

HARMFUL ALGAE BLOOMS

Oregon Tribal
Environmental Forum

November 2, 2015

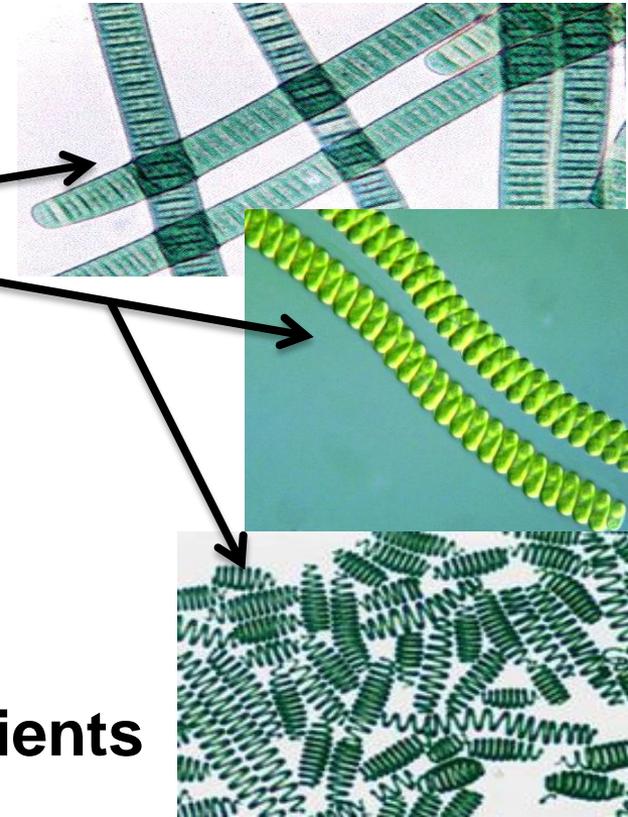
Rebecca Hillwig
Natural Resource Specialist
Public Health Division
971-673-0431
rebecca.hillwig@state.or.us

Oregon
Health
Authority



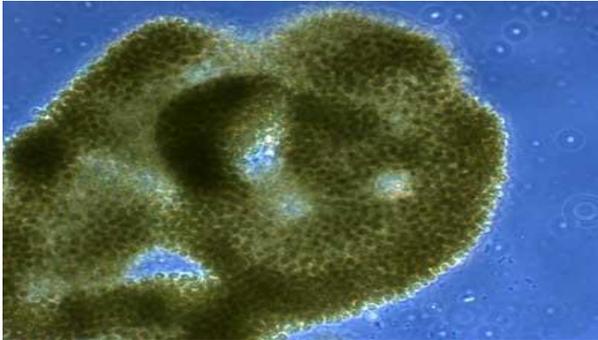
Cyanobacteria – interesting facts

- **Prehistoric:** Oldest life form (3½ billion yrs)/reported since 12th century
- **7,500 species:** 1 of largest most important groups of bacteria
- **Photosynthetic – created earth's O₂ atmosphere**
- **Naturally occurring in water** (suspended)
- **Can be blue-green, pink, red, brown**
 - Red sea named for Oscillatoria blooms
 - White flamingos turn pink eating Spirulina
- **Some species can fix nitrogen**
- **All need a source of phosphorous**
 - Can store P for use when levels limited
 - Slight Δ in water pH can > solubility of P and other nutrients – gives cyanos upper hand
- **Regulate buoyancy - optimal light/nutrients**



Major genus of cyanobacteria in Oregon

Diverse group of aquatic, photosynthetic bacteria (not algae!)



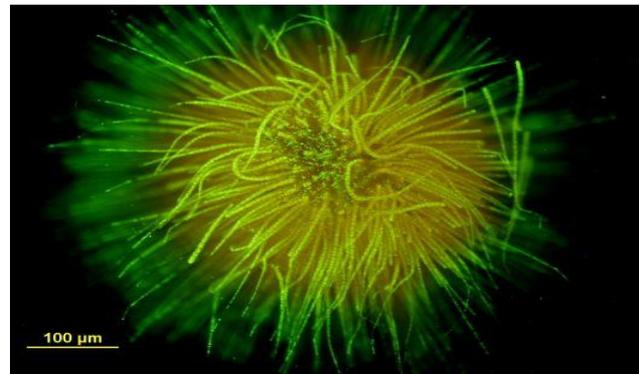
***Microcystis*: Very hardy**
Produces microcystin and anatoxin-a



***Dolichospermum*: Not as hardy**
Produces Microcystin, anatoxin-a + 2 others



***Aphanizomenon flos aquae*:**
Non-toxin producer in Oregon



***Gleotrichia*: Not as hardy**
Produces microcystin

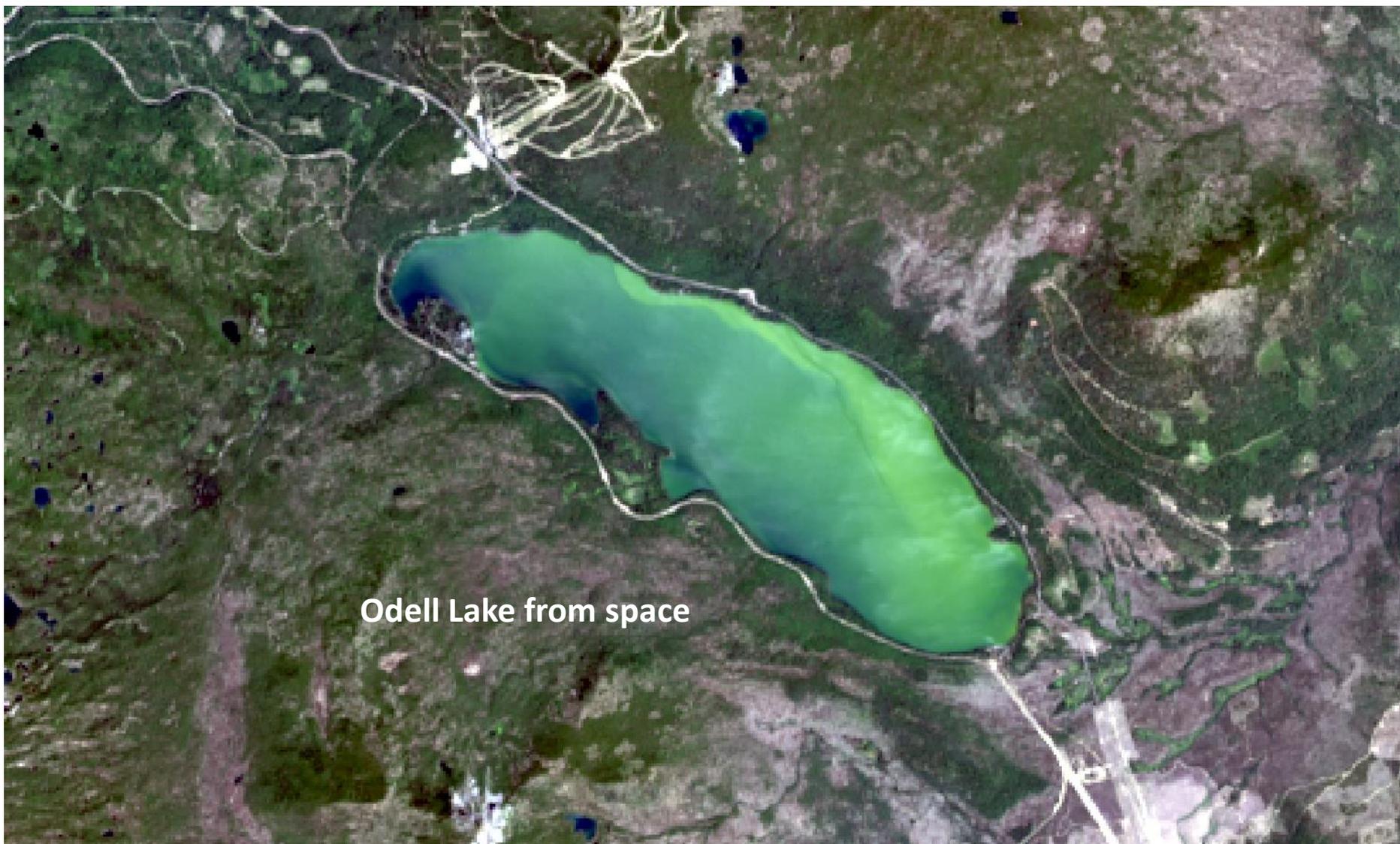
Water monitoring

Recreational

- Non regulatory
- Recommended when heavily used or for source water
- Few lakes monitored
- River systems not usually monitored
- Monitoring strategies in flux
 - Resource limitations pushing less testing
 - Opting for other ways to reduce exposures/liability
 - More education/outreach
 - More signage at monitored & unmonitored lakes

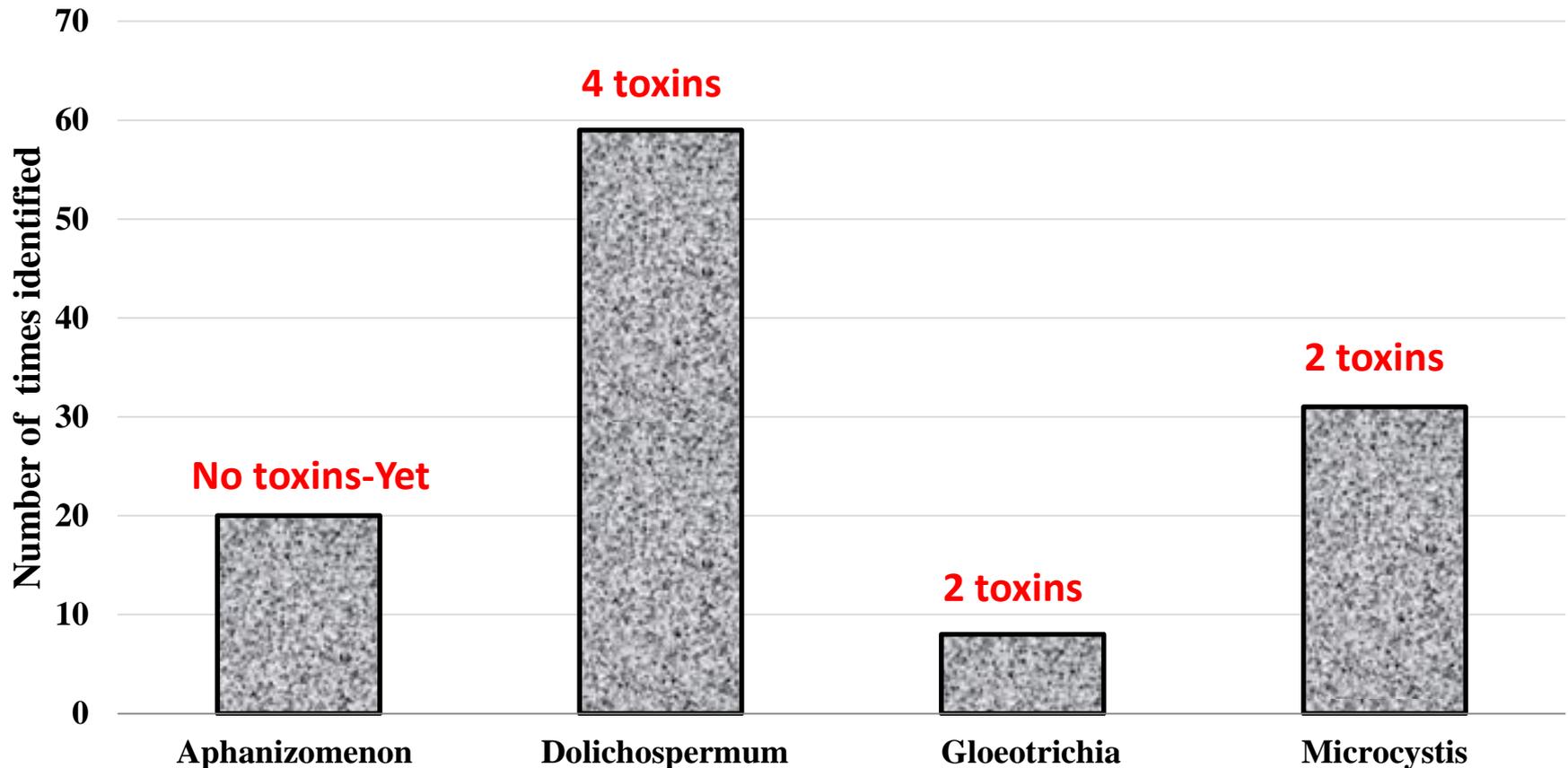


Cyanobacterial blooms in Oregon



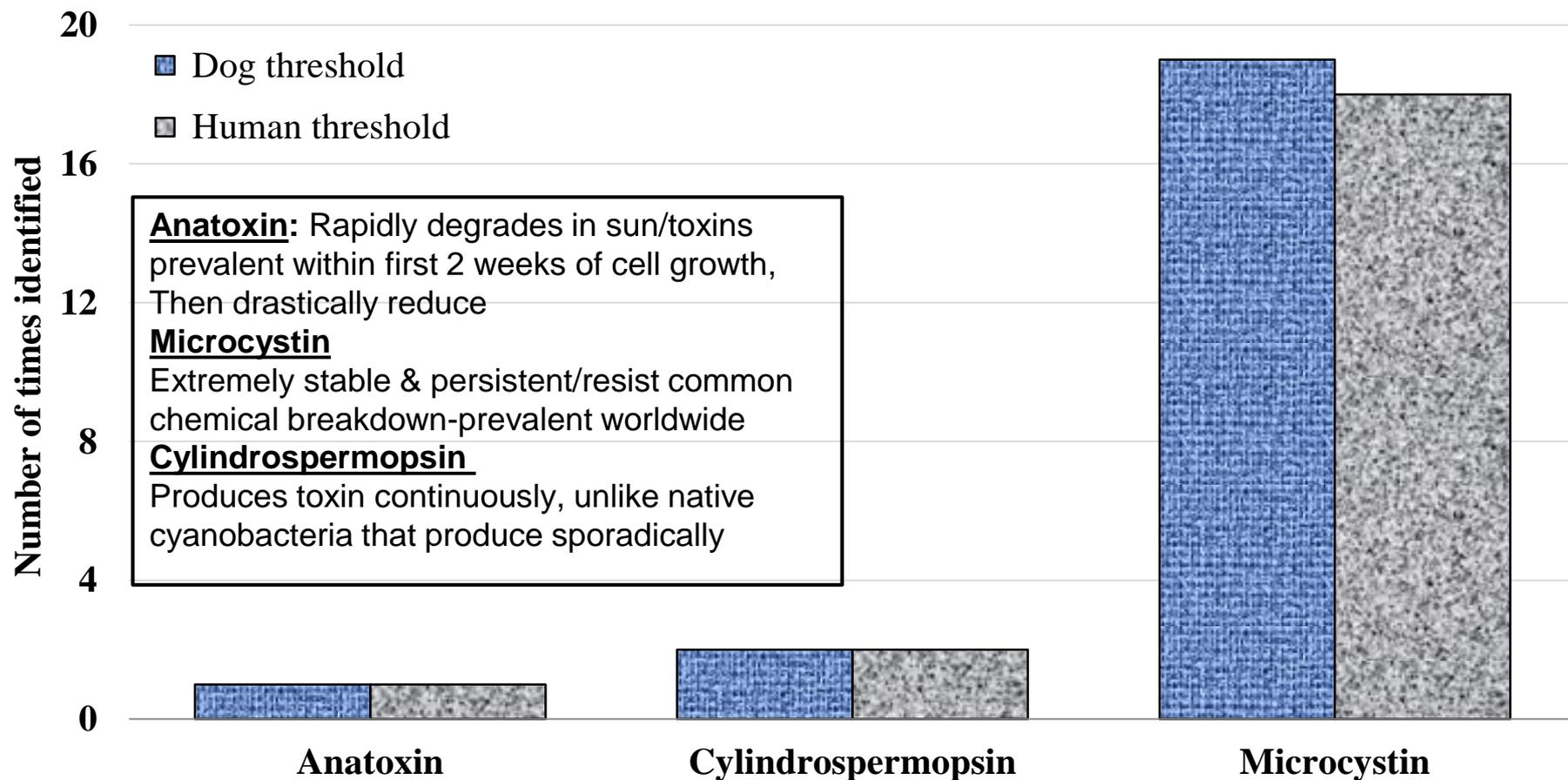
Odell Lake from space

2009-2015: Cell count data



Number of times genera of cyanobacteria identified over cell count guideline values (GV) during advisories in monitored waterbodies.

2009-2015: Toxin data



Number of times cyanotoxins identified over recreational GV advisories in monitored waterbodies - GVs dependent upon genera

Toxins, target organs & symptoms

Genetic and environmental factors can cause toxin production – research is ongoing

Toxins Produced	Type of Toxin	Target Organ	Genus of Algae
Anatoxin-a (20 ppb/ dogs 0.4 ppb)	Neurotoxins	Nervous System <i>Labored breathing, convulsions, numbness, paralysis and death</i> <i>Dog deaths caused by Anatoxin-a</i>	<i>Dolichospermum</i> <i>Planktothrix</i> <i>Oscillatoria</i>
Saxotoxin (10 ppb/dogs 0.02 ppb)			
Microcystin (10 ppb/dogs 0.2 ppb)	Hepatotoxin	Liver <i>GI symptoms (food poisoning), elevated liver enzymes in blood, destruction of cells/blood vessels</i>	<i>Dolichospermum</i> <i>Microcystis</i> <i>Gloeotrichia</i>
Cylindrospermopsin (20 ppb/dogs 0.4 ppb)	Hepatotoxin	Liver and Kidneys <i>Symptoms like food poisoning/Pos. kidney failure</i>	<i>Cylindrospermopsis</i> <i>Dolichospermum</i> <i>Planktothrix</i> <i>Oscillatoria</i>

All species produce Lipopolysaccharides that can cause skin irritation

Things I need to know



- Ingestion is major route of exposure
- Current research says toxins are not absorbed through skin
 - Contact w/cells can cause sensitivity: > exposure = more prone to rash
 - Direct ‘contact’ can cause itchy eyes, sore throat and congestion
- No known antidotes
 - Cannot remove by boiling filtering or treating with camping style filters
- Wash skin & clothes thoroughly with clean water (soap if available)
- Prevent pets from licking fur and rinse with clean water
 - Symptoms develop within 1 hr. of exposure - seek veterinary help
- Children, people w/health conditions & pets at greatest risk
 - Symptoms develop within 24 hrs. – If they persist seek medical help

Much remains unknown, but...

Recent studies have shown:

- Small % of toxins ingested w/food in blood/organs in RT₁
- Barriers to Microcystin (MC) uptake at various levels
 - Can bioaccumulate in invertebrates but reduced up food web
 - if taken up, aquatic organisms can detoxify & fish can rapidly excrete
 - Biodilution occurs in food web: toxins degraded/excreted at every level₂
- MC: liver/viscera/intestine/dig. gland/liquid fat/kidneys/gonads
- Fillets/meat: slight to no accumulation of MC or other toxins
 - People can safely consume two 8-oz fillets/wk from water bodies (WB) with blooms producing MC₃
 - Clean and discard everything but muscle tissue

Much remains unknown, but...

- *Daphnia* spp. vary in sensitivity to blooms
 - all suffer reduced fitness in response to microcystis blooms
- MCs stress juvenile crayfish & freshwater mussels
- Some extracts can disrupt fish endocrine⁴
- Anatoxin-a can cause motor impairment in rainbow trout⁵
- MC can impair plant physiology & metabolism
- Cylindrospermopsin can inhibit plant pollen germination
- No chronic studies have been performed
- MC concn. > in WBs where MC concn. in water high
- MC highest in carnivorous fish

Cyanobacteria outcompete for survival

- Long evolution produced diverse/highly effective adaptations to ensure survival
- Can grow in depleted dissolved O₂ environments detrimental or fatal to fish
- Thrive anywhere & well adapted to environmental stress
 - Live in hot springs, under ice packs & rocks in deserts, > pH conditions
 - First organisms to colonize bare rock/soil after long periods of drought
 - Photosynthesis increases pH – gives cyanos an edge – kills fish
 - Exposure to UV, high solar radiation and extreme temps not a problem
 - Deal with scarce or abundant resources
 - When everything else is gone, they will survive
- Highly toxic strains outcompete toxic/non-toxic strains
- Competitive advantage increases likelihood of HAB events

Cyanobacteria outcompete for survival

Factors promoting survivability/dominance of cyanos¹

Increased water & air temperature

- ✓ Water warms & mixing stops: restricts O₂/nutrients to surface
- ✓ Cyanos move through water column for best food/conditions-others can't
- ✓ Increased water temp - good for cyanos, bad for fish

Decreased water flows - increased salinity

- ✓ Cyanos quite salt tolerant
- ✓ Creates favorable conditions for invasion of marine HABs

Increases in CO₂

- ✓ Cyanos pull N & CO₂ from air/H₂O: > access = > bloom growth and occurrence
- ✓ Competition & shading kills other biota

Extreme weather events

- ✓ Increased transport of nutrients from land to water via runoff
- ✓ Drought increases length of time water can retain nutrients
 - > nutrients & longer retention time = > food longer = > & denser blooms

Health advisory notification and outreach

- E-mail alerts/Gov-Delivery messages sent DMAs/local HDs/DEQ/stakeholders/public
- News release issued
Posted on PHD/OHA websites
- Social media tools (e.g.- Twitter)
- Toll-free information line updated
877-290-6767
- Program website/map updated
<http://www.healthoregon.org/hab>
- Advisory signs posted
- Calls from public and media addressed



HEALTH ADVISORY

AVOID POOLS OF WATER IN BEDROCK ALONG THIS RIVER

Cyanobacteria (blue-green algae) has been found in these pools. This presents a serious health risk because cyanobacteria can produce toxins that cause serious illness in pets, animals and humans.

- Dogs have died after drinking from these pools.
- Stay out of rock formations that hold water.
- Avoid water contact. Do not drink or swallow water.
- Children and pets are at greatest risk.

When in doubt, stay out: don't go in water that is pea-green or blue-green.

For more information contact Douglas County Health Department
OHA Harmful Algae Bloom Surveillance program
www.healthoregon.org/HAB

HARMFUL ALGAE BLOOMS IN OREGON WATERS

What is this stuff?
Harmful algae blooms (HABs) are not algae at all. They're actually made of cyanobacteria, also called blue-green algae. Many cyanobacteria species create toxins that can make people and pets sick.

So, what's the problem? HABs can:

- Create toxins that can cause illness in humans and animals
- Pollute Oregon lakes and other fresh waters with scums
- Limit recreational activities in lakes, reservoirs and rivers
- Cause challenges for public water supplies including taste and odor problems and water filtration difficulties

Why are HABs a health concern?

- Water contact can cause skin irritation or rash
- Swallowing water can result in diarrhea, cramps, vomiting and dizziness
- More severe reactions occur when large amounts of water are swallowed
- Children and pets are at the greatest risk

How can I keep my family and pets safe?

- Do not wade, swim or water ski in waters that have signs of an algae bloom
- Never drink lake or river water
- If you decide to eat fish from affected waters, remove all fat, skin and organs before cooking
- Never cook with natural water from areas suspected to have a harmful algae bloom
- If you or your pet becomes ill, seek medical or veterinary attention immediately

When in doubt, stay out!

Know the signs of an algae bloom. Don't go in water that is foamy, scummy, thick like paint, pea-green, blue-green or brownish red.

Learn more about HABs at healthoregon.org/hab or call 1-877-290-6767.

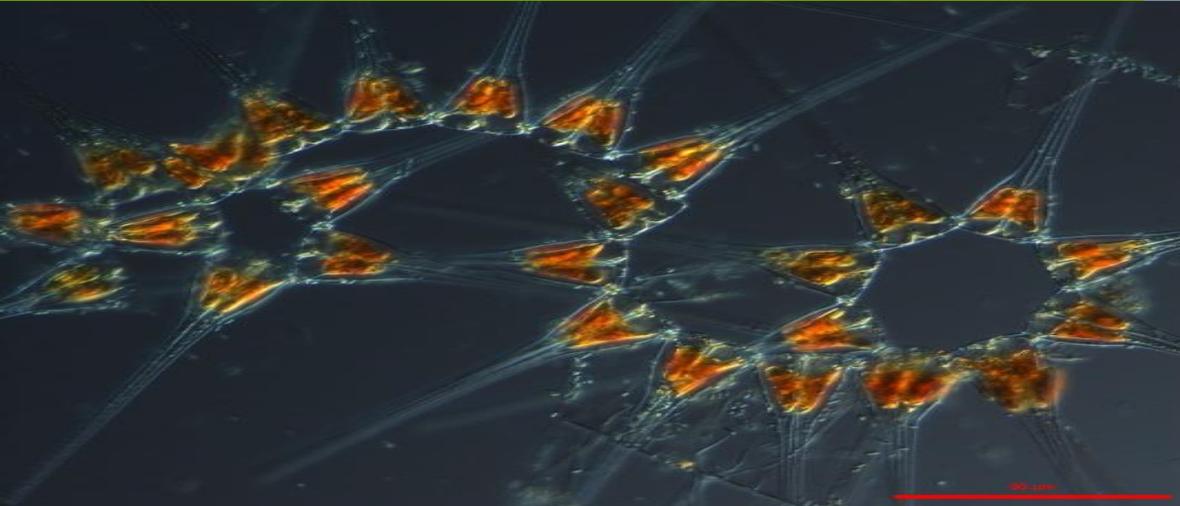
AVOID WATER CONTACT
Do not use this water for drinking or cooking

HARMFUL CYANOBACTERIA (BLUE-GREEN ALGAE) LEVELS

Activities that don't involve water contact like canoeing, hiking & camping are encouraged

For more information contact Oregon Public Health at 877-673-6400 or visit healthoregon.org/HAB

Additional information



- www.healthoregon.org/hab
- Rebecca Hillwig – rebecca.hillwig@state.or.us
- David Farrer – david.g.farrer@state.or.us