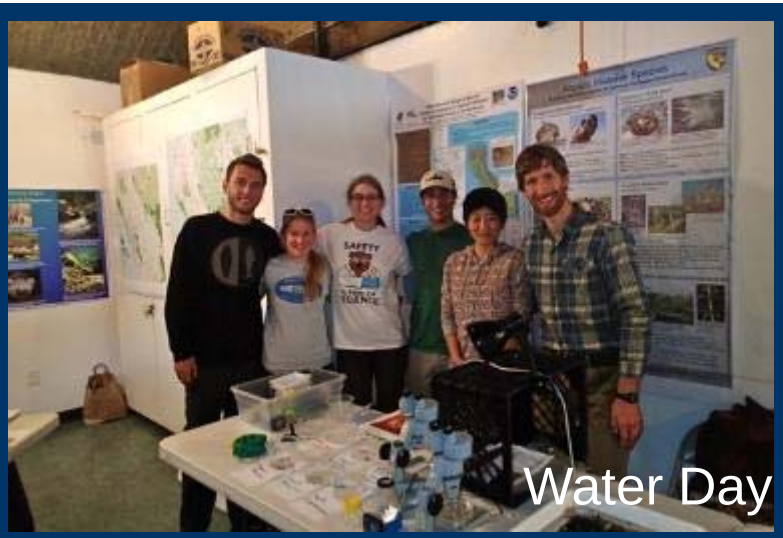
- Visited weekly June – Sep. 2013 and 2014
- Collected algal samples
- Measured cyanotoxin concentrations (SPATT)



# Eel River Recovery Project

www.eelriverrecovery.org

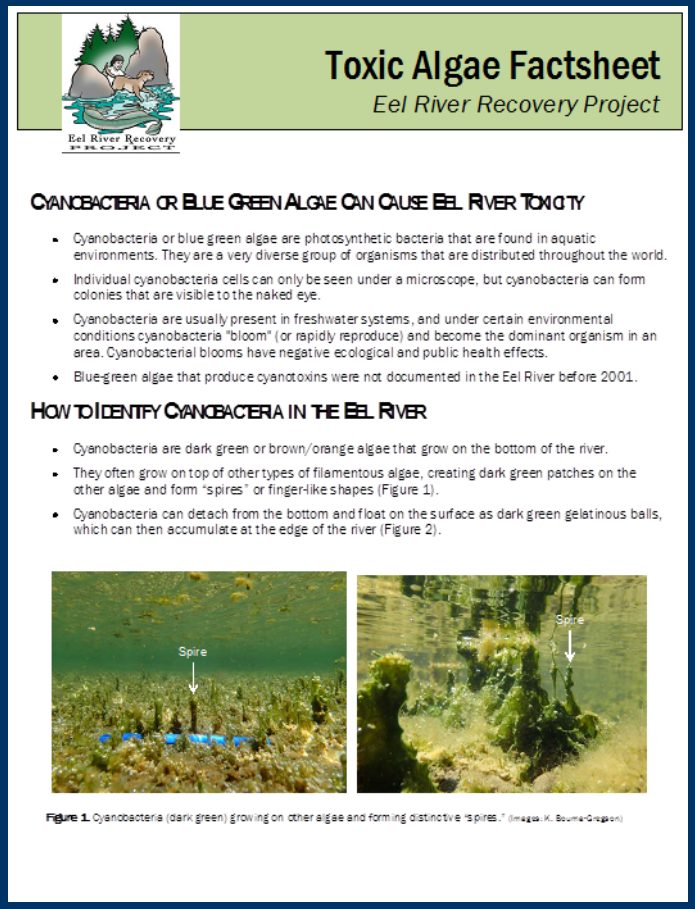

Data Collection


Water Day


Streamside Workshops


Algal Foray 2013 & 2015

# Eel River Recovery Project



## Toxic Algae Factsheet

*Eel River Recovery Project*

### Cyanobacteria or Blue Green Algae Can Cause Eel River Toxicity

- Cyanobacteria or blue green algae are photosynthetic bacteria that are found in aquatic environments. They are a very diverse group of organisms that are distributed throughout the world.
- Individual cyanobacteria cells can only be seen under a microscope, but cyanobacteria can form colonies that are visible to the naked eye.
- Cyanobacteria are usually present in freshwater systems, and under certain environmental conditions cyanobacteria "bloom" (or rapidly reproduce) and become the dominant organism in an area. Cyanobacterial blooms have negative ecological and public health effects.
- Blue-green algae that produce cyanotoxins were not documented in the Eel River before 2001.

### How to Identify Cyanobacteria in the Eel River

- Cyanobacteria are dark green or brown/orange algae that grow on the bottom of the river.
- They often grow on top of other types of filamentous algae, creating dark green patches on the other algae and form "spires" or finger-like shapes (Figure 1).
- Cyanobacteria can detach from the bottom and float on the surface as dark green gelatinous balls, which can then accumulate at the edge of the river (Figure 2).



**Figure 1.** Cyanobacteria (dark green) growing on other algae and forming distinctive "spires." (Image: K. Bouma-Gregson)

2015 and 2016 cyano. monitoring by ERRP and Round Valley Tribes

http://www.eelriverrecovery.org/algae.html

# Cyanobacteria in the Eel

Benthic mats,
not
planktonic soups

**Toxic algae found in Eel River in Mendocino County**



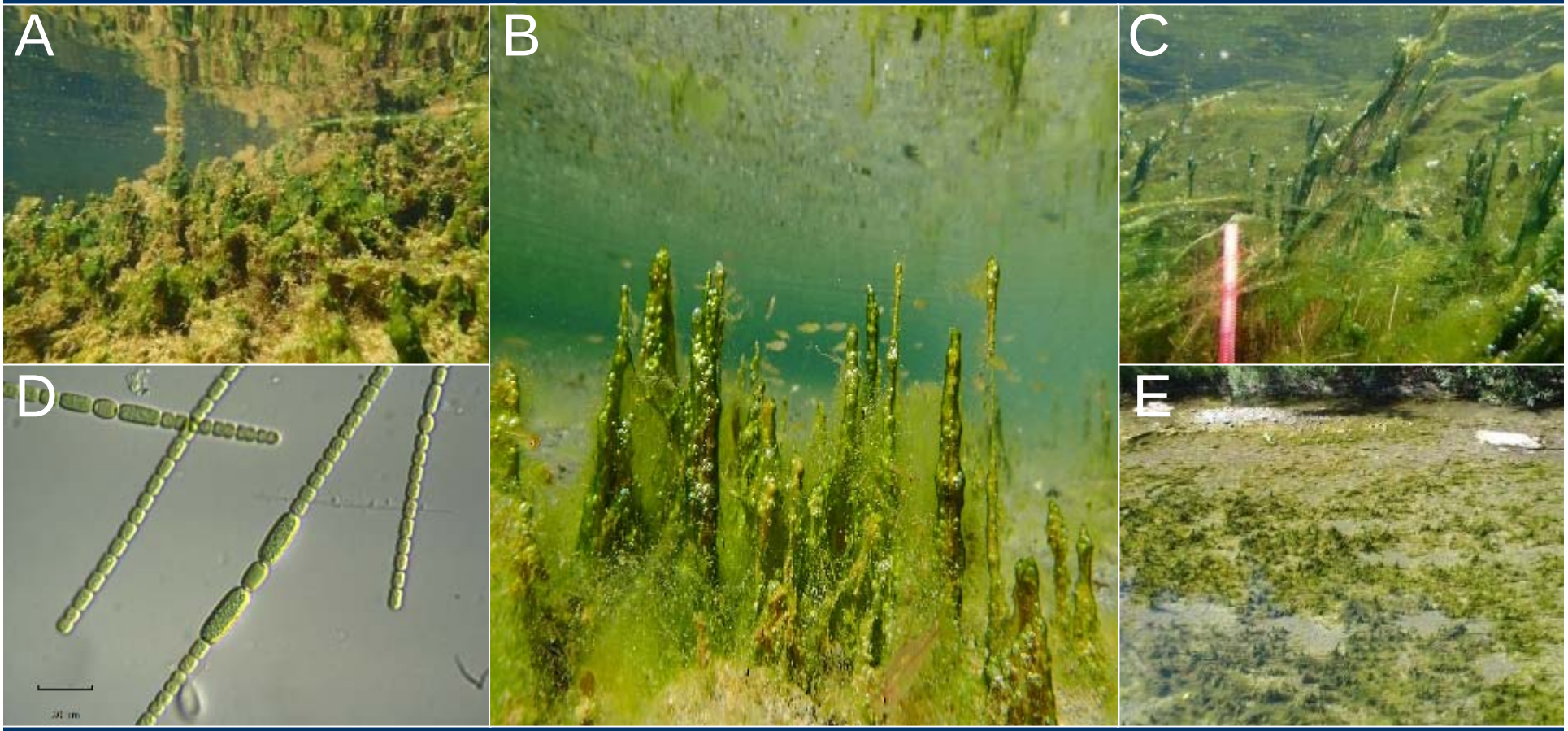
Toxic Blue-Green Algae, pictured here, has been found in the Eel River. At least one dog has reportedly died after swimming in the river and ingesting the cyanobacteria. Contributed

*By Ukiah Daily Journal staff*

0 COMMENTS

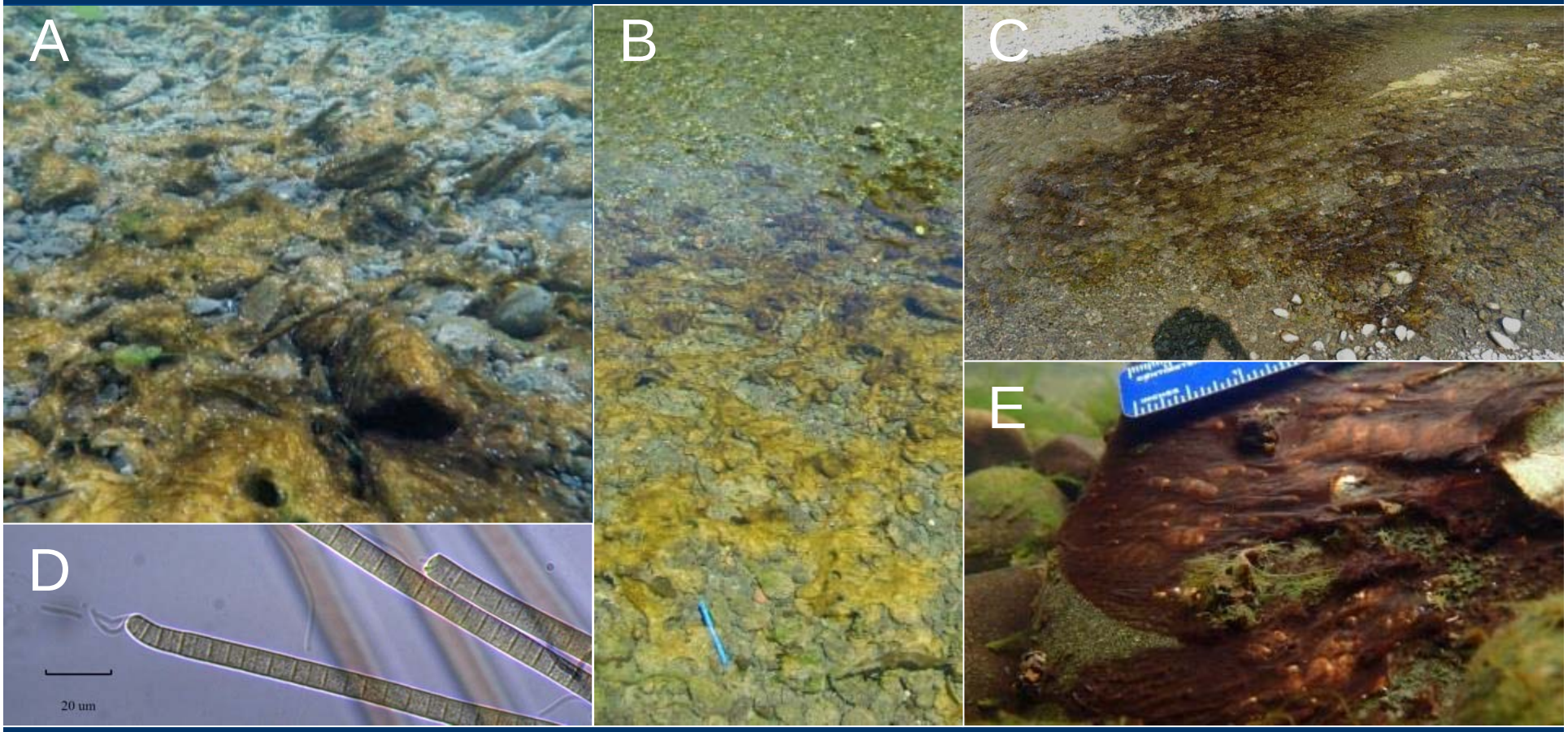
# Observed common cyano. taxa

*Anabaena* spp.: slow water, fragile, on algae



# Observed common cyano. taxa

*Phormidium* spp.: fast water, robust, on rocks



# Floating Cyanobacteria

# SPATT Samplers

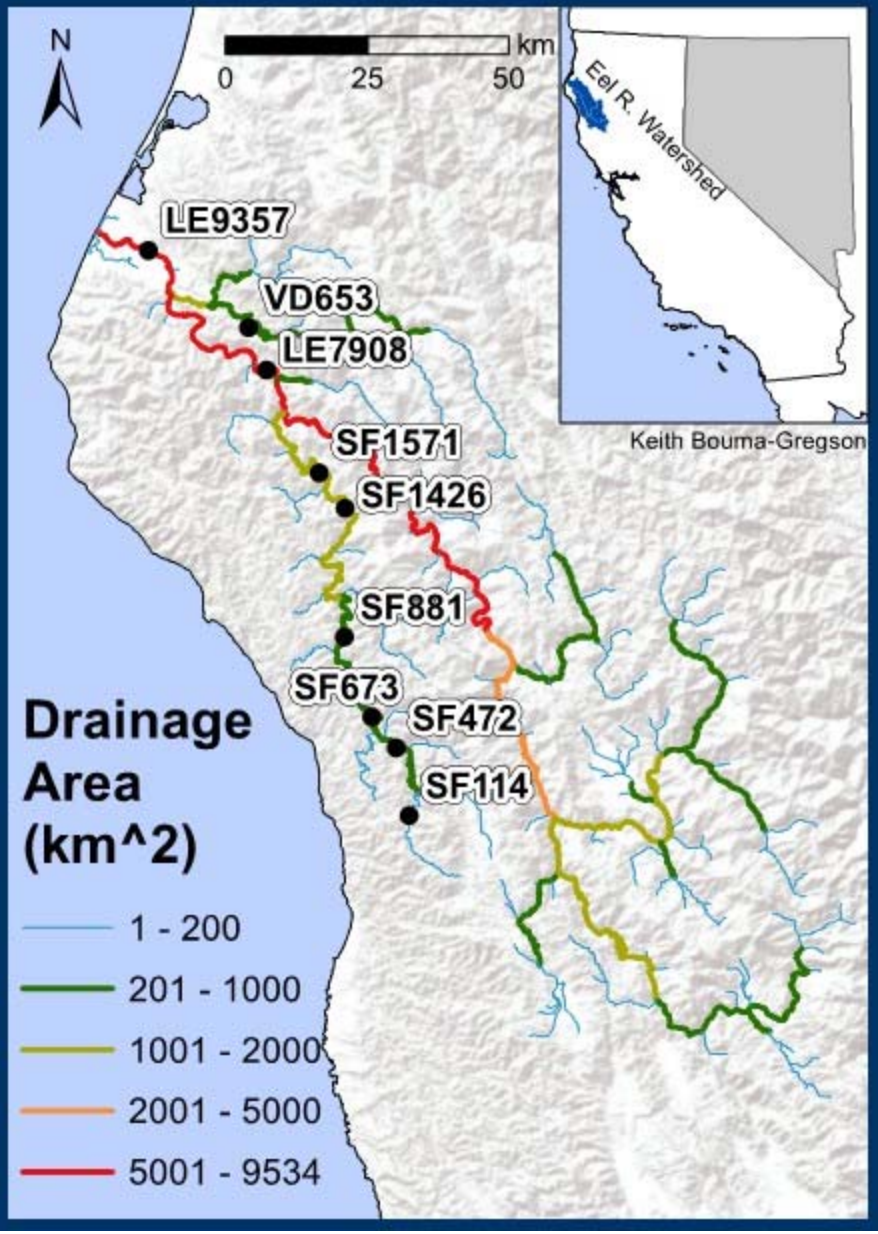
## Solid Phase Adsorption Toxin Tracking (SPATT)

Dr. Raphael Kudela UCSC, oceandatacenter.ucsc.edu

Lane et al. 2010, *Limnology and Oceanography: Methods* Kudela 2011, *Harmful Algae*

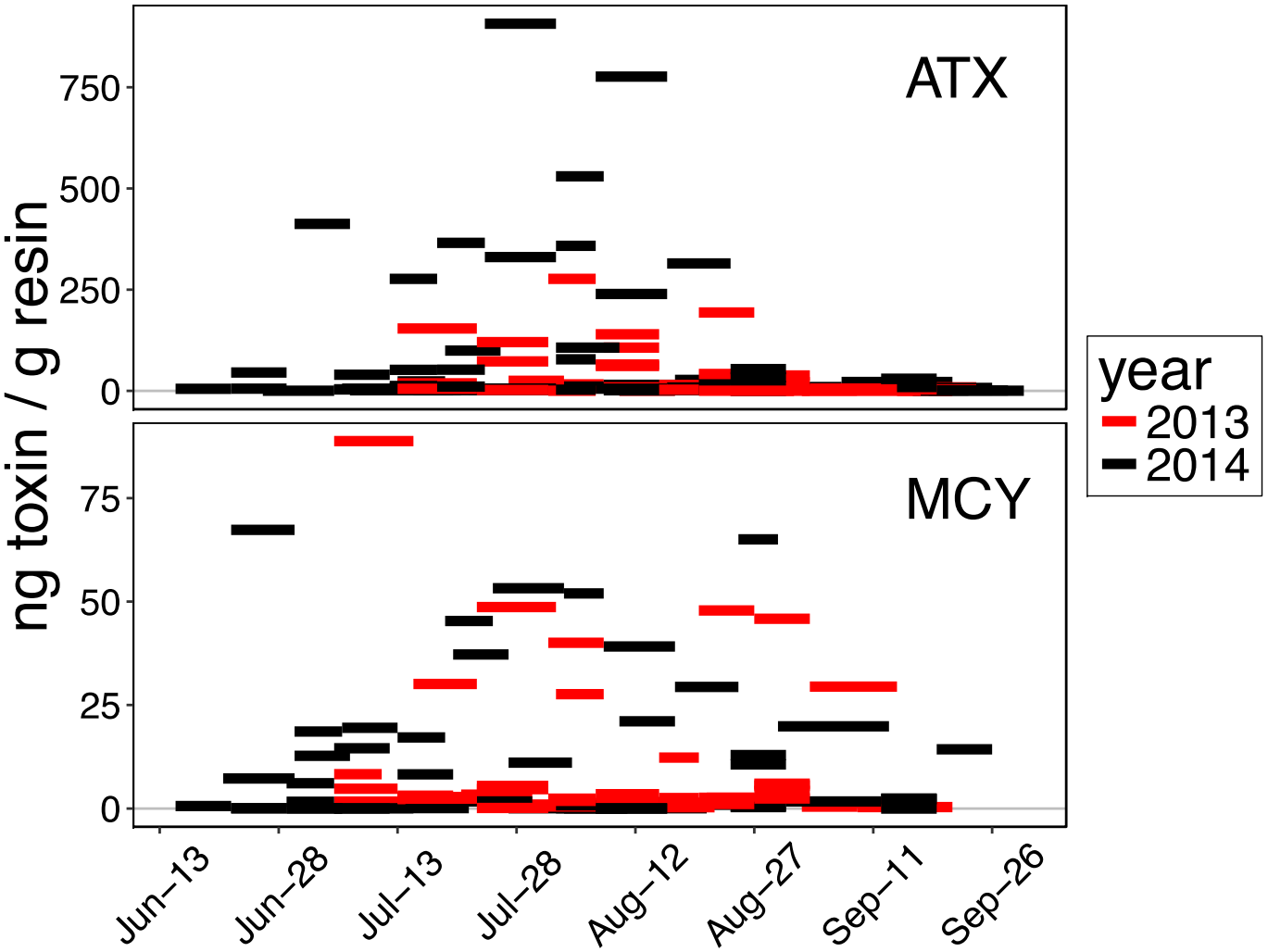
- Time integrative
- Multiple toxins detected (anatoxin-a and microcystins)
- Low limit of detection
- Easy to deploy and analyze
- HP20 DIAION resin not expensive
- Difficult to compare to regulatory limits

# SPATT Samplers

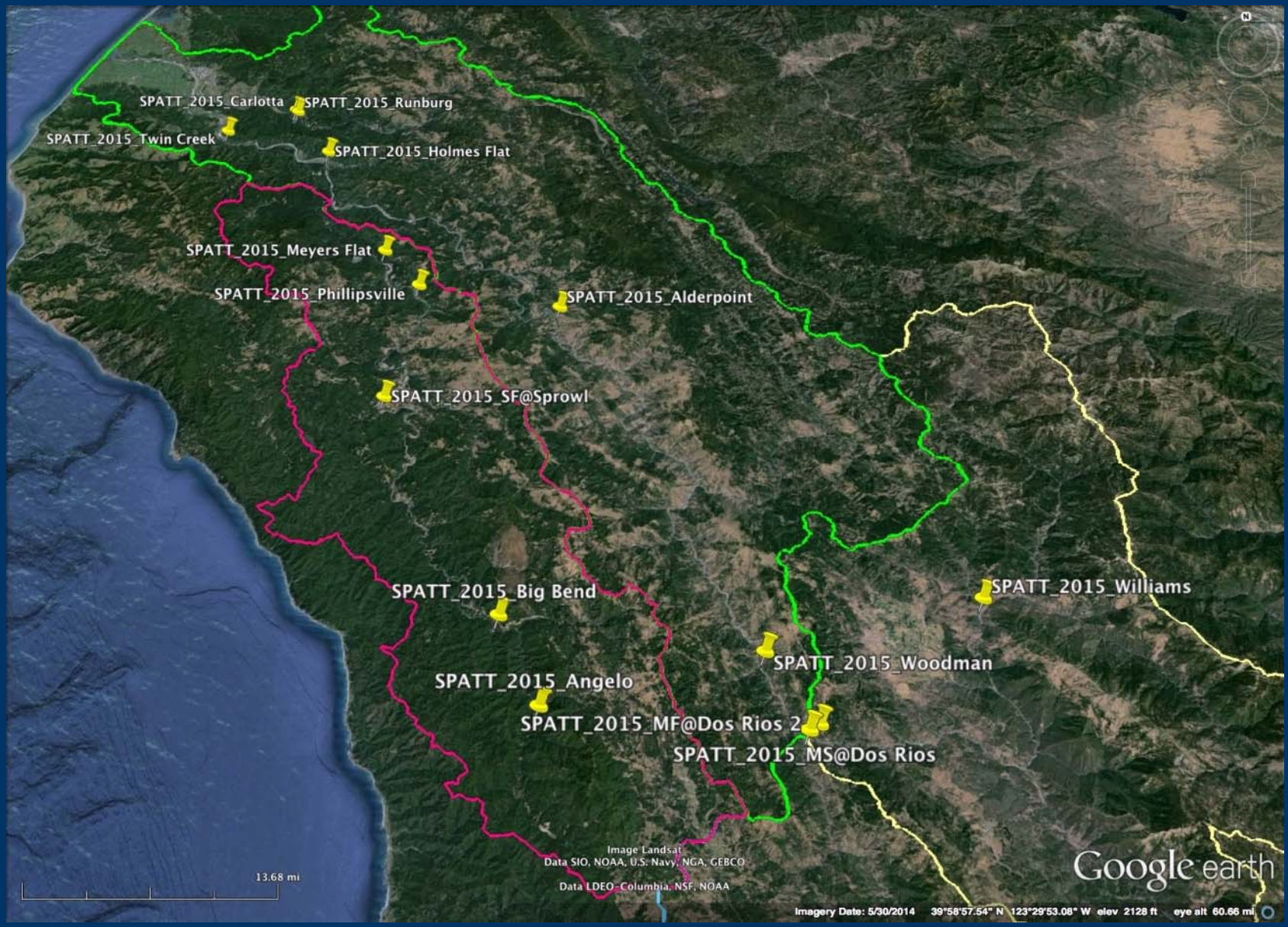


# SPATT Results

## Higher anatoxin-a (ATX) levels than microcystin (MCY)



# SPATT 2015 Map

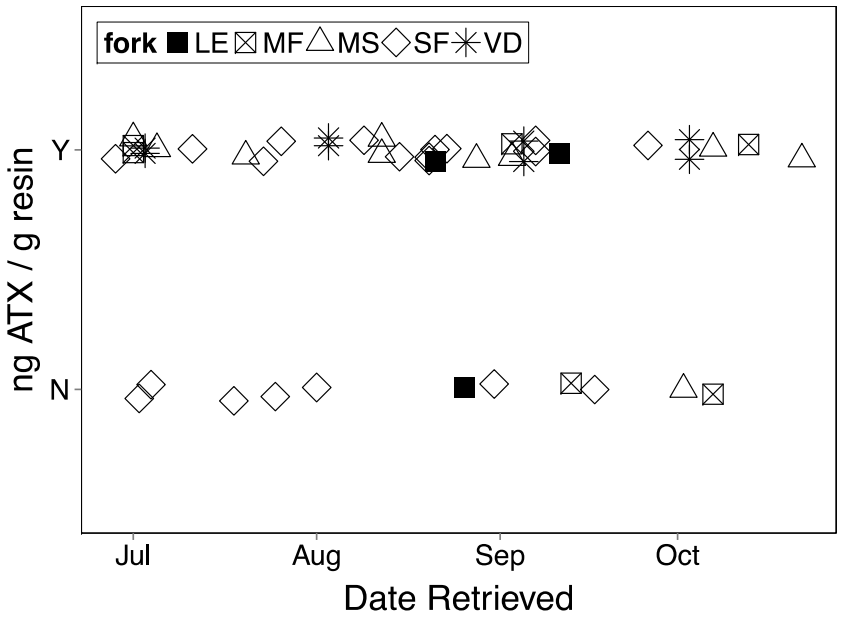


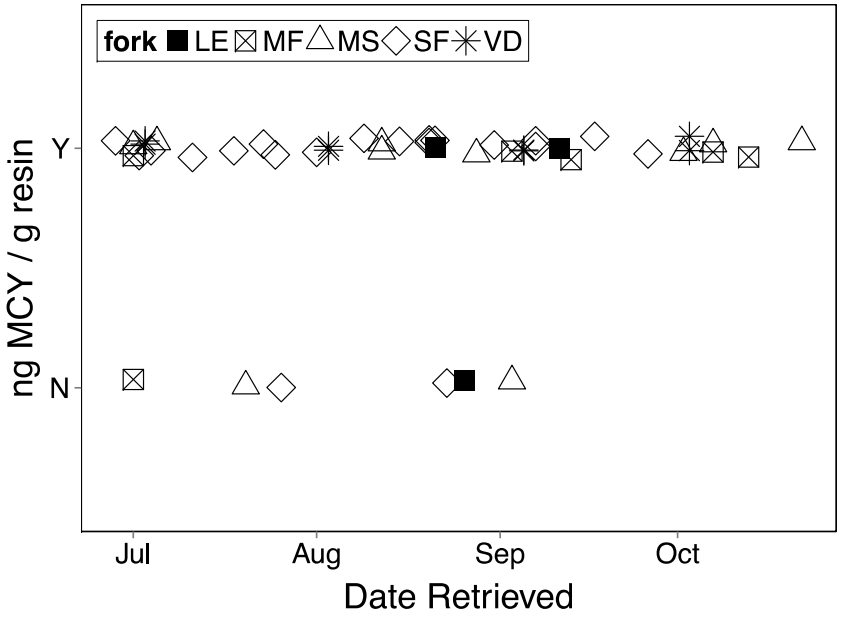
# SPATT 2015: Presence/Absence

N= 47

ATX: 77% positive

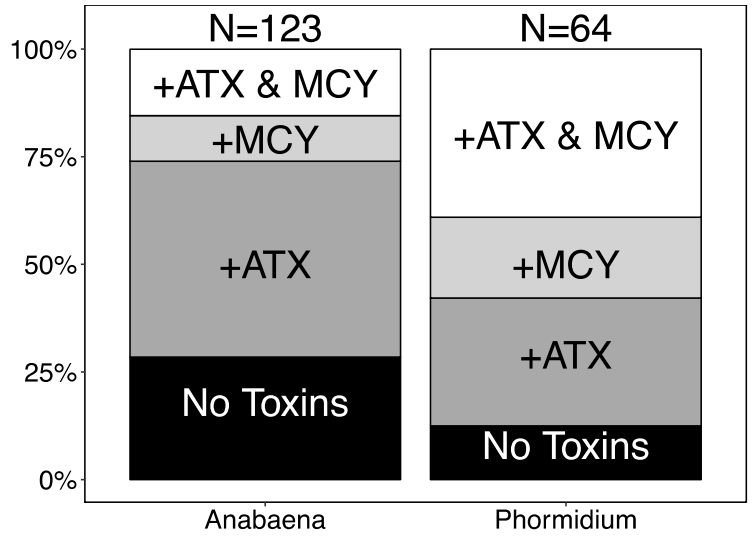
MCY: 87% positive

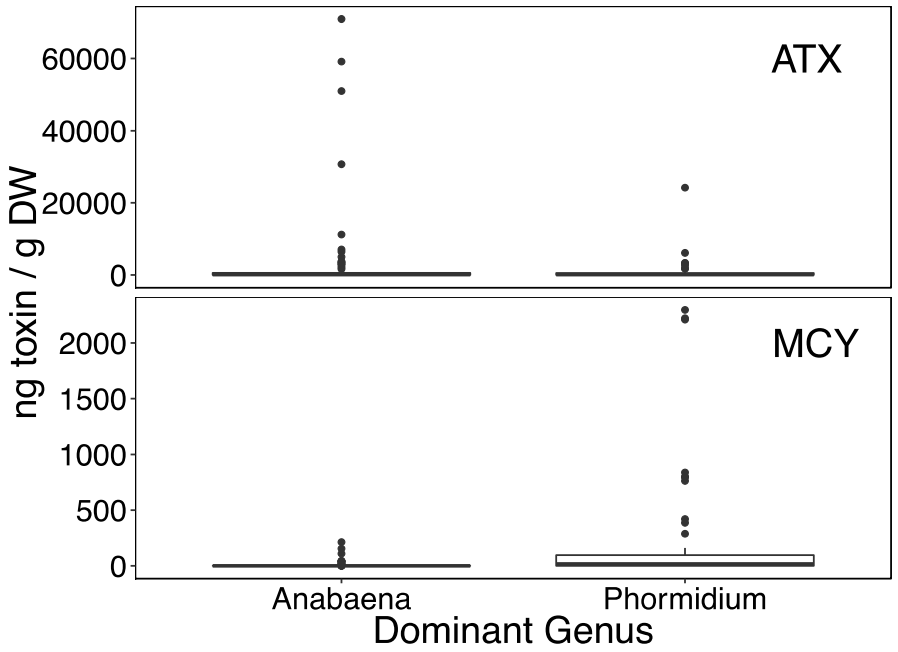


# Cyano. Mat Cyanotoxins

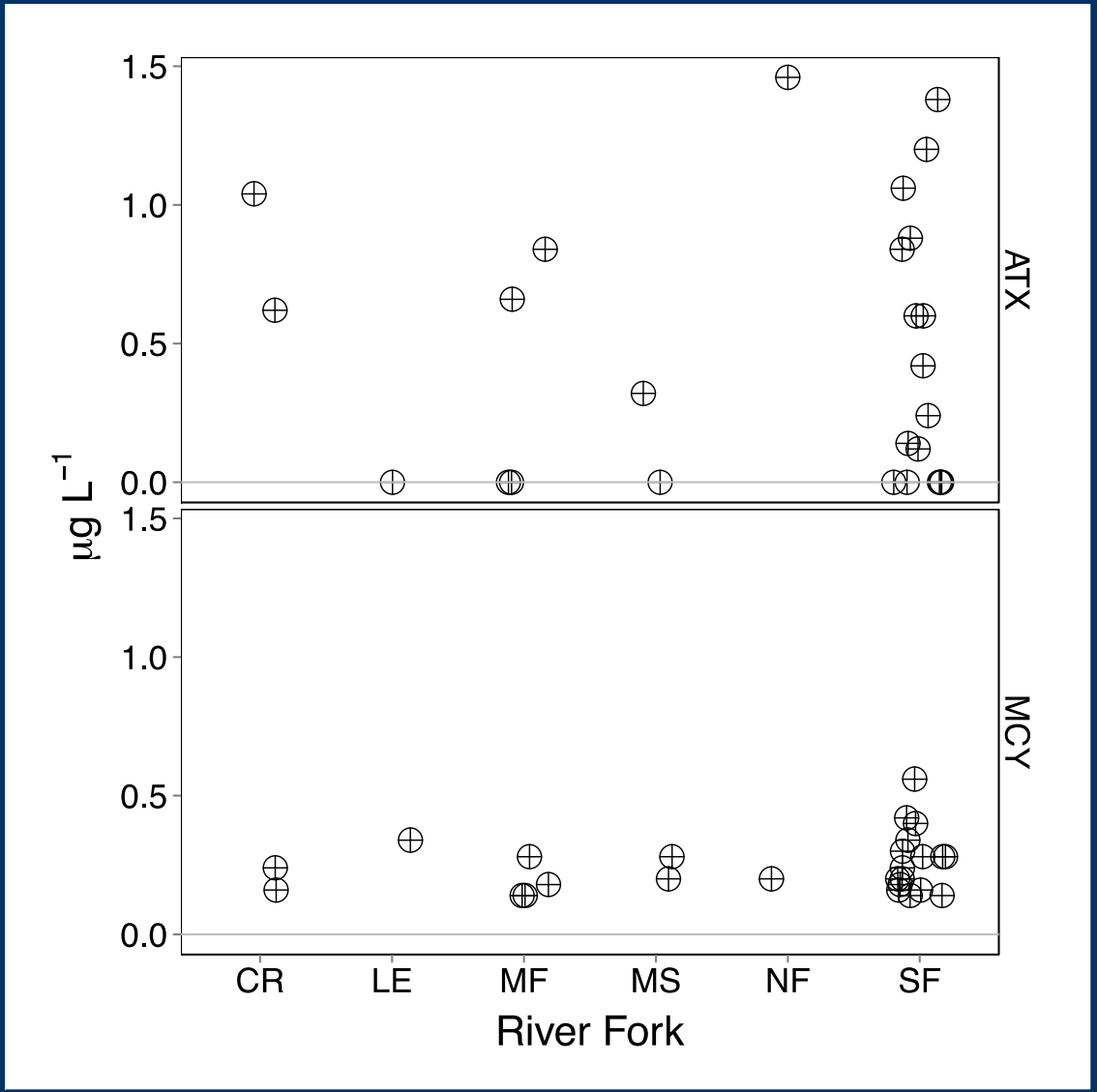
Higher ATX concentrations than MCY concentrations
More frequent ATX detections



# 2015 $H_2O$ Samples

## Unfiltered $H_2O$ samples



# Lessons Learned: Monitoring

- Main public safety threat is ingestion of actual cells, rather than river water.
- Anatoxin-a more of a threat than microcystins.
- SPATT sampling can be conducted by citizen groups.
- Different regulatory metrics and sampling methods for rivers & streams with benthic cyanobacteria, versus lakes and open water with planktonic cyanobacteria.

# Acknowledgements


## Funding:

EPA STAR Fellowship

NSF Eel River Critical Zone Observatory

UC Mathias Graduate Research Grant

NorCal SETAC Summer Student Grant


## People:

Dr. ME Power, Dr. RM Kudela, Dr. JC Finlay, K Hayashi, and Eel River Recovery Project Volunteers

Lab Members: Hiromi Uno, Phil Georgakakos, Gina Hervey, Caroline Ribet, Jeanine Porzio, Ari Nuri, Aditi Narawayan, Natalie Soto, Wes Cooperman, and Anika Bratt

# Questions?

Keith Bouma-Gregson

kbg@berkeley.edu