Blue River Reservoir, Dolichospermum Bloom (7/13/2020)

HAB Monitoring Efforts in the McKenzie Subbasin

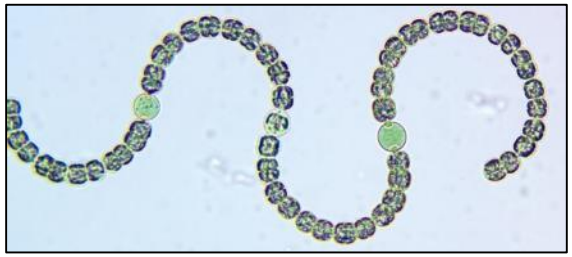
David Donahue, Eugene Water & Electric Board

Protecting Drinking Water Sources from Cyano-HAB Impacts in the Willamette Basin
Virtual Workshop, April 28, 2021

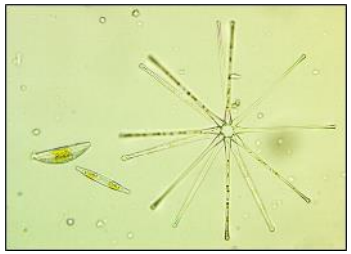
EWEB

Potential drinking water impacts from HABs

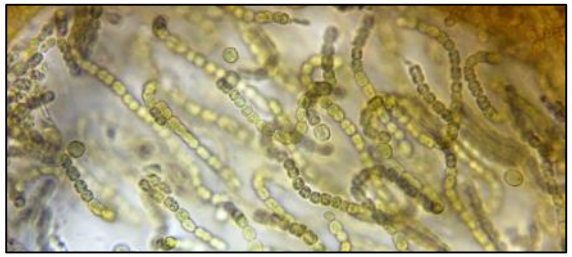
- Cyanotoxins
  - Hepatotoxins – affect the liver (microcystin, cylindrospermopsin)
  - Neurotoxins – affect the nervous system (anatoxin-a, saxitoxin)
- Dissolved Organic Carbon (DOC)
  - Precursor to disinfection by-product (DBP) formation
- Taste and odor issues - Geosmin and 2-methylisoborneol (MIB)
- Intake clogging/reduced filter run times
- Increased diurnal pH swings can complicate treatment



Dolichospermum, Blue River Reservoir, 4/5/2021

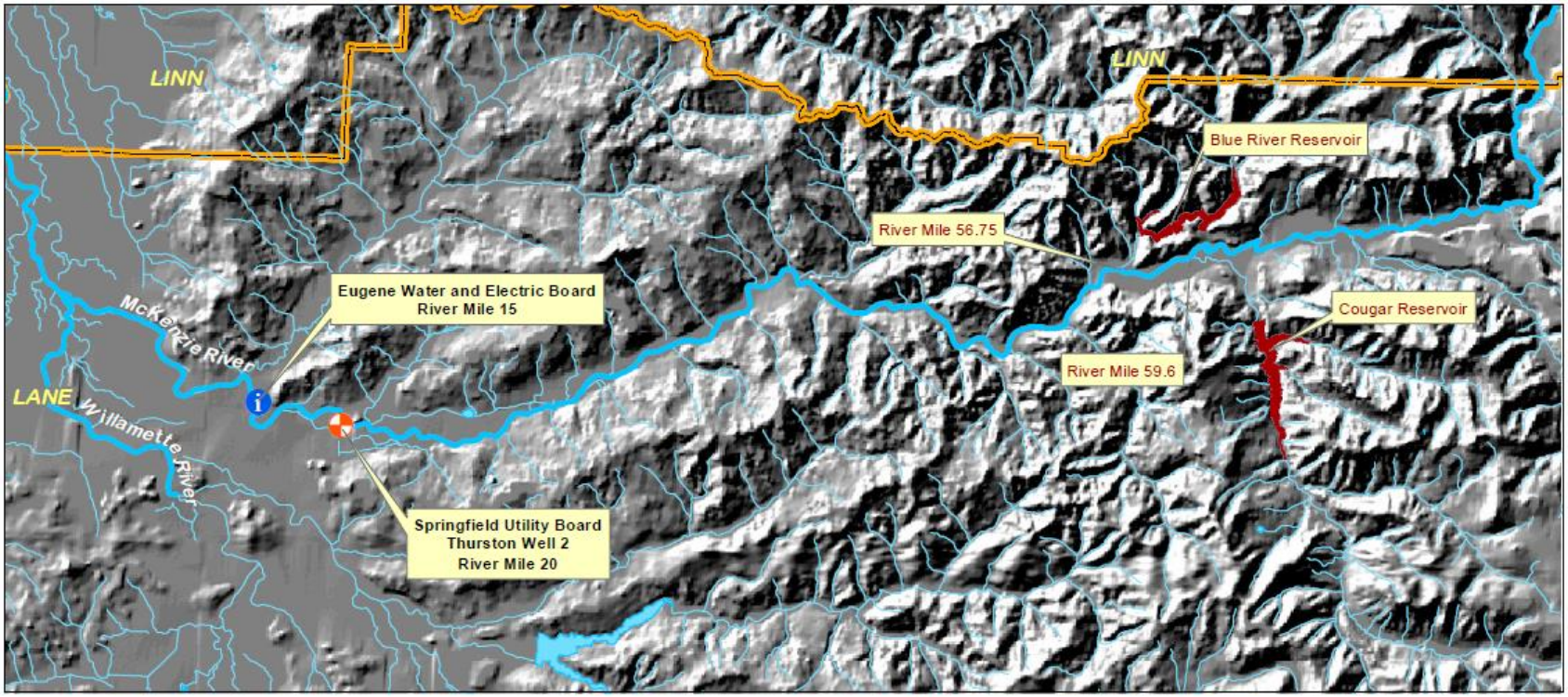


Diatoms, Cougar Reservoir



Nostoc, South Fork McKenzie River, 4/5/2021

McKenzie River Basin - Public Water System HAB Response Network



Harmful Algae Bloom Locations

Bloom locations are in red. In many cases, the locations are connected by tributaries downstream from the original bloom. The confluence with major drinking water sources are shown in red text and include river mileage. Generally, the river miles were estimated from U.S. Geological Survey 7.5 minute topographical maps.

Miles
0 1.5 3 6 9 12

1:225,000

- Surface Water Intakes
- GWUDI Wells
- Rivers
- Harmful Algae Blooms
- Lakes
- County Boundaries

Drafted by S. Stevenson G.I.T.
Map Revised 11/19/2012

Oregon Health Authority

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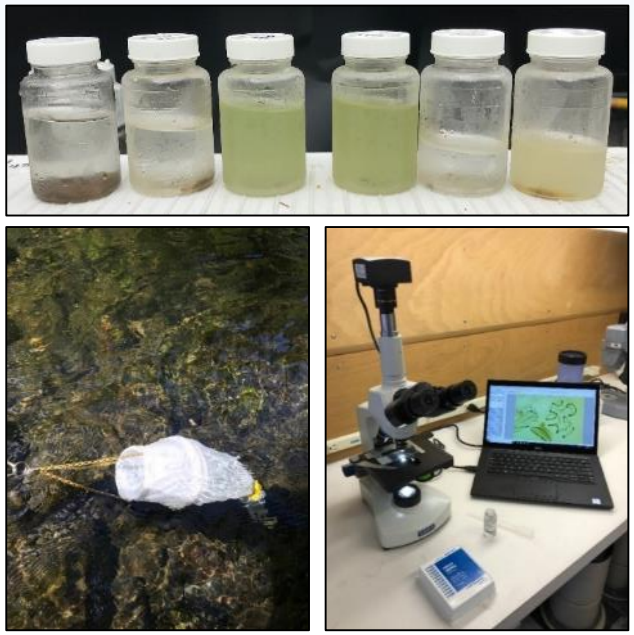
EWEB's HAB Monitoring Plan

Source Protection sites include major reservoirs, outfalls, mainstem and tributary sites.

- Routine sampling occurs from shore/bank every other week (April through October)
- Reservoir profile sampling occurs once per month by boat

Field visits include:

- Visual assessment of water conditions
  - Clarity, color, algae presence
- Microscopy/qualitative algae assessments
  - Planktonic net-tows
  - Benthic scrapes
- Water quality sonde measurements
  - Temperature/Specific Conductivity
  - pH/ORP
  - Dissolved Oxygen
  - Turbidity
  - Chlorophyll/Phycocyanin
  - fDOM (fluorescent dissolved organic matter)



EWEB's HAB Monitoring Plan Cont.

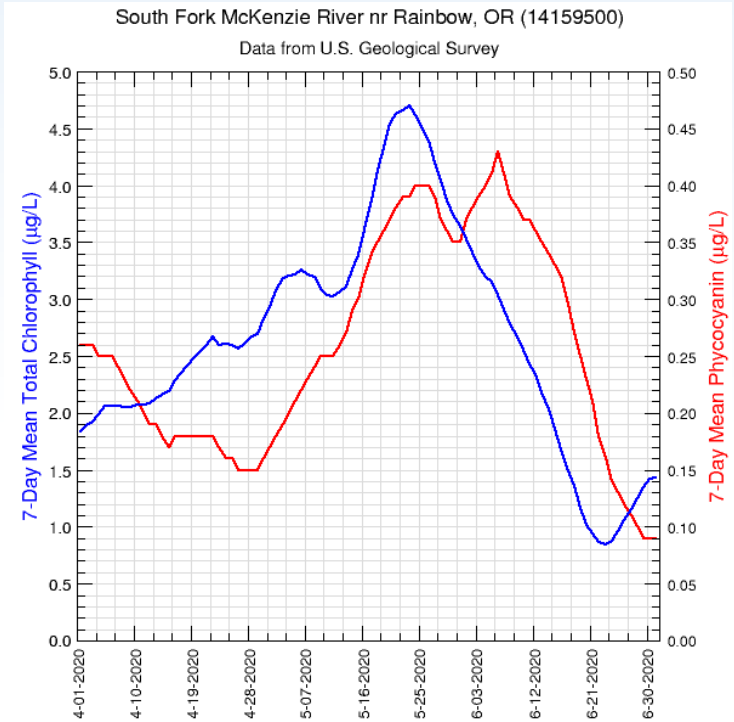
Analytical parameters include:

- Algae Identification and Enumeration (private lab)
  - Cyanobacteria, Algae, Diatoms, Flagellates
- Cyanotoxins via ELISA Method (EWEB Water Quality Lab/DEQ Lab)
  - Cylindrospermopsin, Total Microcystin, Anatoxin-a
- Nutrients (EWEB Water Quality Lab)
  - Nitrate/Nitrite, Ammonia
  - Total Phosphorus, Orthophosphate
  - TOC/DOC
- Toxigenic Gene Analysis via qPCR (private lab)
  - Cyanobacteria (16S rDNA)
  - Anatoxin-a (anaC)
  - Cylindrospermopsin (cyrA)
  - Microcystin (mcyE)
  - Saxitoxin (sxtA)

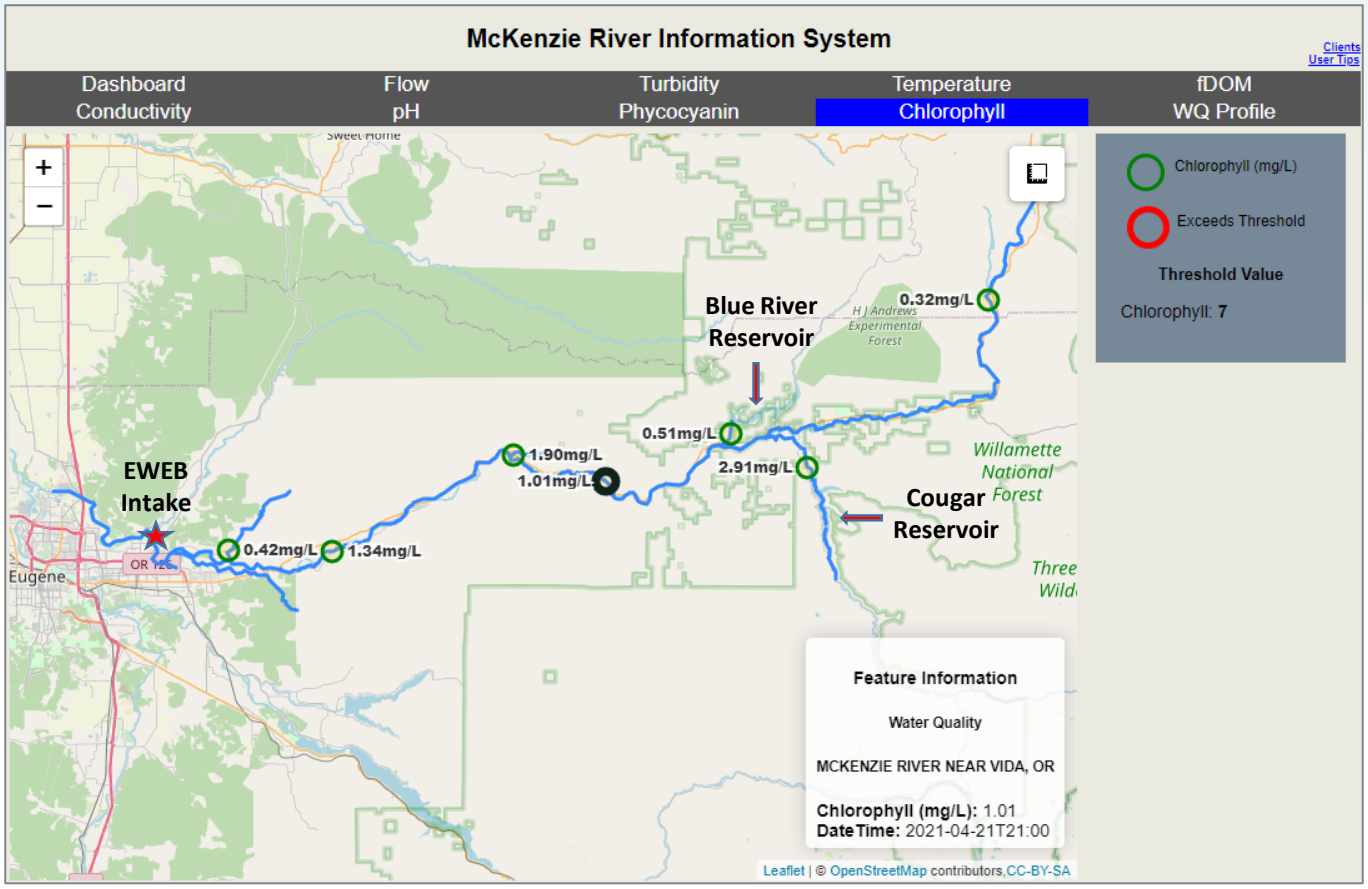
Continuous Real-Time Monitoring Network

Multi-parameter sondes deployed at the following sites (USGS/EWEB/USACE)

- McKenzie River below Trail Bridge
- Cougar Reservoir – Profiling Buoy
- S. Fork McKenzie River below Cougar
- Blue River below Reservoir
- McKenzie River near Vida
- Gate Creek
- McKenzie River @ Walterville
- Camp Creek
- McKenzie River @ Hayden Bridge



Real-Time River Monitoring Dashboard



Potentially Toxigenic Cyanobacteria Taxa Observed
McKenzie Subbasin, 2010-2021

Cyanobacteria (Genus)	Primary Type	Potential Toxins	Primary Location Observed
Aphanizomenon	Planktonic	ATX, CYN, MCY, STX	Blue River & Cougar Reservoirs
Aphanocapsa	Planktonic	MCY	Blue River Reservoir
Dolichospermum	Planktonic	ATX, CYN, MCY, STX	Blue River & Cougar Reservoirs
Gloeotrichia	Planktonic	MCY	Blue River Reservoir
Microcystis	Planktonic	MCY	Walterville Pond (no longer filled)
Nostoc	Benthic	MCY	McKenzie River, Tributaries
Oscillatoria	Benthic	ATX, CYN, MCY, SXT	McKenzie River, Keizer Slough
Planktolyngbya	Planktonic	STX	McKenzie River, Keizer Slough
Pseudanabaena	Benthic	ATX, MCY	McKenzie River, Keizer Slough

Abbreviations: Anatoxin-a (ATX), Cylindrospermopsin (CYN), Microcystin (MCY), Saxitoxin (STX)

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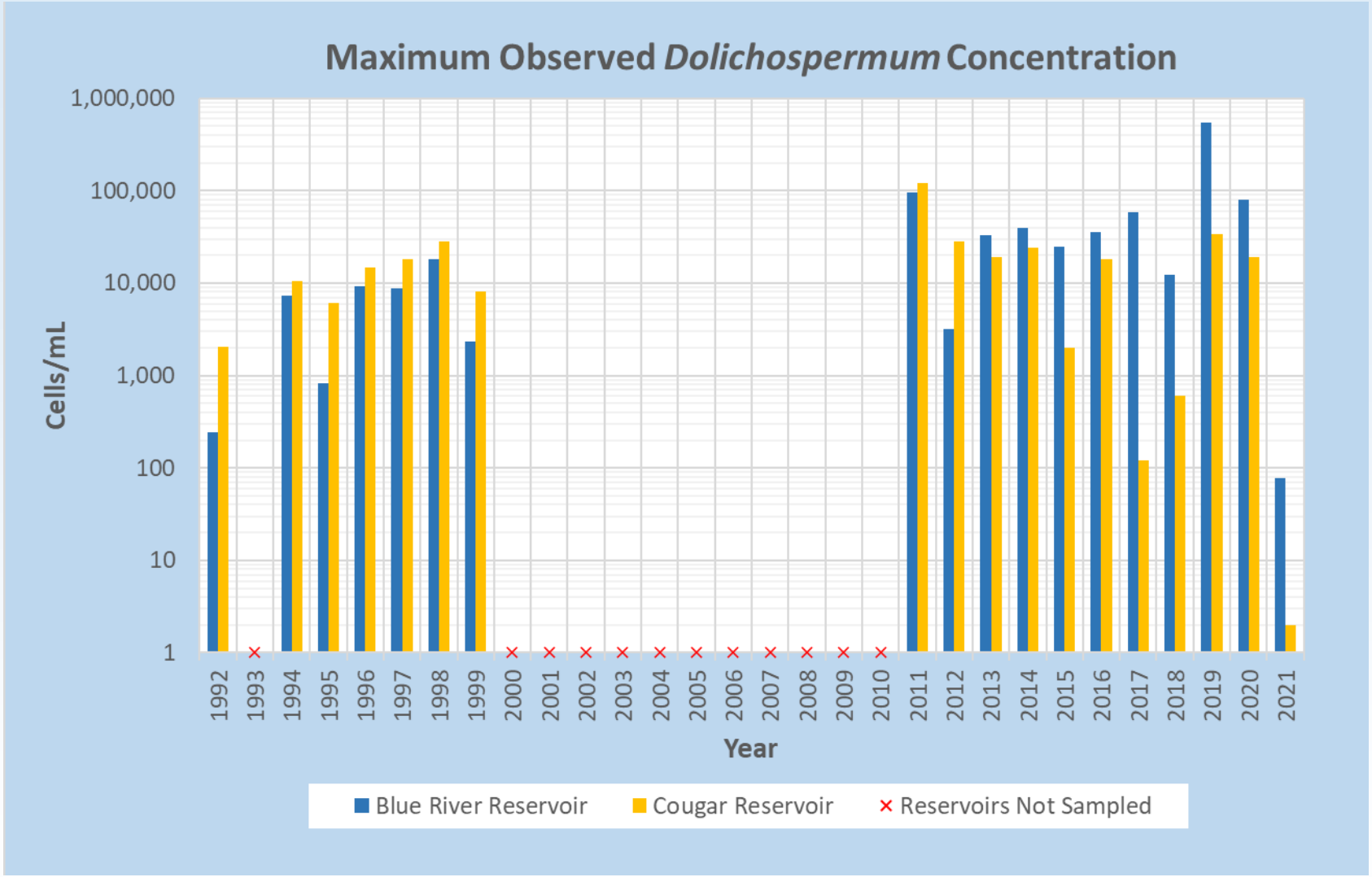
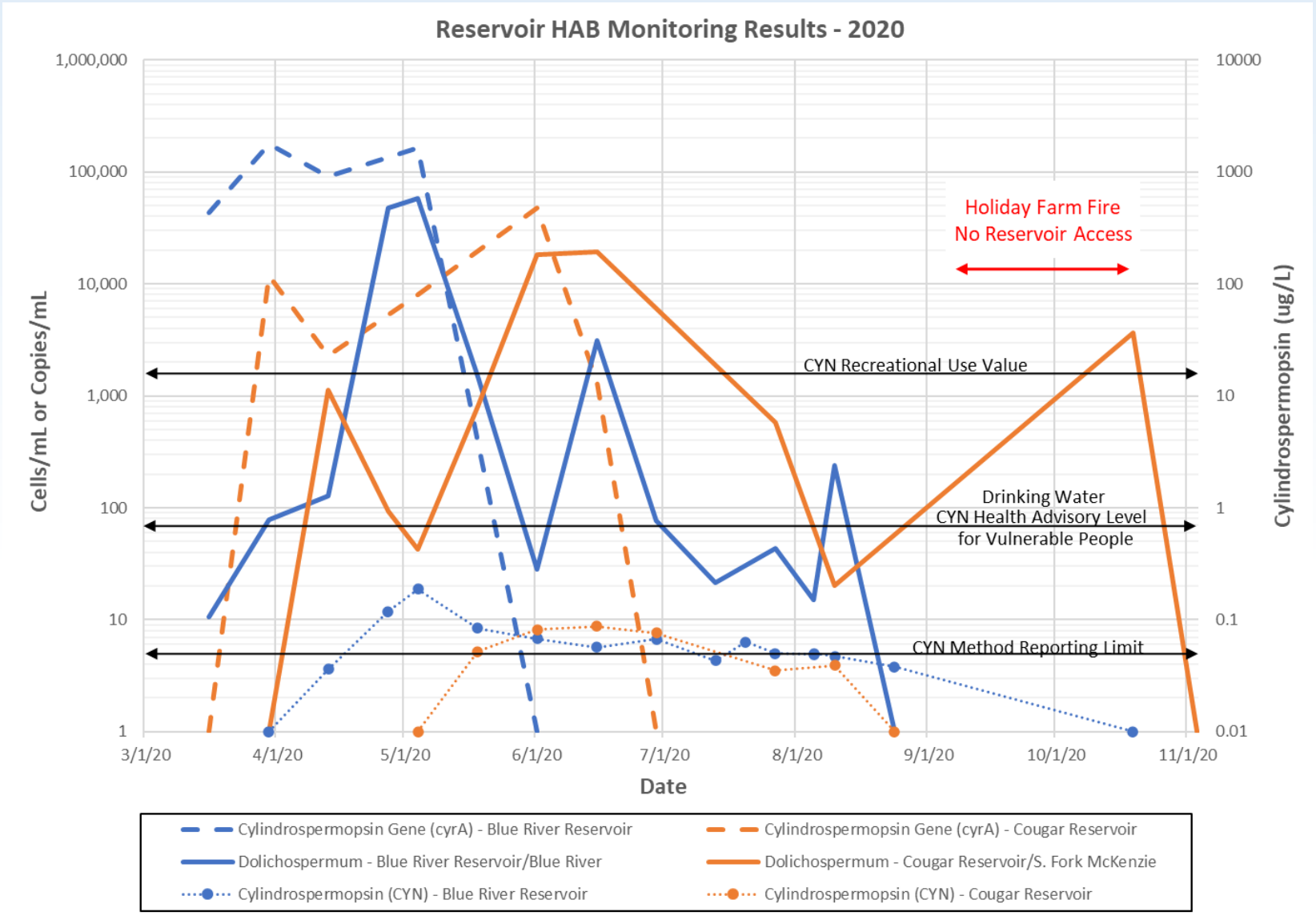
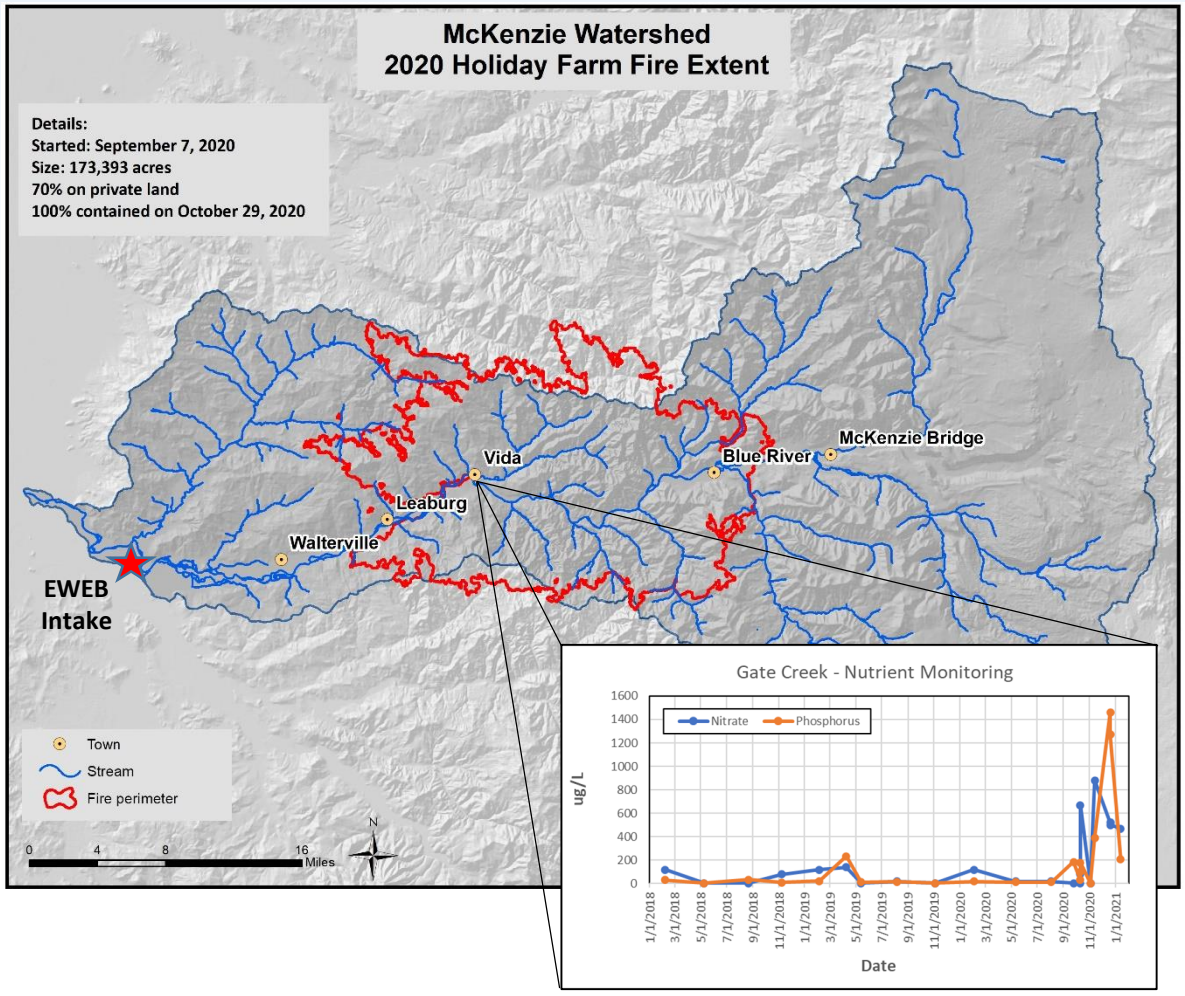

Maximum Observed *Dolichospermum* Concentration
1,000,000
100,000
10,000
1,000
100
10
1
Cells/mL
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Year
Blue River Reservoir
Cougar Reservoir
Reservoirs Not Sampled


Reservoir HAB Monitoring Results - 2020
Cells/mL or Copies/mL
Cylindrospermopsin (ug/L)
1,000,000
100,000
10,000
1,000
100
10
1
10000
1000
100
10
1
0.1
0.01
3/1/20
4/1/20
5/1/20
6/1/20
7/1/20
8/1/20
9/1/20
10/1/20
11/1/20
Date
Holiday Farm Fire
No Reservoir Access
CYN Recreational Use Value
Drinking Water
CYN Health Advisory Level
for Vulnerable People
CYN Method Reporting Limit
Cylindrospermopsin Gene (cyrA) - Blue River Reservoir
Cylindrospermopsin Gene (cyrA) - Cougar Reservoir
Dolichospermum - Blue River Reservoir/Blue River
Dolichospermum - Cougar Reservoir/S. Fork McKenzie
Cylindrospermopsin (CYN) - Blue River Reservoir
Cylindrospermopsin (CYN) - Cougar Reservoir

Holiday Farm Fire Impacts



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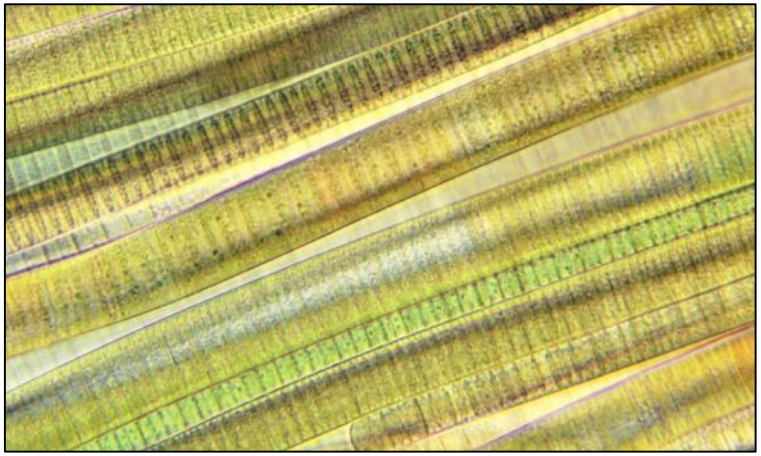
Benthic HAB Monitoring – Planning Stage (with USGS)

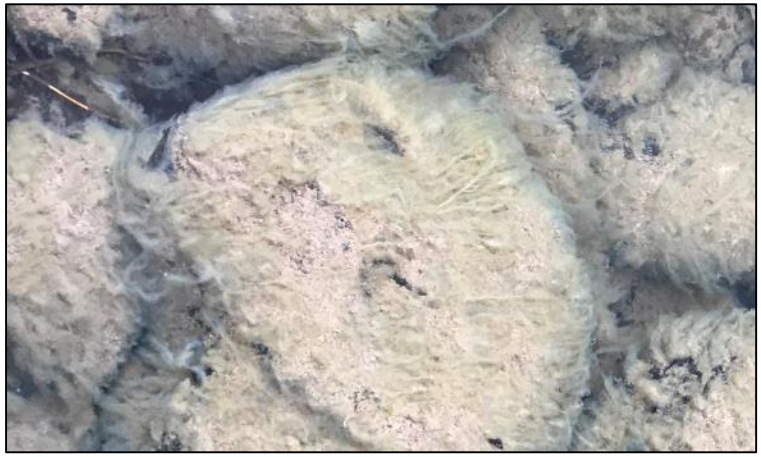
Focus on 6-8 long-term study sites upstream, within and downstream of Holiday Farm Fire.

Target parameters will include:

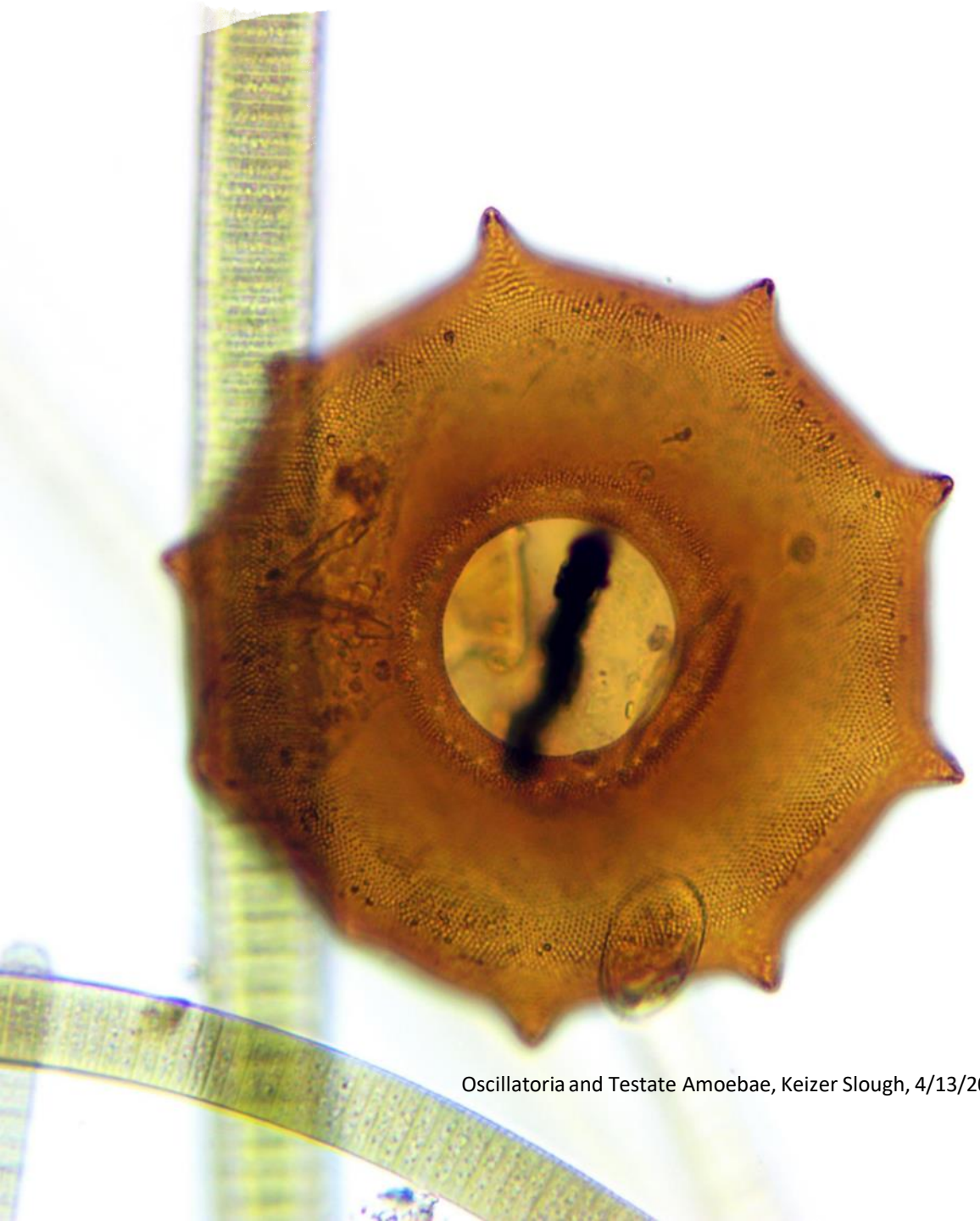
- Periphyton composition
- Relative abundance
- Spatial/temporal distribution
- Hydrologic setting
- Toxigenic genes
- Cyanotoxins
- Nutrients
- In-situ water quality measurements



Filamentous Cyanobacteria, Keizer Slough, 4/19/2021



Melosira, Blue River, 4/19/2021



Oscillatoria and Testate Amoebae, Keizer Slough, 4/13/2021

Thank you.

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