



OREGON  
**HEALTH**  
AUTHORITY

March 16, 2026

# **Novel threshold development to protect animal and human health**

Gregg Baird, David Farrer, Linda Novitski, Stuart Dyer

Public Health Division

# Agenda

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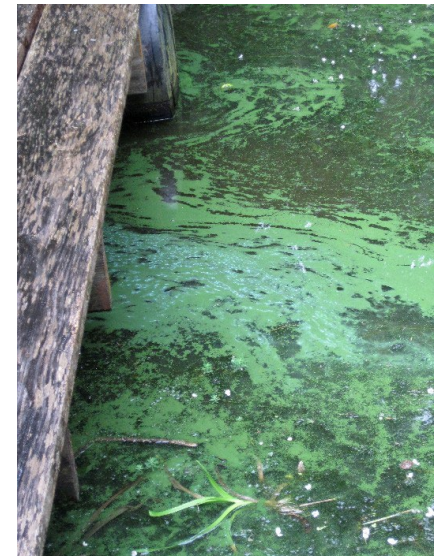
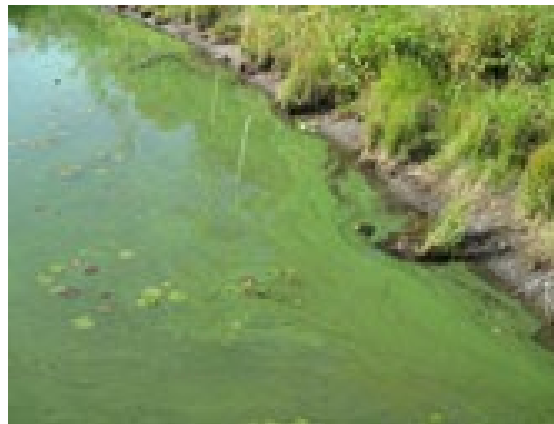
- Oregon-specific drinking water rules and implementation
- Recreational use value (RUV) development
- Implementation of RUVs
- Human and dog biospecimen collection
- Microcystin health-based guideline values for freshwater fish tissue



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# Oregon Cyanotoxin Rules for Public Water Systems



# Regulatory landscape

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- US Environmental Protection Agency (EPA) currently has no regulations for cyanotoxins in drinking water
  - EPA has non-regulatory Health Advisory Levels for two cyanotoxins (Total Microcystins and Cylindrospermopsin)
- National testing occurred for cyanotoxins with the fourth Unregulated Contaminant Monitoring Rule (UCMR4) from 2018-2020
- Some states (like Oregon) implementing regulatory programs

# Drinking Water Health Advisory Levels - Oregon and EPA

Cyanotoxin	For Vulnerable People (µg/L)	For Everyone (µg/L)
Total microcystins	0.3	1.6
Cylindrospermopsin	0.7	3

- **Health advisory level** is the concentration of a cyanotoxin at or below which adverse health effects are not expected to occur if consuming water containing cyanotoxins at this concentration for up to 10 days.
- These drinking water health advisory levels are **regulatory** and **enforceable** in Oregon

Vulnerable people include:

- Infants, particularly those that are formula-fed
- Children younger than 6 years
- People with pre-existing liver conditions
- People receiving dialysis treatment
- Pregnant women and nursing mothers



# Required advisory health effects language

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- **If an advisory is required**, water systems must include the following standard health effects language in the public notice (PN) and consumer confidence report (CCR):

*Consuming water containing concentrations of cyanotoxins over the health advisory level for more than 10 days may result in upset stomach, diarrhea, vomiting, as well as liver or kidney damage. Seek medical attention if you or your family members experience illness.*

# Cyanotoxins history in Oregon

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- **2000-2007:** Periodic recreational health advisories for lakes posted. Dog deaths.
- **2008-2009:** Oregon Health Authority (OHA) recommends PWSs test weekly for cyanotoxins during visual bloom (water system pays)
- **2011:** OHA starts paying for cyanotoxin analysis and shipping
- **2012-2013:** Developed Best Management Practices and webpage created
- **2015-2018:** Oregon uses EPA Health Advisory Levels and EPA guidance/recommendations documents
- ❖ During this time, no cyanotoxins detected in finished (treated) drinking water...



## ....until May of 2018

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- City of Salem routinely conducts cyanotoxin monitoring in their surface water source (Detroit reservoir), downstream of reservoir, and at their treatment plant
- May 23: Recreational HAB advisory posted on Detroit reservoir
- **May 26:** Total microcystins and cylindrospermopsin detected over the health advisory level for vulnerable people in Salem's drinking water
- **May 29:** Do-not-drink advisory issued for vulnerable populations



# Salem Cyanotoxin Incident

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- Salem is the state capitol
- Water system serves almost 200,000 people
- Local emergency response with State support (ICS, ORWARN)



# Salem Cyanotoxin Incident

- **33 days** of Do Not Drink Advisory for vulnerable people
- 12 drinking water samples showed exceedances of Health Advisory Levels (HALs) (no 10-day exceedance)
- Confusion over 10-day HAL
- Confusion over data / lab methods
- **LOTS OF QUESTIONS!**



# So many questions from the public...

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- What populations are considered vulnerable?
- Can I boil the water to make it safe?
- Do camping-style or home water filters or purifiers remove cyanotoxins?
- What should schools, day cares, day camps and preschools do?
- What should restaurants, food service, and grocery stores do?
- Is it safe to shower and wash hands?
- Can vulnerable people eat vegetables irrigated with tap water?
- Can house plants and gardens be watered during a health advisory?
- What about pools, waterparks and spas?
- How do cyanotoxins affect livestock and pets?



## ...and from medical providers...

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- Hospitals (Sterilization, Washing Surfaces, Wound Care, Skin Conditions)
- Surgical Facilities
- Birthing Centers
- Dental Offices
- Dialysis Centers
- In-Home Dialysis
- Residential Care/Assisted Living Facilities
- Skilled Nursing/Long-Term Care Facilities



# ...led to development of FAQs...

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- [Cyanotoxin Health Advisory for Vulnerable People Frequently Asked Questions](#)
- [Cyanotoxin Health Advisory for All Consumers Frequently Asked Questions](#)
- [Guidance for Health Care Providers and Facilities Frequently Asked Questions](#)

# ...and Public Notice (PN) templates

- [PN for vulnerable pops](#)
- [PN for all people](#)

## DRINKING DO NOT DRINK THE [CYANOTOXIN NAME] IS

### WHY IS THERE AN ADVISORY?

- [Cyanotoxin name], a toxin produced by [cyanobacteria name] on [date results received].
- Samples collected on [dates] from fully treated water at [location/entry point to the distribution system] show [cyanotoxin name] in the drinking water at [levels and/or ranges] micrograms per liter (µg/L). These results are above Oregon's [cyanotoxin name] drinking water health advisory level for vulnerable populations (listed below) of [level] µg/L.
- Drinking water containing [cyanotoxin name] at levels exceeding [level] µg/L can put you at risk of various adverse health effects, including *upset stomach, diarrhea, vomiting, as well as liver or kidney damage. Seek medical attention if you or your family members experience illness.*

### WHAT SHOULD I DO?

- Do not drink the tap water.
- [Alternative sources of water] food and beverages.
- Do not boil the tap water. Boiling does not destroy cyanotoxins.
- Everyone may use tap water for cleaning and doing laundry, bathing and during other activities.
- Animals may be vulnerable to adverse health effects at the levels indicated above; consider providing alternative sources of water for animals. Contact a veterinarian if animals show signs of illness.
- If you, your family members or your animals have experienced adverse health effects, contact [state or local health department] to report the illness.

### WHY IS THERE AN ADVISORY?

- [Cyanotoxin name], a toxin produced by cyanobacteria, was detected in the drinking water from [system name] on [date results received].
- Samples collected on [dates] from fully treated water at [location/entry point to the distribution system] show [cyanotoxin name] in the drinking water at [levels and/or ranges] micrograms per liter (µg/L). These results are above Oregon's [cyanotoxin name] drinking water health advisory level for vulnerable populations (listed below) of [level] µg/L.
- Vulnerable populations, as listed below, who drink water containing [cyanotoxin name] at levels exceeding [level] µg/L are at risk of various adverse health effects. Consuming water containing concentrations of cyanotoxins over the health advisory level for more than 10 days may result in *upset stomach, diarrhea, vomiting, as well as liver or kidney damage. Seek medical attention if you or your family members experience illness.*

### WHO IS AFFECTED BY THIS ADVISORY?

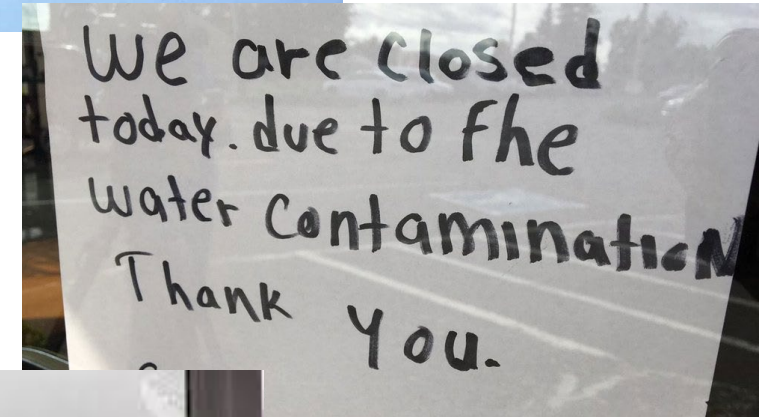
- The following vulnerable populations should not drink the tap water because they may be vulnerable to the effects of [cyanotoxin name]:
  - Infants.
  - Children younger than 6.
  - Pregnant women and nursing mothers.
  - Those with pre-existing liver conditions.
  - Those receiving dialysis treatment.
- As a precautionary measure, the elderly and other sensitive populations should consider following these advisory instructions.
- Animals may be vulnerable to adverse health effects at the levels indicated above; consider providing alternative sources of water for animals. Contact a veterinarian if animals show signs of illness.

**DRINKING WATER ADVISORY FOR VULNERABLE POPULATIONS:  
INFANTS, YOUNG CHILDREN AND OTHER VULNERABLE INDIVIDUALS  
DO NOT DRINK THE TAP WATER – [DATE ISSUED]  
[CYANOTOXIN NAME] IS PRESENT IN [WATER SYSTEM NAME]**



# Salem incident aftermath

- Loss of trust in water supply
- Salem installed powdered activated carbon (PAC) pre-treatment within weeks, and eventually ozone
- OHA adopted temporary emergency cyanotoxin rules *within 3 weeks*
- OHA adopted permanent cyanotoxin rules within 6 months



# Our cyanotoxin rules - Who is required to monitor?

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- Public water systems with “**susceptible sources**” required to monitor:
  1. Documented HAB in past or previously detected cyanotoxin; **or**
  2. Intake is downstream of or influenced by another surface water source susceptible to HABs or release of cyanotoxins; **or**
  3. Source is on a water quality limited listing in the Oregon DEQ Integrated Report and Clean Water Act Section 303(d) list for the limiting factors of algae and aquatic weeds.
  4. **Or** OHA determines source is susceptible based on characteristics of the source.

❖ 65 water systems currently meet the rule criteria for conducting routine monitoring



# Cyanotoxins monitoring requirements

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- Raw water (source) monitoring **every 2 weeks** between May 1 and October 31 for total microcystins & cylindrospermopsin
- If recreational HAB advisory upstream, monitor raw water **weekly**
- If raw water microcystins  $\geq 0.20 \mu\text{g/L}$  or cylindrospermopsin  $\geq 0.30 \mu\text{g/L}$  (trigger levels), raw and finished water **weekly**
- If cyanotoxins detected in finished water, monitor finished water **daily**
- If cyanotoxins detected in finished water  $>$  Health Advisory Levels (HAL):
  - Collect confirmation sample within 24 hrs
  - If confirmed  $>$  HAL = issue a Do-Not-Drink advisory



# Oregon Cyanotoxin Resources

- [OHA Treatment Optimization Guidance](#)
- [EPA Treatment Optimization Guidance](#)
- [EPA Cyanotoxin Management Plan Template](#)
- [EPA Cyanotoxins Preparedness and Response Toolkit](#)

FAQs & guidance docs can be found at:

- [www.healthoregon.org/dwcyanotoxins](http://www.healthoregon.org/dwcyanotoxins)



## Cyanotoxin Resources for Drinking Water

Drinking Water Services

Water System Operations

Surface Water Treatment

Capacity Development

Public Notice Templates and Resources

Fact Sheets & Best Management Practices

Water System Surveys & Outstanding Performance

Circuit Rider Program

Emerging Contaminants in Drinking Water

Per- and Polyfluoroalkyl Substances (PFAS)

Groundwater

Groundwater Under the Direct Influence of Surface Water (GWUDI)

ePipeline Newsletter

### Rules for Cyanotoxin Monitoring in Drinking Water

Oregon Health Authority (OHA) has developed regulations that require drinking water systems using surface water sources susceptible to harmful algae blooms to routinely test for two cyanotoxins that these blooms produce and notify the public about the test results.

The rules apply to the two cyanotoxins with a health advisory level established by EPA. These are for total microcystins and cylindrospermopsin, at the levels shown in the table below.

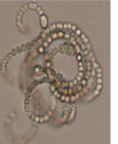
Cyanotoxin	For Vulnerable People (ug/L or ppb)	For Anyone (ug/l or ppb)
Total Microcystins	0.3	1.6
Cylindrospermopsin	0.7	3

These rules are effective starting December 27, 2018 and replace temporary administrative rules adopted for cyanotoxin monitoring and testing that were effective July 1, 2018 through December 27, 2018.

OHA is encouraging water systems not subject to the cyanotoxin monitoring rules that serve surface water and have had algae issues in the past to voluntarily test for cyanotoxins and notify the public about the results. If analysis is performed for anatoxin-a or saxitoxins and found in the raw or finished water, please contact OHA-Drinking Water Services for guidance and recommendations.

### Rules Resources

- [Rules for Cyanotoxin Monitoring for Public Water Systems - Revised rules effective January 1, 2025](#)
- [List of Susceptible Sources Required to Monitor for Cyanotoxins - Updated May 7, 2024, subject to change](#)
- [Cyanotoxin Monitoring Flowchart - Updated January 2025](#)
- [Cyanotoxin Rules Fact Sheet - Updated January 2025](#)
- [Cyanotoxin Sampling DEQ & OHA Presentation from 4/24/2024 \(webinar recording\)](#)



# Anatoxin-a & Saxitoxin

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- **No EPA drinking water health advisory levels for anatoxin-a or saxitoxin**
- OHA has developed state *non-regulatory* drinking water health advisory levels for anatoxin-a and saxitoxin
- Water systems not required to routinely monitor for anatoxin-a & saxitoxins under OHA rules
- If recreational HABs monitoring shows detections of anatoxin-a or saxitoxin upstream of a water system, OHA requests downstream water systems test for those two cyanotoxins
- **2027 season (hopefully!):** OHA is planning an anatoxin-a + saxitoxin sampling project to assess the risk to public water systems from anatoxin-a & saxitoxin in surface water sources used to provide drinking water
  - In addition to required regulatory monitoring for microcystins & cylindrospermopsin, water systems would also monitor raw water for anatoxin-a & saxitoxin between May 1 and October 31.

# Thank you!

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[www.healthoregon.org/dwcyanotoxins](http://www.healthoregon.org/dwcyanotoxins)



# Drinking Water HALs and RUVs ( $\mu\text{g}/\text{L}$ ) for Oregon

	Microcystin	Cylindro-spermopsin	Anatoxin-a	Saxitoxin
Drinking Water (HALs)	0.3	0.7	0.7	0.3
<b>RUVs</b>	<b>8</b>	<b>15</b>	<b>15</b>	<b>8</b>

OHA issues recreational advisories when toxin concentrations are above the RUVs listed above.

# Elements of HALs and RUVs

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- Health guideline value (HGV) (e.g., Reference dose, Tolerable daily intake, Minimal risk level, etc.) ( $\mu\text{g}/\text{kg}/\text{day}$ )

- Exposure factors

$$\text{RUV or HAL } (\mu\text{g}/\text{L}) = \frac{\text{Health Guideline Value } (\mu\text{g}/\text{kg}/\text{day}) \times \text{Bodyweight (kg)}}{\text{Water Intake Rate (L/Day)}}$$

# Anatoxin-A Oregon Health Guideline Value

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- Critical toxicological study: Fawell 1994 and 1999
- 10 male and 10 female mice per exposure group (0, 100, 500, 2,500  $\mu\text{g}/\text{kg}/\text{day}$ )
- Dosed orally by gavage daily for 28 days

$$\text{Health Guideline Value} = \frac{\text{NOAEL}}{\text{Uncertainty Factors}} = \frac{100 \mu\text{g}/\text{kg}/\text{day}}{1,000} = 0.1 \mu\text{g}/\text{kg}/\text{day}$$


Uncertainty factor breakdown: 10 for animal to human extrapolation, 10 for human variability, 10 for database limitations

# Saxitoxins Oregon Health Guideline Value

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- Critical Study: European Food Safety Authority 2009 reference dose (0.5 μg/kg/day)
- Based on case reports of toxicity in people from eating contaminated shellfish

$$\text{Health Guideline Value} = \frac{\text{NOAEL}}{\text{Uncertainty Factors}} = \frac{0.5 \mu\text{g/kg/day}}{10} = 0.05 \mu\text{g/kg/day}$$


Uncertainty factor breakdown: 10 for database limitations\*

\*Original value did not include this UF, but followed Ohio's lead in adding in 2014

# Dog-specific Guideline Values

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- Used same health guideline values as for people\*
- Used California EPA's 2012 water intake rate for dogs (0.255 L/kg/day) as the exposure factor

	<b>Microcystin</b>	<b>Cylindro-spermopsin</b>	<b>Anatoxin-a</b>	<b>Saxitoxin</b>
<b>Dog Safety</b>	<b>0.2</b>	<b>0.4</b>	<b>0.4</b>	<b>0.02</b>

\*Except for saxitoxins; added additional UF of 10 for extrapolating from people to dogs.

# Contact Information

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Toxicologist

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# Implementation of RUVs in Recreational CyanoHAB Program

Linda Novitski, Ph.D.

Healthy Waters Unit

Environmental Public Health Section

# RUVs and dog safety values ( $\mu\text{g/L}$ )

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	<b>Microcystin</b>	<b>Cylindro-spermopsin</b>	<b>Anatoxin-a</b>	<b>Saxitoxin</b>
<b>RUVs</b>	<b>8</b>	<b>15</b>	<b>15</b>	<b>8</b>
<b>Dog Safety</b>	<b>0.2</b>	<b>0.4</b>	<b>0.4</b>	<b>0.02</b>

# Implementation of RUVs

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- Issue advisories for water bodies that exceed OHA-established **Recreational Use Values (RUVs)**
- Track cyanotoxin results
- Educate and inform the public regarding health risks
- Conduct health investigations
- Build capacity of our partners to monitor water bodies
- Work with DEQ to determine if a water body is susceptible to cyanoHABs

# Advisory process



**“Advisory”** (posted to OHA website and publicized with news release)

Site is known to have public recreational or occupational contact with water, partners are available and willing to post advisory signage on site, plus one of the following criteria are met:

- 1. Visible scum:** Visible scum is indicated with supporting photographs or satellite imagery **and** sampling can be done within 1 business day; this advisory will be confirmed or lifted based on cyanotoxin analysis.
- 2. Toxin-based Monitoring:** Analysis showing cyanotoxin levels above OHA RUVs.

# Advisory process continued

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**“Precaution”** (posted to OHA website, no news release)

All the following criteria are met:






1. Photos submitted by public are deemed by OHA/DEQ to represent a possible cyanoHAB **or** satellite data indicate a possible cyanoHAB.
2. Site is known to have public recreational or occupational contact with water.
3. Immediate (< 1 business day) water quality testing is unavailable due to resources limitations, remoteness, etc.

# Advisory table

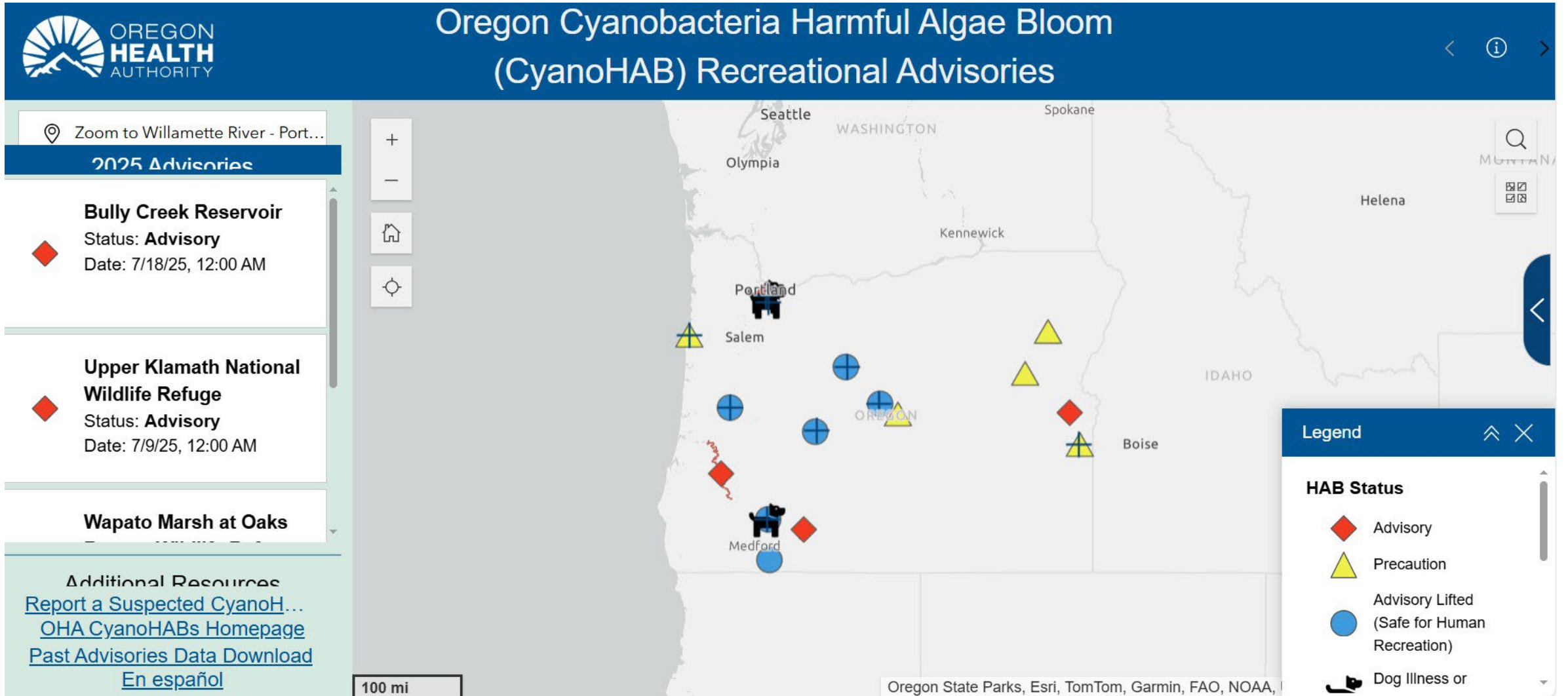
## Advisory Levels

 = Advisory in effect    = Precaution in effect    = Advisory/precaution has been lifted

- **Advisory:** Cyanotoxins have been confirmed through testing and are at unsafe levels, or a bloom has been sighted and water will be sampled within 1 business day.
- **Precaution:** A bloom has been sighted and water sampling is unavailable within 1 business day due to limited resources.
- **Advisory/Precaution Lifted:** An 'Advisory' is lifted when water testing shows safe levels. If a site has previously tested at unsafe levels, regular testing continues until the bloom is visibly gone and cyanotoxins are at safe levels. A 'Precaution' is lifted when testing shows cyanotoxin levels are safe, or when the bloom is visibly gone.

Waterbody	Status	Date/Link	County	Toxin	Data
Bully Creek Reservoir	 Advisory	<a href="#">7/18/2025</a>	Malheur	Microcystin	> 10 ug/L
Thief Valley Reservoir	 Precaution	7/18/2025	Baker & Union		
Upper Klamath National Wildlife Refuge	 Advisory	<a href="#">7/9/2025</a>	Klamath	Microcystin	2,304.5 ug/L
Antelope Flat Reservoir	 Precaution	7/9/2025	Crook		
Unity Reservoir	 Precaution	7/1/2025	Baker		

# Advisory map



# Communication

**ADVISORY**






## Cyanobacteria and Toxins Present

**AVOID WATER AND AREAS WHERE:**  
You see a visible scum that is foamy, scummy, thick like paint, pea-green, blue-green or brownish red


**HOW AM I EXPOSED?**  
By swallowing affected water in and around a bloom.  
Toxins are not absorbed through the skin.

**CHILDREN and ANIMALS are at greatest risk**

**DO NOT USE water for drinking or cooking**  
Toxins are not removed by boiling or using camping filters or treatment.  
Local water systems should not be affected.

For advisory information go to: <https://www.healthoregon.org/hab>  
For questions about blooms, exposures or illnesses (people/pets), call the Oregon Health Authority at 971-673-0440



## Cyanobacteria Harmful Algae Blooms Can Make People and Animals Sick



Cyanobacteria are natural bacteria that live in water. They are not really algae! Blooms can be bright green or blue-green and often look like scum or paint on the water.





Some cyanobacteria produce toxins that can make people and pets sick.

**People are exposed to toxins by swallowing affected water. If there is a bloom:**



Don't swim, wade or play in the water



Never drink or cook with affected water



Don't let pets play in the water, eat the scum or lick the scum from their fur

**Most at risk:**



Infants, if the water is used for their formula



Children age 6 and younger



Dogs



People age 60 and older and those with health conditions

**Be aware and take action**

Look out for diarrhea, vomiting or flu-like illness. Seek medical care if symptoms continue. Seek veterinary care right away if your dog gets sick.

**When in doubt, stay out!**



Learn more about cyanoHABs at [www.healthoregon.org/hab](http://www.healthoregon.org/hab).



Questions? Call 1-877-290-6767 or email [hab.health@odhsoha.oregon.gov](mailto:hab.health@odhsoha.oregon.gov).



You can get this document in other languages, large print, braille or a format you prefer. Contact the Cyanobacteria Harmful Algae Bloom program at 1-877-290-6767 or email [hab.health@odhsoha.oregon.gov](mailto:hab.health@odhsoha.oregon.gov). We accept all relay calls or you can dial 711.

OHA 4192 (03/2022) TMP(03/2025)



## Dog Safety Alert



Cyanobacteria are natural bacteria found in fresh water everywhere. Sometimes they multiply into blooms and produce toxins harmful to pets. You can't tell by looking if a bloom has toxins. Dogs have died after drinking water with low toxin levels.



Do not let your pet swim in or drink water that is foamy, scummy or looks like spilled paint. Don't let them lick scum off rocks or their fur.

**If your dog is exposed to a bloom:**

Wash your dog with clean water as soon as possible. Get veterinary help right away if your dog shows symptoms like drooling, weakness, vomiting or staggering.



Urine samples from affected pets can help scientists better understand blooms and their impact on animal health. Contact our program to learn more about collecting a sample.

Learn more at [www.healthoregon.org/hab](http://www.healthoregon.org/hab). Questions? Call 1-877-290-6767 or email [hab.health@odhsoha.oregon.gov](mailto:hab.health@odhsoha.oregon.gov).





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# Bloom and illness reporting

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## One Health Harmful Algal Bloom System (OHHABS)

- Investigate human and animal illness
- Report HAB-related illnesses to the Centers for Disease Control and Prevention (CDC) for national surveillance program
- Communicate with other states



# CDC Biospecimen Pilot – objectives

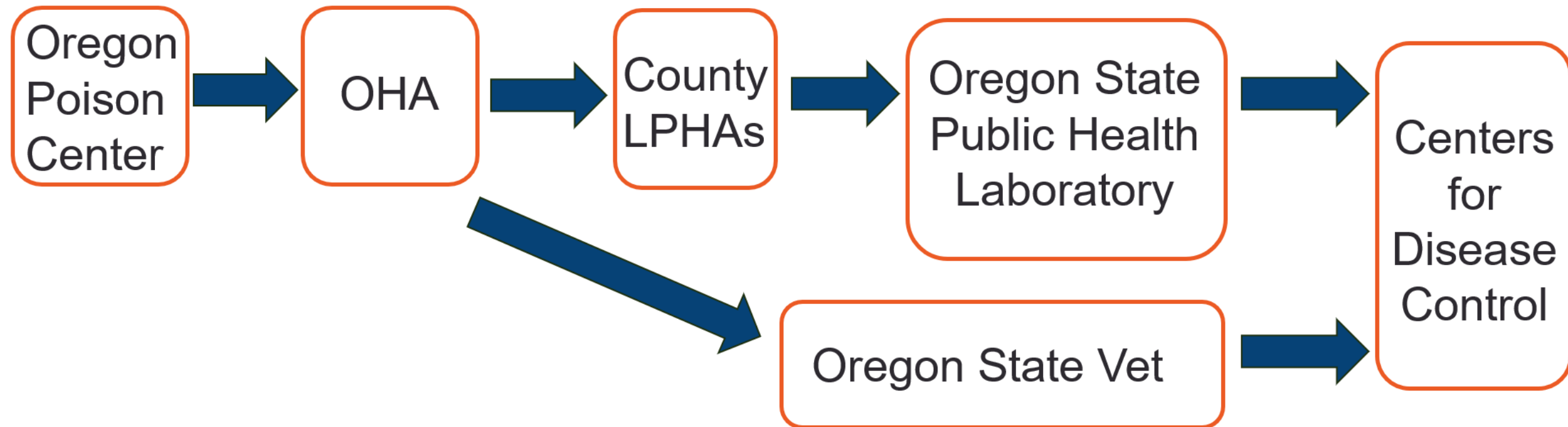
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## Pilot Program Objectives

- Test biospecimens for HAB toxins (microcystins, anatoxin-a, brevetoxins) and related metabolites
- Accept urine and serum for humans and urine for dogs
- Enhance surveillance of HAB-associated illnesses in the United States by strengthening evidence of HAB toxin exposure as a cause of clinical illness.

# CDC Biospecimen Pilot – Oregon's process

Test for microcystin, anatoxin-a and their metabolites in **human plasma and urine** and **dog urine** after harmful algae bloom exposure



# Educational resources



- About OHA ▾
- Programs and Services ▾
- Oregon Health Plan ▾
- Health System Reform ▾
- Licenses and Certificates ▾
- Public Health ▾
- Jobs ▾

## When in Doubt, Stay Out!

- Cyanobacteria Blooms
- Cyanobacteria Season
- Current Advisories
- Advisory Archive
- Frequently Asked Questions
- Advisory, Sampling, and LPHA Guidance
- Education and Outreach
- Partners
- Private Drinking Water Intakes and In-Home Treatment Systems

## Cyanobacteria Harmful Algae Blooms (CyanoHABs)

The Oregon Health Authority (OHA) reviews available information on cyanobacteria harmful algae blooms (called CyanoHABs) in the water. When the data show risk, OHA issues recreational health advisories to inform the public through the issuing and lifting of recreational use health advisories to warn people about areas that might not be safe for activities like swimming.



These advisories help people make safer choices about where to enjoy the water and avoid getting sick. OHA works with [partners](#) who provide water samples for testing. Learn more about how [water testing works](#).

- [View Current Advisories](#)
- [FAQs](#)
- [Report a HAB](#)
- [Report a HAB-Related Animal Illness](#)
- [Report a HAB-Related Human Illness](#)

[hab.health@odhsoha.oregon.gov](mailto:hab.health@odhsoha.oregon.gov)

<http://healthoregon.org/hab>

# Thank you

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Environmental Public Health  
Cyanobacteria Harmful Algae Bloom (CyanoHAB) Program  
800 NE Oregon St.  
Portland, OR 97232  
1-877-290-6767  
<http://healthoregon.org/hab>





# **Development of Health-Based Guideline Values for Microcystins in Fish Tissue and Associated Fish Consumption Advisories for Freshwater Fisheries in Oregon**

Oregon Health Authority  
Public Health Division

# Introduction

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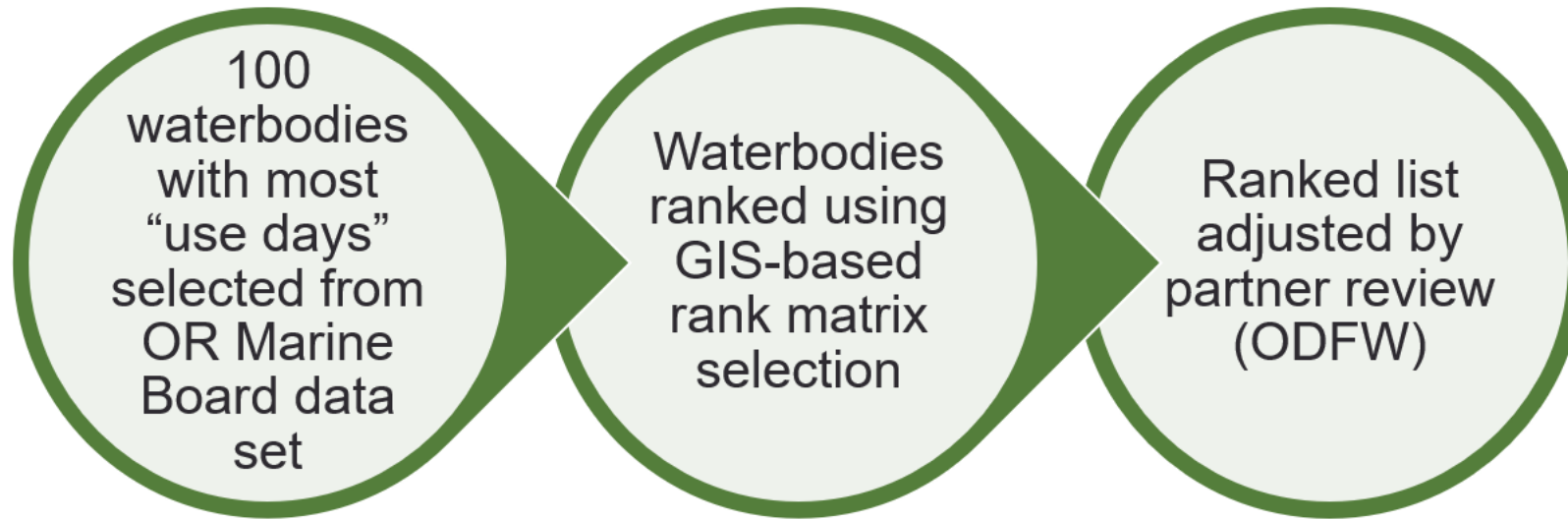
## Goal

Investigate the relationship between cyanobacteria harmful algae bloom (cyanoHAB) events and the presence of microcystins in fish tissue to better understand potential risks to public health.



# Site Selection:

Prioritizing proximity to populations at disproportionate health risk

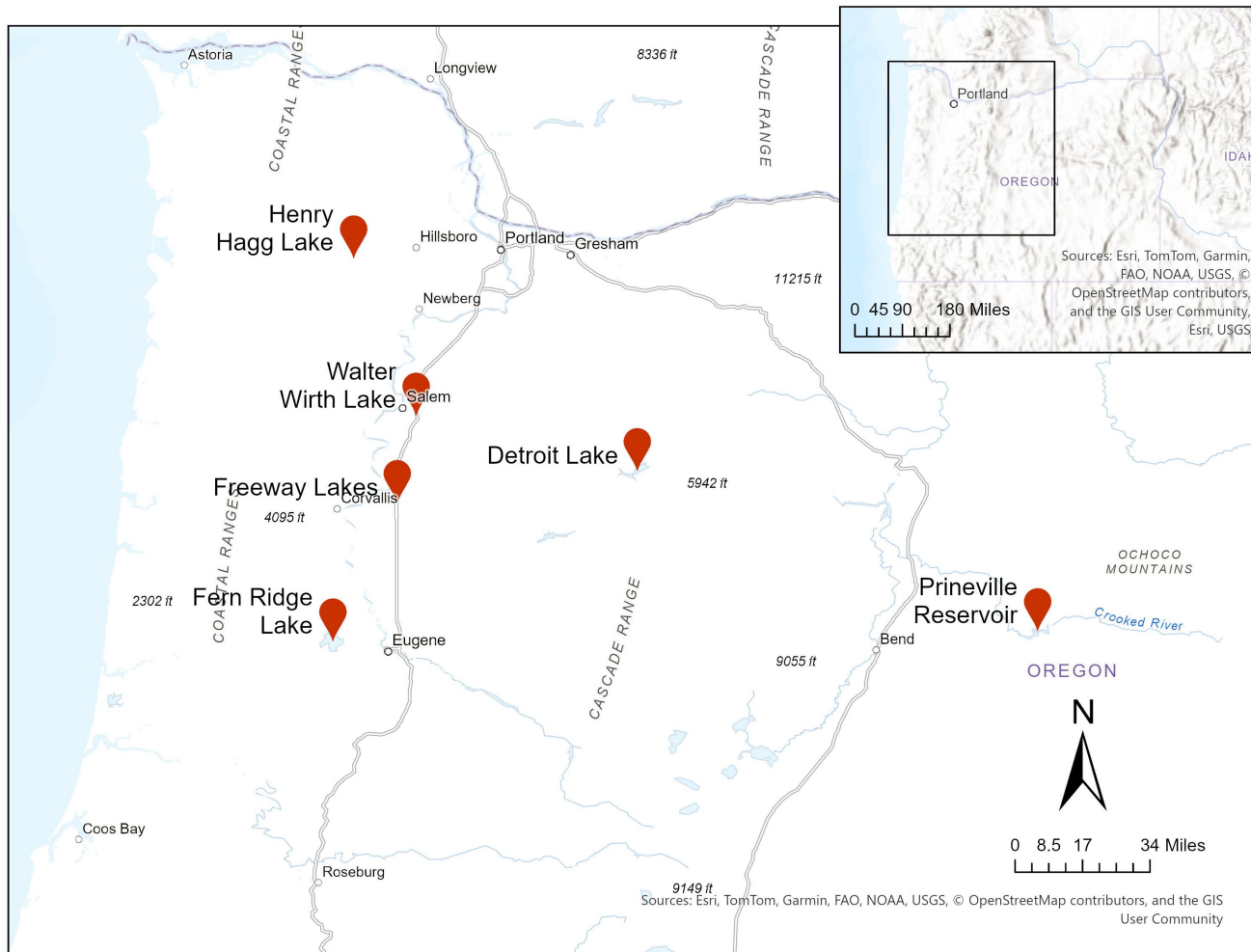


## Indicators:



# Location Map + Target Fish

Sampling Locations for OHA Spring 2025 Fish Tissue Sampling Study



- 6 sites
- Whole fish composite samples
  - 3 – 5 fish per composite
- 2 – 3 composite samples per trophic level per site
  - Lower trophic level species
  - Higher trophic level species
  - Target species

# Fishing Results and Composite Processing

- Sample Period: March 2025 – May 2025
- Sampling methods prioritized recreational fishing techniques
  - e.g. “hook and line” fishing was used before electrofishing
- 198 whole fish = 45 composites total
  - 18 higher trophic level composites
  - 18 low trophic level composites
  - 9 target species composites



# Watershed Monitoring Procedures

## Routine monitoring includes

- Cyanotoxin analysis—EPA 546 (2018-present)
- Cell counts (2011-present)
- Nutrient profiling (2009-present)
- Secchi depth (2009-present)
- In situ sonde measurements (2009-present)
  - CTD, %DO, pH, chl-a, BGA PC, and fDOM



# Analytical Methods

- Samples analyzed for total microcystins/nodularins using **MMPB technique**



Using the MMPB technique to confirm microcystin concentrations in water measured by ELISA and HPLC (UV, MS, MS/MS)

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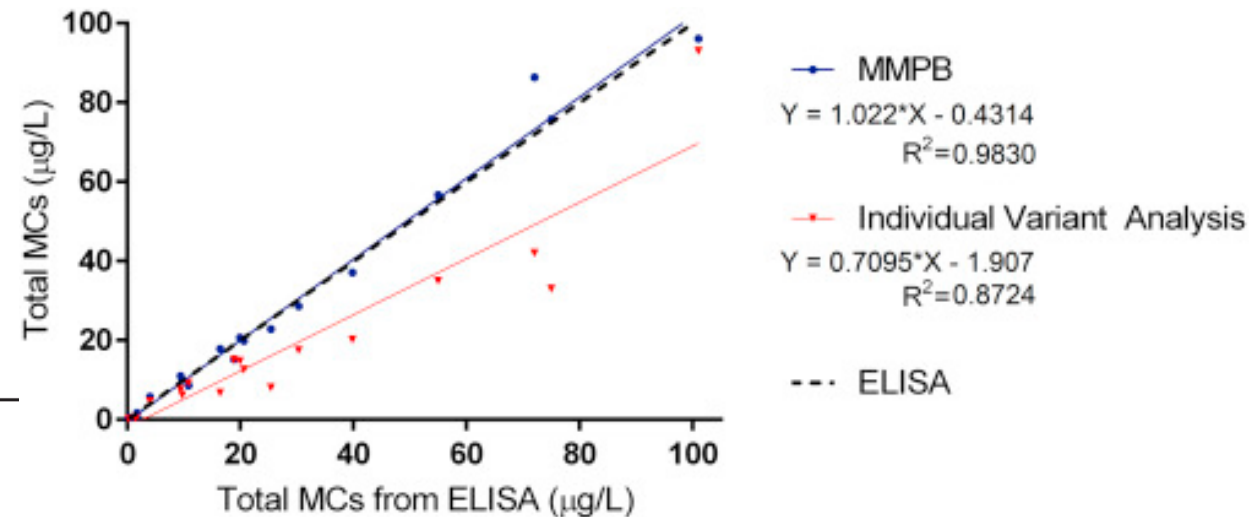
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10110

ALGAL TOXIN ANALYSIS—MICROCYSTINS AND NODULARINS (PROPOSED)

Approved by Standard Methods Committee, 2022. Joint Task Group: Amanda Foss (chair), Hunter Adams, Greg Boyer, Steve Morton, Ann St. Amand.



- Samples with positive results for total microcystins/nodularins were then analyzed for individual variants.

# Microcystin Results Overview

Sites	Microcystin Detections
Walter Wirth Lake	Not Detected
Freeway Lakes	Not Detected
Fern Ridge Reservoir**	Not Detected
Detroit Lake*	6 composites (67%)
Henry Hagg Lake**	Not Detected
Prineville Reservoir*	Not Detected

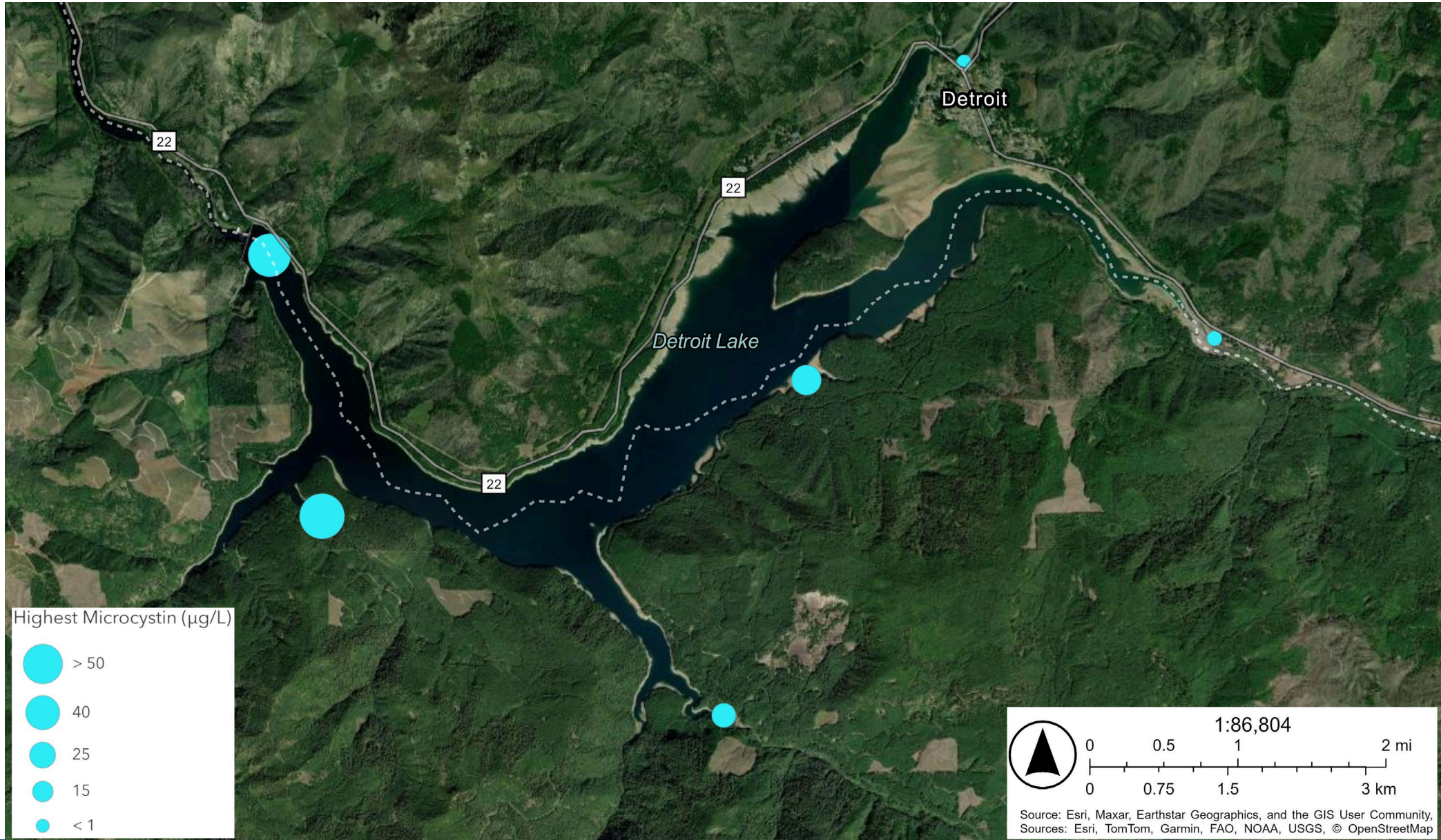
\*= historic presence of cyanobacterial blooms with microcystin detection

\*\* = historic presence of cyanobacterial blooms (16Sqpcr)

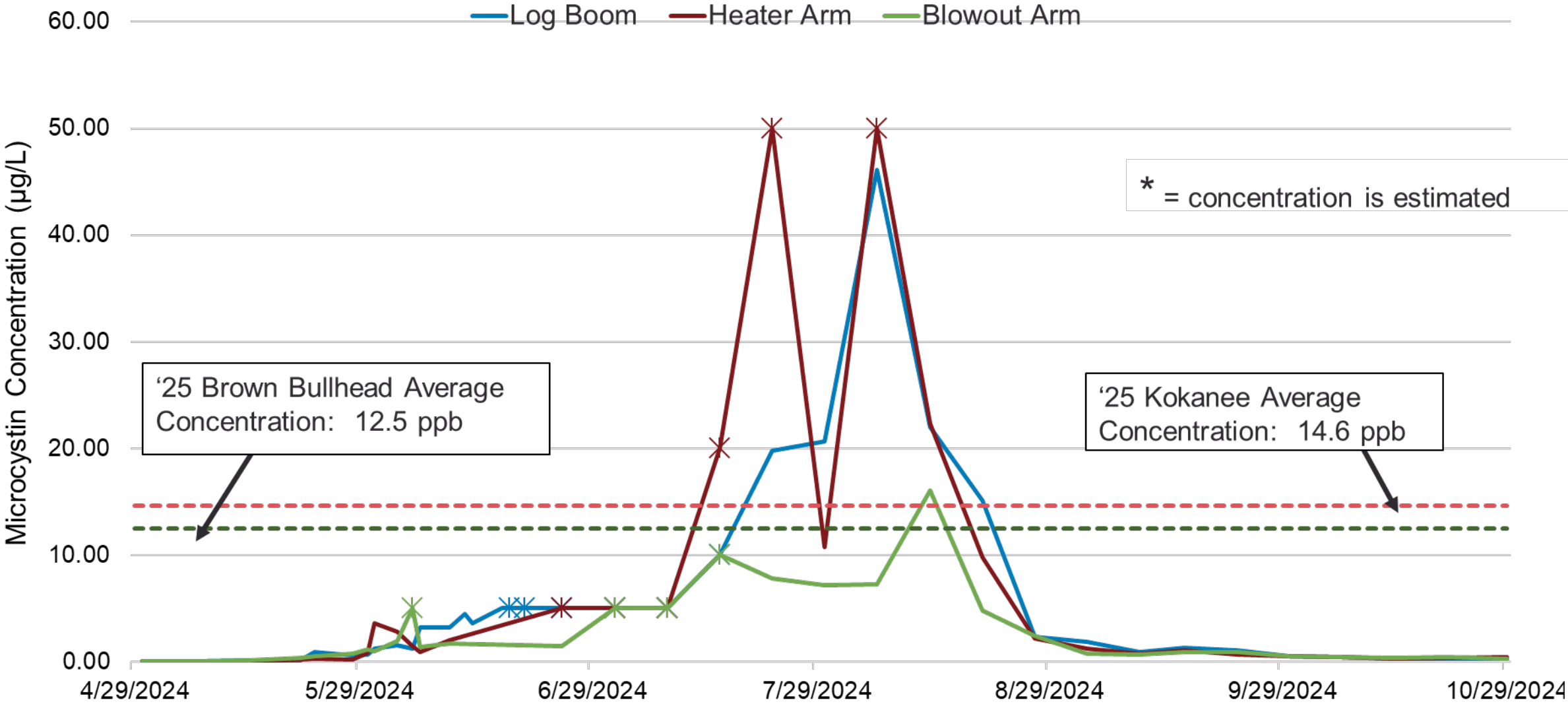
# Detroit Lake Microcystin Results

Composite	Species	Total Microcystin/ Nodularin Result (NG/G)
41930A	Mountain Whitefish	ND
41930B	Mountain Whitefish	ND
41930C	Mountain Whitefish	ND
41930D	Brown Bullhead	10.7
41930E	Brown Bullhead	11.8
41930F	Brown Bullhead	15.2
41930G	Kokanee	12.2
41930H	Kokanee	15.0
41930I	Kokanee	16.6

# Detroit Lake – 2024 Highest Microcystin Detections



# 2024 Detroit Reservoir Microcystin Detections



# Advisory Development

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**RfD** = 0.04  $\mu\text{g}/\text{kg}/\text{day}$  } Based on 2020 WHO Tolerable Daily Intake (TDI)

$$\text{Meals per month recommended} = \left( \frac{BW \times 30.44 \frac{\text{days}}{\text{month}}}{0.227 \frac{\text{kg fish}}{\text{meal}}} \right) \times \frac{RfD}{\text{Avg microcystin concentration}}$$

Fish consumption advisory required at < 23 meals/month

# Advisory Development Example: Kokanee

- Kokanee are a popular species targeted for consumption at Detroit Reservoir
- Grouped mean for total microcystins/nodularins: 14.6  $\mu\text{g}/\text{kg}$



$$\left( \frac{80\text{kg} \times 30.44 \frac{\text{days}}{\text{month}}}{0.227 \frac{\text{kg fish}}{\text{meal}}} \right) \times \frac{0.04 \mu\text{g}/\text{kg}}{14.6 \frac{\mu\text{g}}{\text{kg}} \cdot \text{day}} = 29 \frac{\text{meals}}{\text{month}} =$$

**No Advisory  
Needed**

# Next Steps

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- Analyze temporal aspect of cyanotoxin production vs accumulation/elimination in fish tissue to inform public health recommendations.
- Target sites for future sampling that had high microcystin concentrations within the last year (e.g., Prineville Reservoir, Upper Klamath Lake)
- Evaluate fish organs, specifically liver, skin, and muscle separately to better understand microcystin distribution throughout fish tissue and refine fish cleaning and consumption guidance for public health protection.
- Incorporate future study results into messaging and outreach to the public, particularly subsistence fishers.

# Thank you!

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