Anderson Lake: Very Fast Death Factor

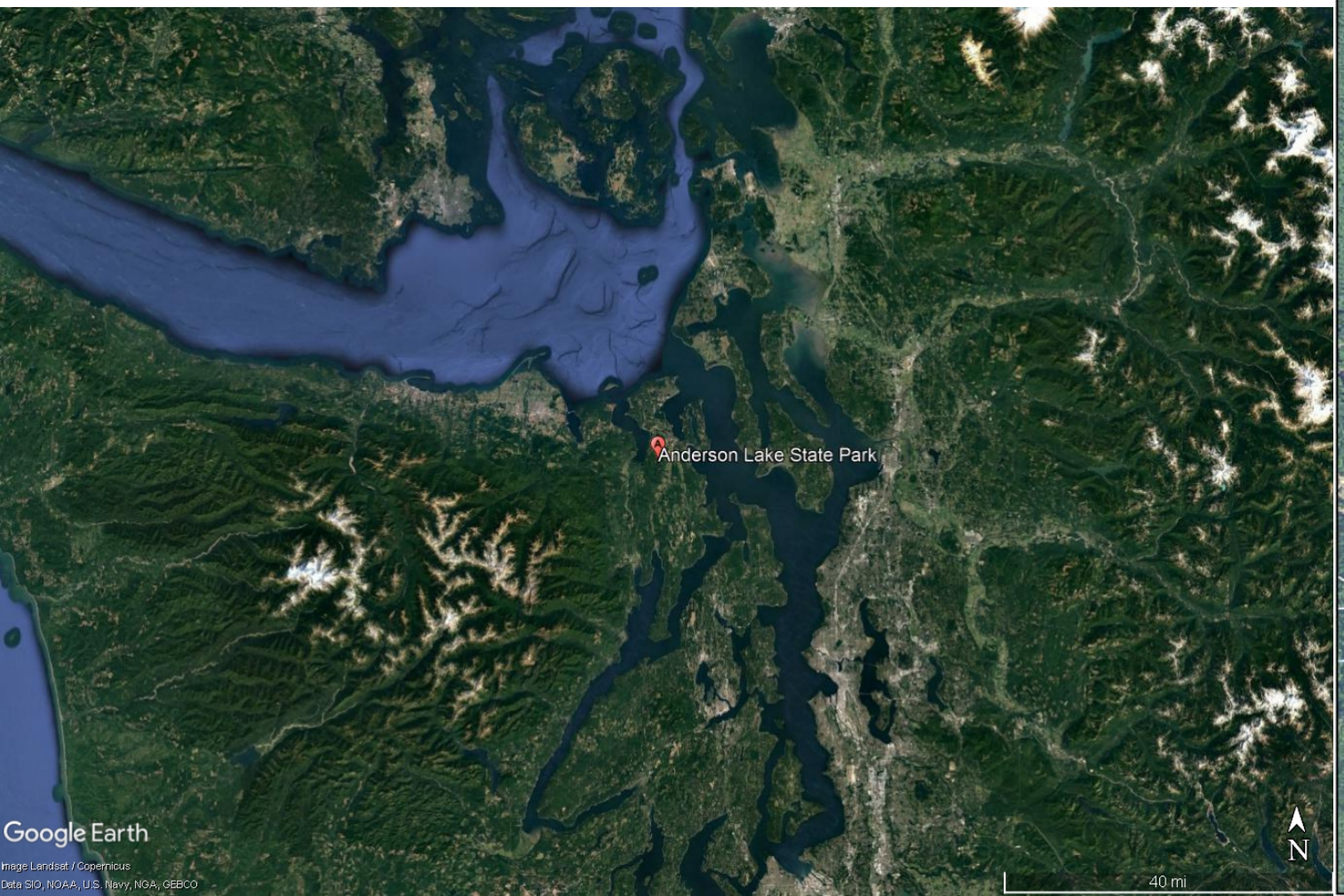
May 2019

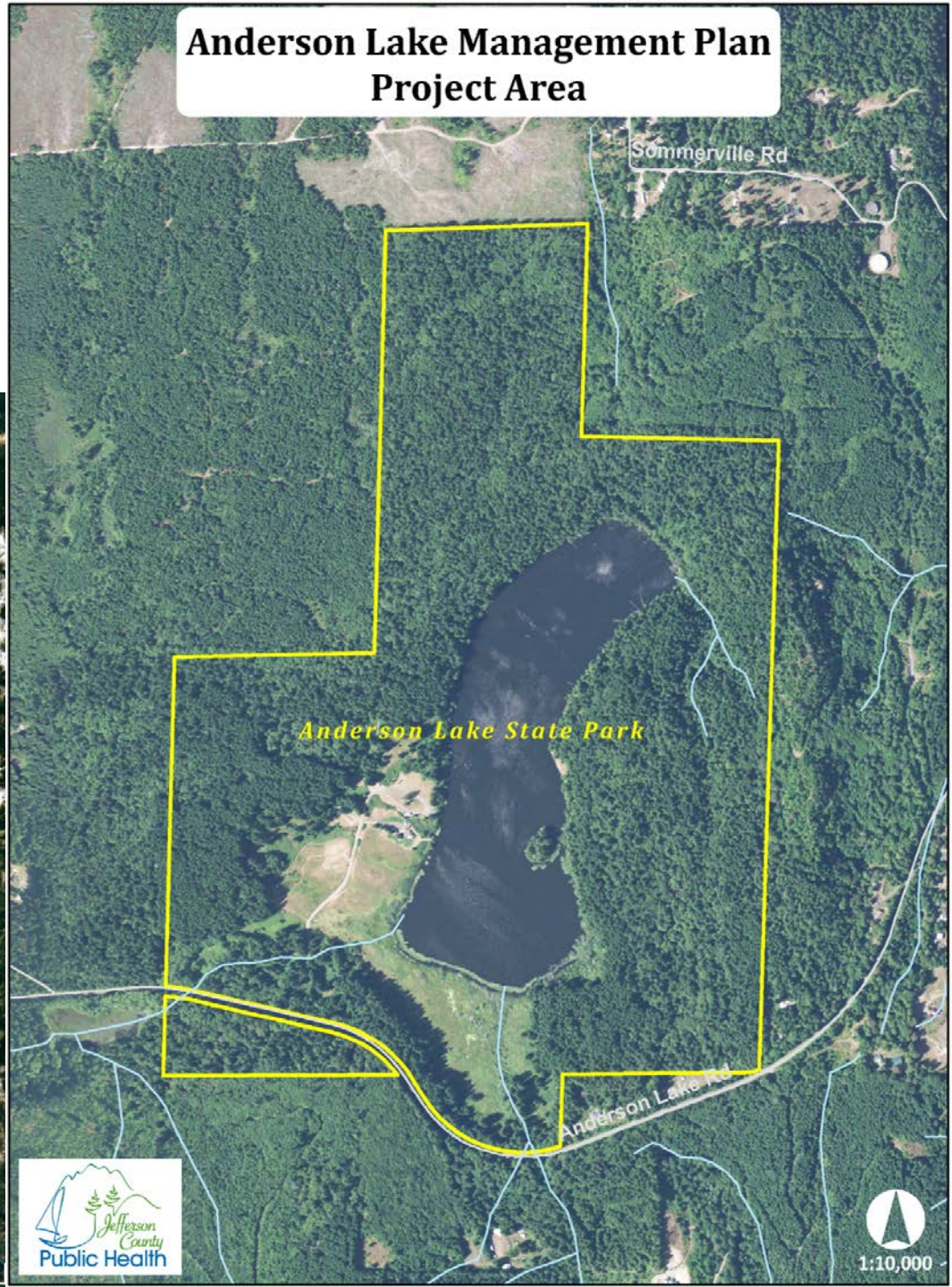
Tim Weissman

Environmental Health Specialist

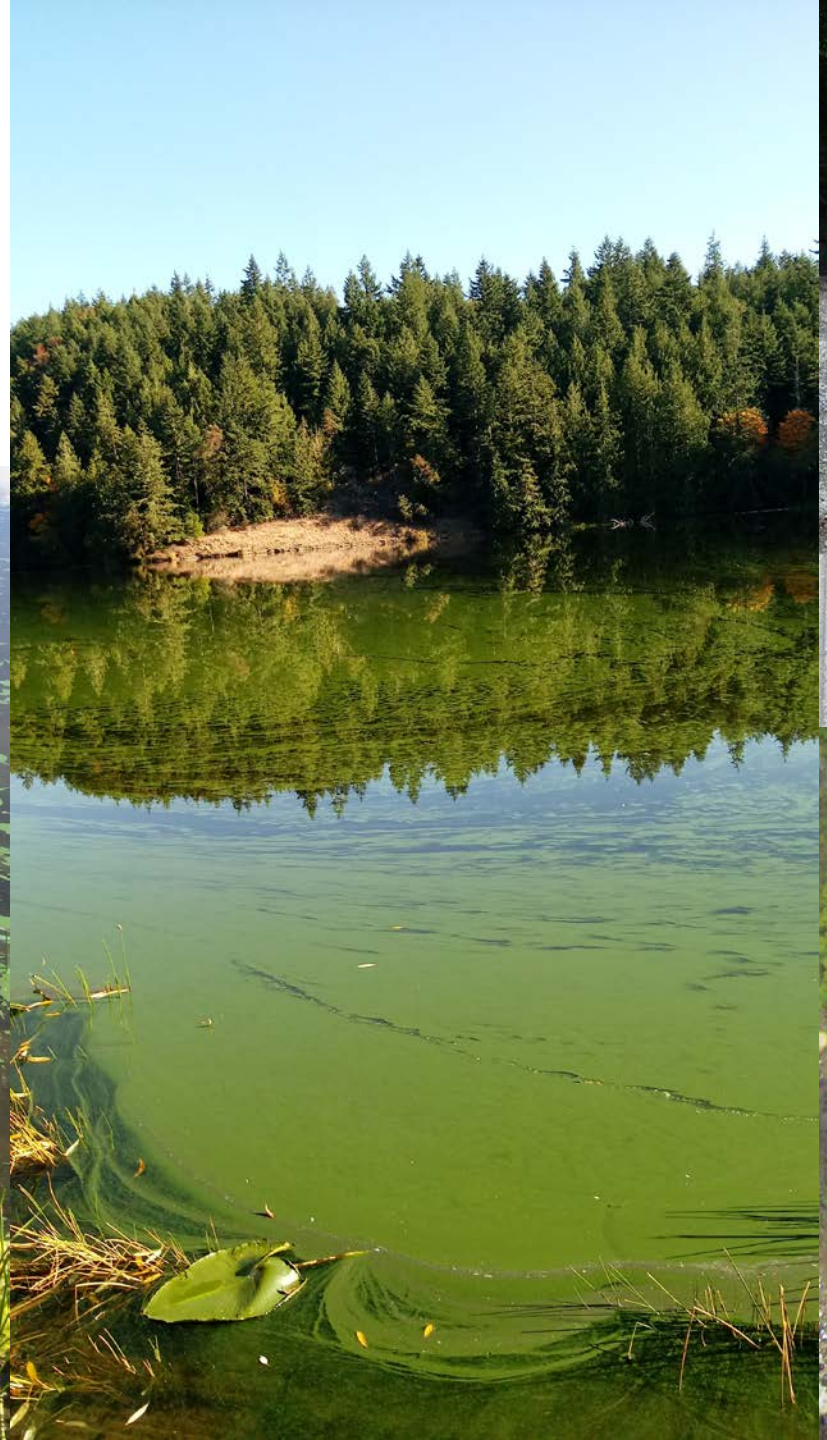
Jefferson County Public Health

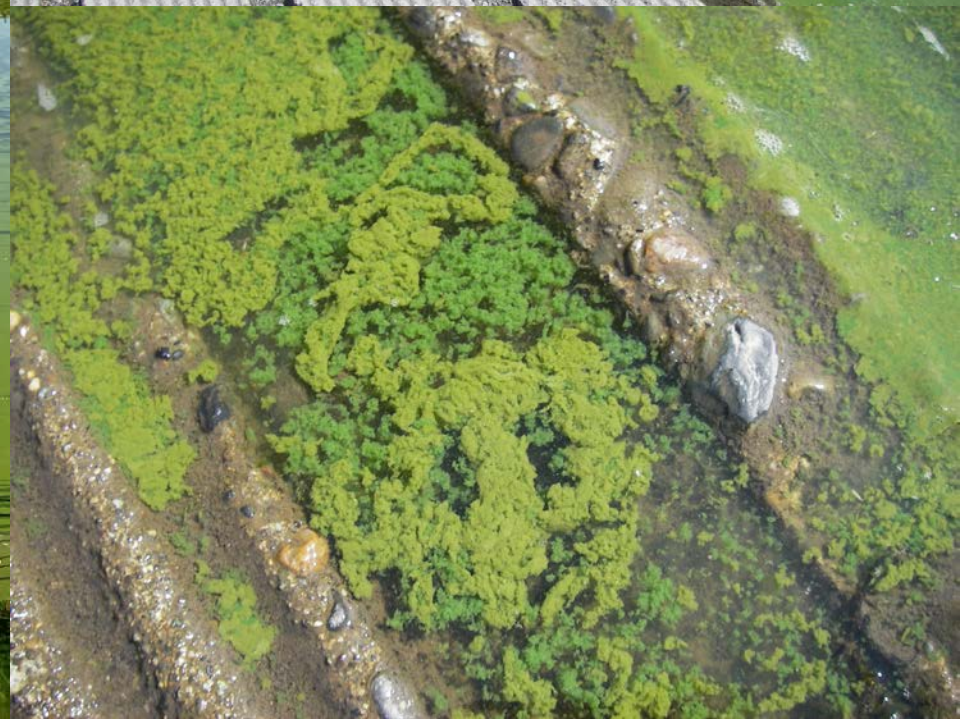
Anderson Lake





What’s the big deal?





Cyanobacteria Blooms

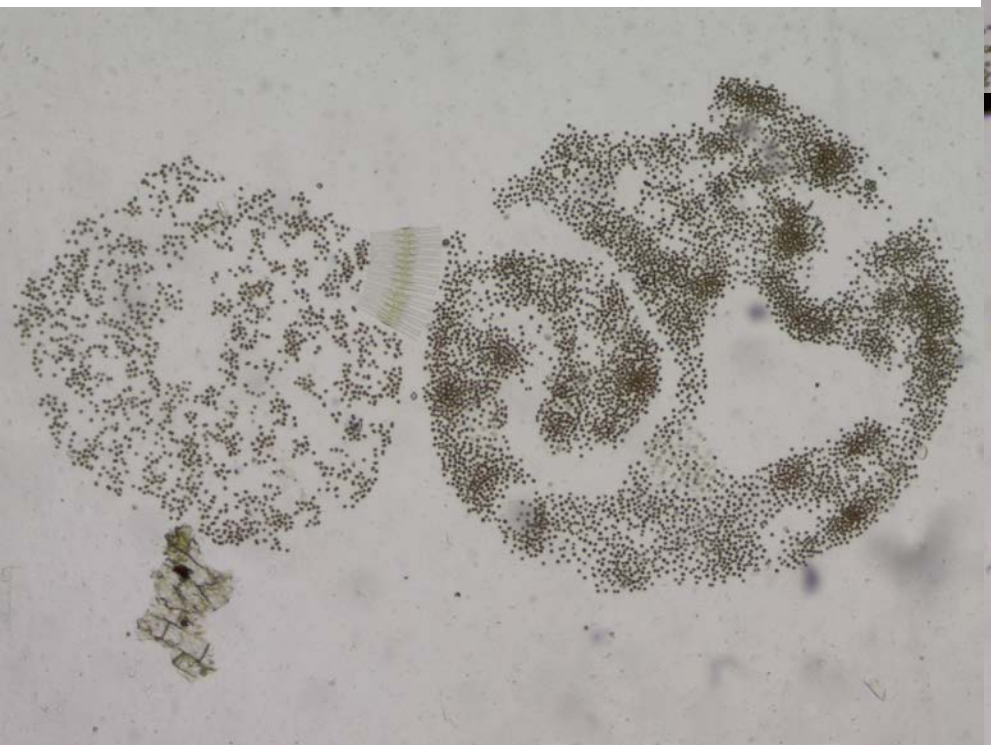
- Naturally occurring
- Can be toxic, but not always
- We aren’t very good at predicting toxicity or blooms, in general
- Toxicity can’t be determined visually
- Sunlight, warmth, and nutrient levels all play a role in bloom prevalence

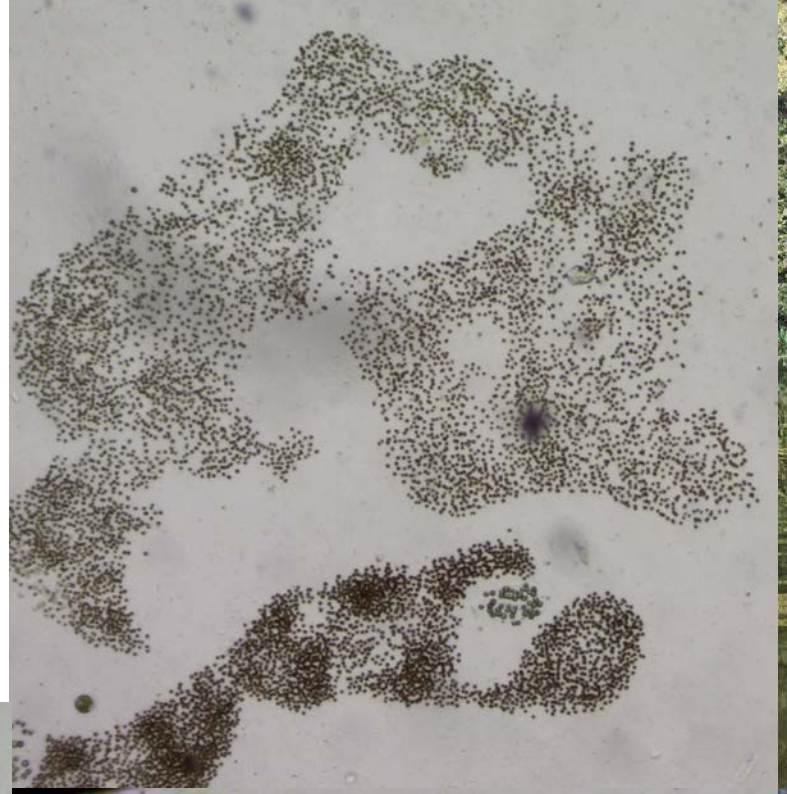
2006 – Beginning of JCPH Lake Program

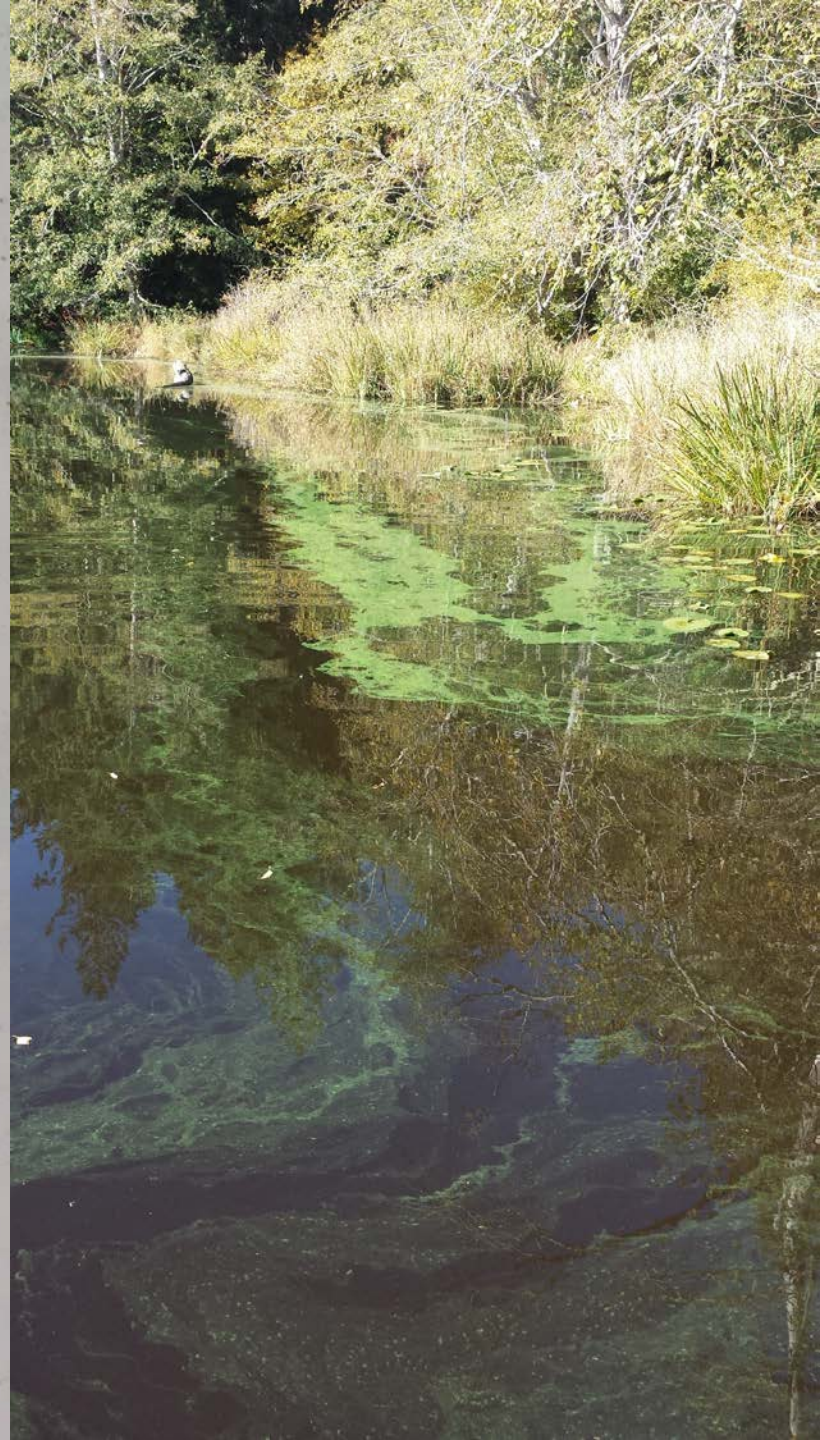
- 2 dogs died after drinking water from Anderson Lake and a 3rd went into a coma
  - Symptoms were apparent within minutes after ingesting the water
  - Death occurred within the hour
  - The surviving dog ended up in a coma and was put on life support
- Anatoxin-a was found to be present at concentrations of 20 µg/L

- To avoid future problems, our lakes program was developed to regularly monitor heavily recreated lakes April through October

Microcystis

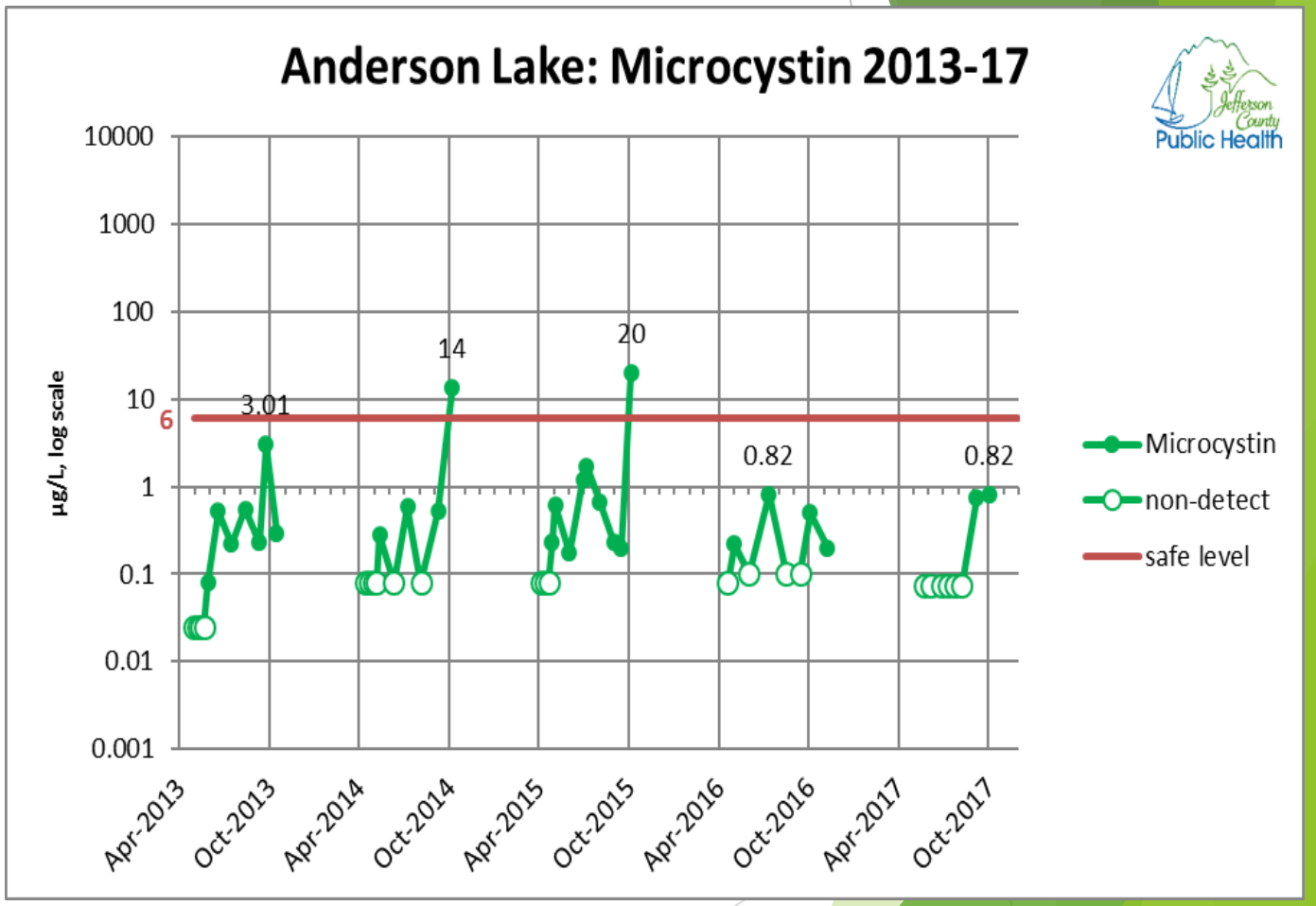






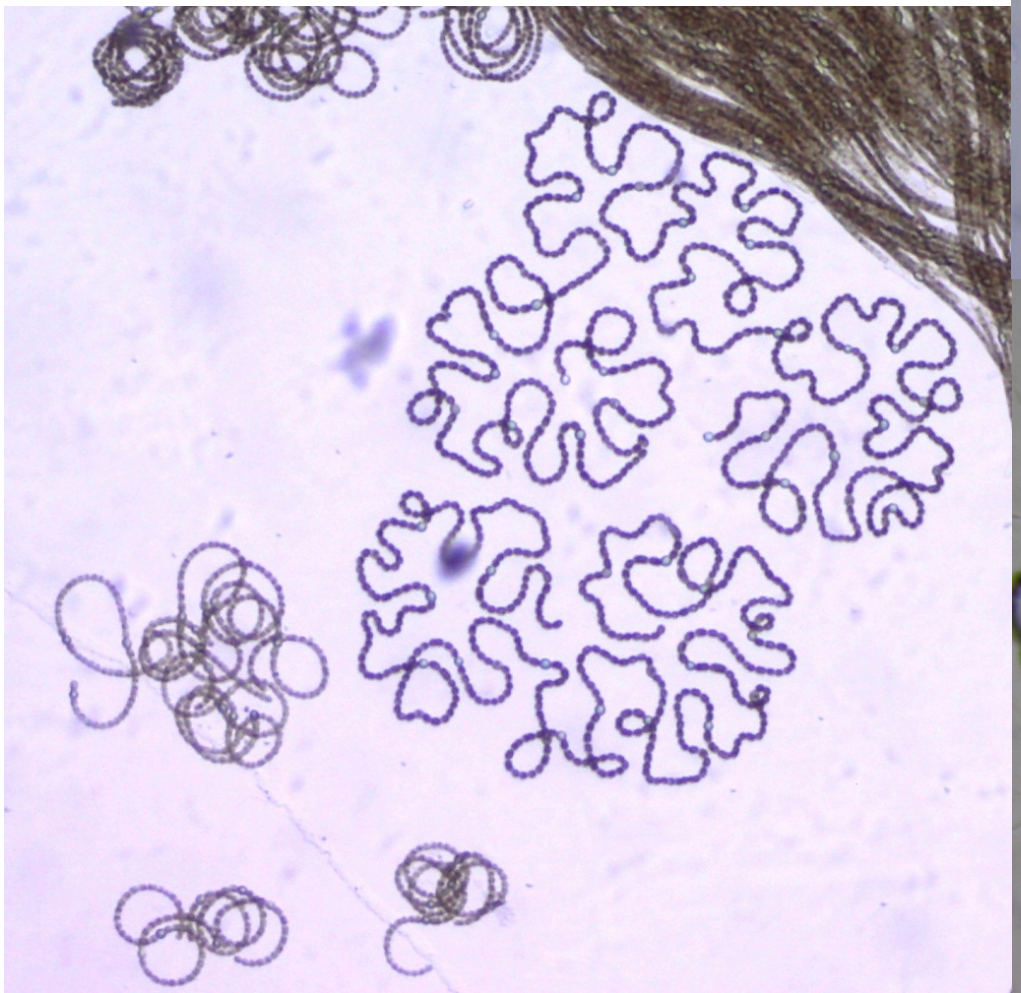
Microcystin

- Last observed above the WA recreational guidelines in 2015
- Last detected in November of 2018 at low levels
- High microcystin concentrations have coincided with high anatoxin concentrations



Dolichospermum

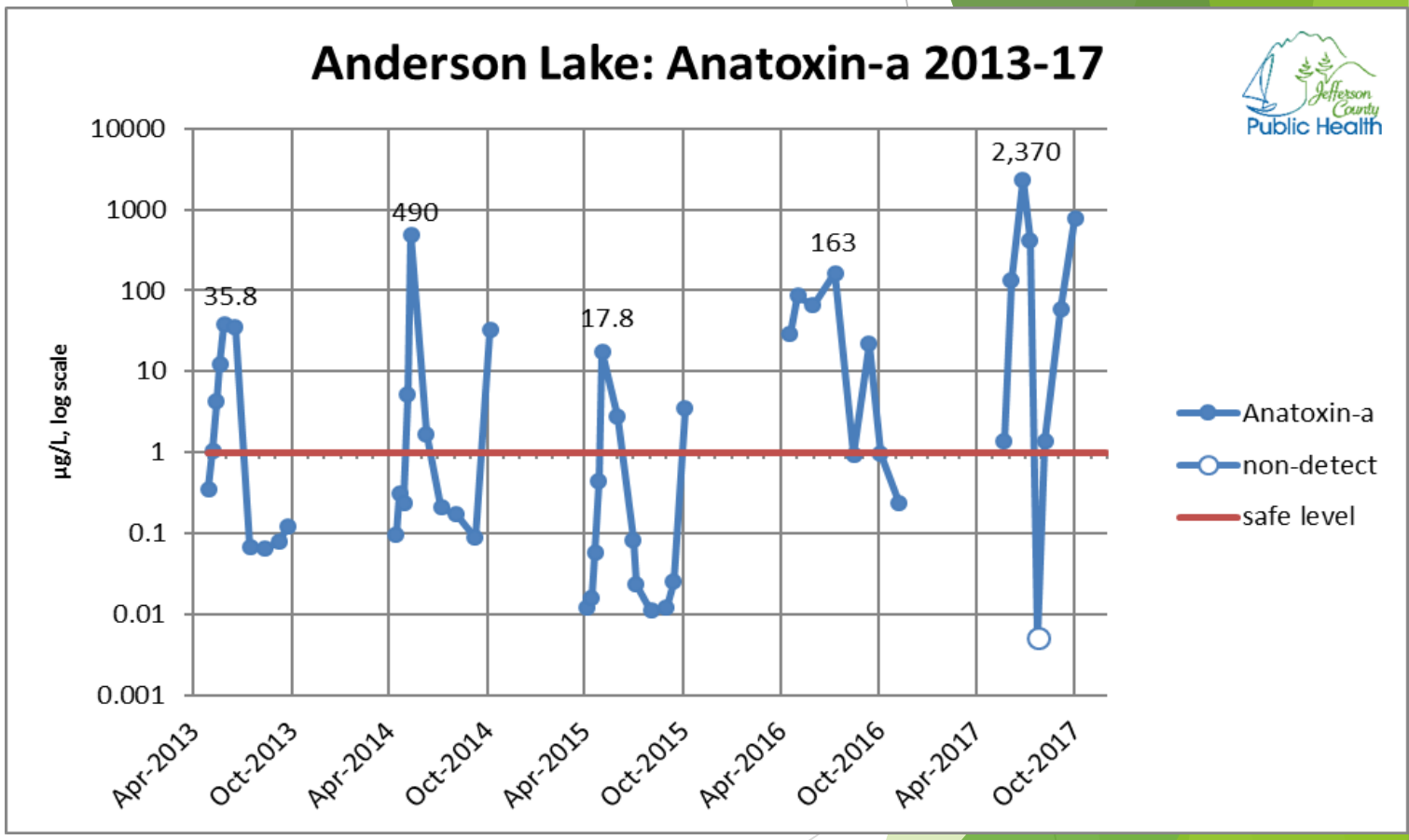
- Different coiling patterns
- Different toxin production
- Different prevalence



Anatoxin-a

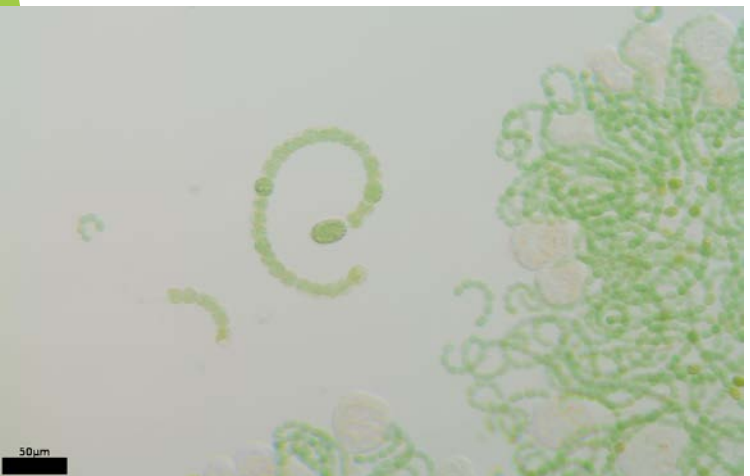
- Acute neurotoxicity
- Can lead to respiratory arrest

- Anderson Lake has had Anatoxin-a concentrations above the WA recreational guideline every year since we began monitoring in 2006
- There have been 3 samples taken where Anatoxin-a concentrations were below the detection limit.

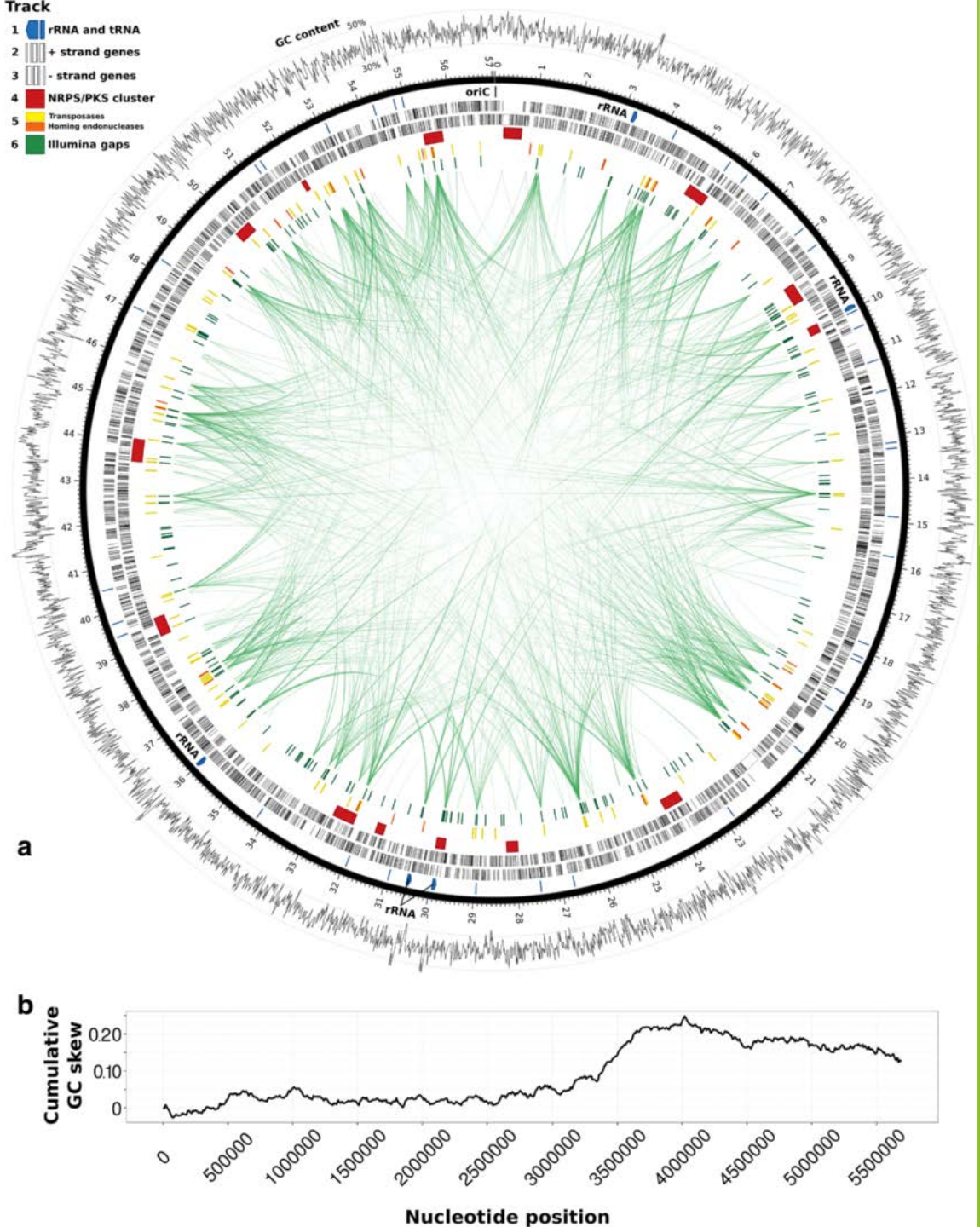


Anabaena sp. WA-102

- Using samples collected in 2012 and 2013, Oregon State University sequenced the genome of an Anabaena morphotype found in Anderson Lake
- Produces Anatoxin-a at higher concentrations than other morphotypes
- Found in other WA lakes
- Small cell morphology



Brown *et al. BMC Genomics* (2016) 17:457



Bloom Monitoring

- Weekly monitoring for blooms April – October
  - Collect toxin and cyanoscope samples during blooms
    - Toxin samples are shipped to King County Environmental Labs
    - Cyanoscope samples are viewed to ID the cyanobacteria present
  - Once Anatoxin-a levels are high, monthly toxin samples are taken to be more cost effective
- If toxins and blooms persist beyond October, regular monitoring continues until yearly funding is spent

Management Plan

- Developing a phosphorus budget
  - Inflow samples
  - Epilimnion samples
  - Hypolimnion samples
- Developing a water budget
  - Inlet flow samples
  - Precipitation data
  - Groundwater flow data
- Water quality data

The Fix?

http://friendsofgreenlake.org/wp-content/uploads/2016/04/alumTreatment2016barge2.jpg

- With help from Herrera Environmental Inc.
  - The water and phosphorus budgets will be developed
  - Potential lake management options will be identified
    - Alum treatment?
    - Do nothing?
    - Lake dredging?
- This will include stakeholder meetings along the way, to include input from invested groups

Local Partnerships

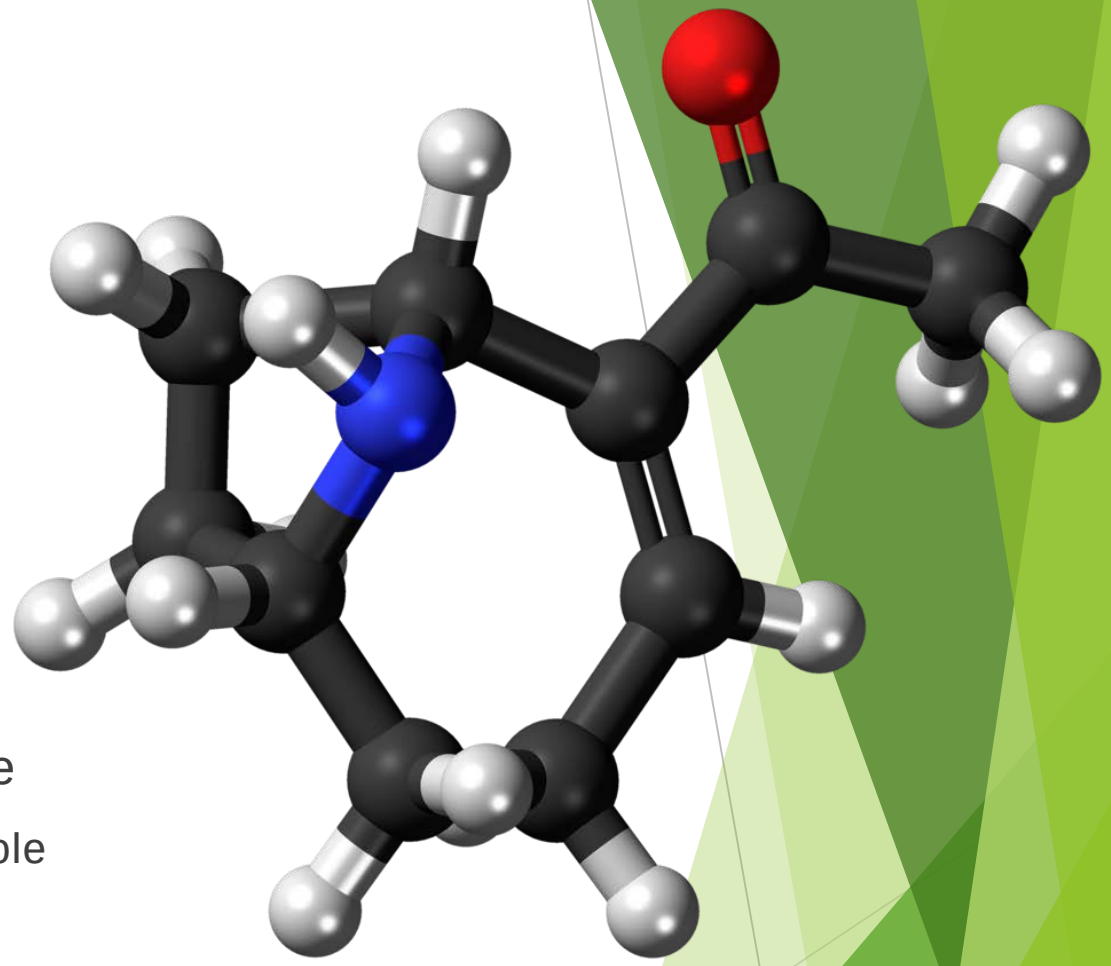
- Anderson Lake is located in a state park, so we work with them closely
  - Educating the volunteer host
  - Testing the well for toxins
  - Maintaining adequate signage
  - Park staff agrees with our decisions for when to close and open the lake for public usage
- WDFW has taken our opinion into consideration for fish stocking

Problems with Anderson

- Sediment core data
  - indicates blooms were present before development
  - Eutrophic prior to development
- Historical fishing use without health issues can lead to public mistrust
- Anatoxin-a contact isn’t required to be reported
- Lack of knowledge regarding cyanotoxins for health staff
  - Doctors and nurses
  - Veterinarians

Problems with Anatoxin-a

- Unstable in water
- Degrades under UV light
  - Sample collection time matters
- Doesn't store in fish tissue
- Not always an even concentration throughout the lake
  - Bathymetry, vegetation, wind, and flow can all play a role
  - Point samples only tell us so much



Lessons Learned

- Just because signs are posted doesn't mean they are being followed
  - Education is very helpful
  - Developing relationships with the people fishing can be beneficial
- Developing local partnerships to assist with bloom management
- Providing educational information and general outreach is the most effective approach to protecting public health with regards to Anderson
- Alerting local vets to the potentials of Anatoxin-a poisoning is a good precaution
  - Dogs are more likely to drink the water than humans
  - Dogs are smaller and are affected easier

Thank you!

- Washington State Parks for working with us to protect public health
- U.S. EPA for loaning the Cyanoscope
- WDFW for working with us in regards to fish stocking in a toxic lake
- Herrera Environmental Inc. for assisting with the management plan

Questions?