Drought, Water Quality, and Human Health

Hannah Riedl
Water Quality Specialist
Montana Department of Environmental Quality
DEQ public water supply:

• Training for managing systems during drought
• Source water protection
MPDES permits issued by DEQ are based on 7Q10 flow conditions (ARM 17.30.635(2))

- 7Q10: based on historical stream flow data, this is the minimum flow expected for 7 consecutive days during any 10-year period
- If flows fall below the 7Q10, the permit no longer ensures beneficial uses are protected
Water quality standards are tied to specific pollutants and beneficial uses.

Aquatic life

Recreation

Drinking water

Agriculture
Less water during drought conditions could result in water quality exceedances due to:

- Less dilution potential
- Increased thermal loading
- More mixing (lakes, reservoirs)
Harmful and nuisance algal blooms are of concern due to changing precipitation regimes, increased temperatures, and prevalence of drought (e.g., Smucker et al. 2018; Walter et al., 2018)
Cyanobacteria are thought to be responsible for creating the oxygen in our environment and they do an A+ job fixing nutrients, but.....

Cyanobacteria can produce toxins that impact liver, nerve, and skin cells.
HABs like warm, nutrient rich, stagnant water and sunlight.

It is hard to predict when toxin production will occur.

Example cyanobacteria

Example cyanotoxin they may produce

Microcystis

Aphanizomenon

Anatoxin

<table>
<thead>
<tr>
<th>Tier 1: Caution</th>
<th>Tier 2: Caution</th>
<th>Tier 3: Consider Closure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Probability of Acute Health Effects</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Cyanobacterial Cell Density (cells/ml)</td>
<td>&lt;20,000</td>
<td>20,000 – 100,000</td>
</tr>
<tr>
<td>Microcystins (ug/L)</td>
<td>&lt;4</td>
<td>4 – 20</td>
</tr>
<tr>
<td>Anatoxin-a (ug/L)</td>
<td>Non-Detect</td>
<td>Detect – 20</td>
</tr>
<tr>
<td>Additional Factors</td>
<td>Visual presence but no reported illness</td>
<td>Reports of animal illness or death</td>
</tr>
<tr>
<td>Health Risks</td>
<td>Negligible</td>
<td>Short-term effects such as skin irritation, nausea, vomiting, diarrhea. Potential for long-term effects.</td>
</tr>
<tr>
<td>Recommended Actions</td>
<td>Post caution signs, visually monitor for changes</td>
<td>Post caution signs, notify private water users and media with advisory.</td>
</tr>
</tbody>
</table>

Exposure to toxins via inhalation, ingestion, contact

Cannot tell toxicity just by looking!
Although nuisance green algae don’t produce toxins, these blooms do impact aquatic life and humans

- Depletes oxygen in water column
- Shifts aquatic food web
- Decreases carrying capacity in ditches, interferes with diversions
- Decreases people’s desire to recreate (Suplee et al., 2009)
- Decreases property values (e.g., Wolf and Klaiber, 2017)
Benthic ("bottom") HABs are gaining more attention

Exposure through ingestion of mat material

Benthic HABs like clear water with stable flows and substrate

(photos: hcb-2.itrcweb.org, UT DEQ)
Resources offered by Montana’s State HAB Program:

- Accepts reports of HABs

1) Enter “HAB.mt.gov”

2) Click here
Montana accepts reports of harmful or nuisance algal blooms through HAB.mt.gov

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Reports</th>
<th>Confirmed Cyanobacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>46</td>
<td>NA</td>
</tr>
<tr>
<td>2018</td>
<td>63</td>
<td>50</td>
</tr>
<tr>
<td>2019</td>
<td>47</td>
<td>26</td>
</tr>
<tr>
<td>2020</td>
<td>64</td>
<td>42</td>
</tr>
<tr>
<td>2021</td>
<td>47</td>
<td>29</td>
</tr>
</tbody>
</table>
Resources offered by Montana’s State HAB Program

Monitoring

- Visual confirmation
- Cyanotoxin presence/absence
- Taxonomic ID
Resources offered by Montana’s State HAB Program

- Public outreach via articles, signage, press releases, attending events, other opportunities
- Coordination with partners to issue closures when necessary
Questions?
Hannah.Riedl@mt.gov 406-444-0549