Harmful Algal Bloom (HAB): Lady Bird Lake

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Agenda

• HAB Background

• Review of 2019 HAB

• 2020 Plan

• Feedback and Questions
What is a “Harmful Algal Bloom?”

It occurs when algae produces toxins

• Most commonly occur with Cyanobacteria (blue-green algae)
HAB types

Planktonic (free floating)  
(Most common)  
Lake Erie

Cohesive mats (benthic or floating)  
Lady Bird
Cyanobacteria Toxins

Species may produce a toxin from four main groups

• Anatoxin-a (neurotoxin)
• Cylindrospermopsin (cytotoxicity, liver/kidney toxicity)
• Microcystin (hepatotoxin)
• Saxitoxin (neurotoxin)

Drinking water standards

• EPA – microcystins 0.3 \( \mu \text{g/L} \); Cylindrospermopsin 0.7 \( \mu \text{g/L} \)
• States – Anatoxin-a 0.7 – 20 \( \mu \text{g/L} \); Saxitoxin – 0.3 – 3 \( \mu \text{g/L} \)

A lot of toxin variants!

• For example, over 100 types of microcystin structurally ID’d
HAB E(a)ffects

Human and animal health

Economic

Perception

Health Impacts of Cyanotoxins

Note: Not all cyanotoxins lead to all of these health impacts. These listed impacts are caused by microcystins or cylindrospermopsin, the two cyanotoxins that EPA has issued Health Advisories for.

Brain
Source: Ingestion
Symptoms:
- Headache
- Incoherent speech
- Drowsiness
- Loss of coordination

Respiratory System
Source: Inhalation
Symptoms:
- Dry cough
- Pneumonia
- Sore throat
- Shortness of breath
- Loss of coordination

Digestive System
Source: Ingestion, drinking contaminated water, or eating contaminated fish
Symptoms:
- Abdominal pain
- Nausea
- Vomiting
- Diarrhea
- Stomach cramps

Body
Source: Contact, e.g. swimming
Symptoms:
- Irritation in eyes, nose, and throat
- Blistering around the mouth
- Skin rash, including tingling, burning and numbness
- Fever
- Muscle aches (from ingestion)
- Weakness (from ingestion)

Organs
Source: Ingestion
Symptoms:
- Kidney damage
- Abnormal kidney function
- Liver inflammation

Nervous System
Source: Ingestion
Symptoms:
- Tingling
- Burning
- Numbness

IN HUMANS

IN PETS

Symptoms:
- Vomiting
- Fatigue
- Shortness of breath
- Difficulty breathing
- Coughing
- Convulsions
- Liver failure
- Respiratory paralysis leading to death
What Happened in 2019?

Lady Bird, specifically Red Bud and Auditorium shores, experienced benthic-surface HAB event
Locations

- Red Bud Isle (below Tom Miller Dam)
- Auditorium Shores (across from Downtown)
- Long-Term Monitoring Site
The City’s Response to 2019 HAB

Response Initiation and Timeline

• Fast! Samples collected first weekend dog deaths reported, parks/launches closed, signage up, media engaged

How we kept people informed?

• Media, social media, on-site signage

How we monitored

• Approx. bi-weekly sampling of water quality and mats to determine nutrient dynamics at sites, duration of bloom
The 2019 Bloom

Species in the Order Oscillatoriales

- Many known toxin producers in this group
- UT developing species database

Within algae mats dihydroanatoxin dominant

Contents = <1 – >130 ng/g wet weight mat (or 0.13 mg/kg)

- State and federal guidelines and criteria have been developed for water (i.e., ug/L concentrations)
- Means that there is no guidance as to what is a “safe” level of toxin present
- Toxicology study suggested 0.3 mg/kg acute toxicity for dogs
## The 2019 Bloom

### Water Temps

- **>30°C weekend of dog deaths**

### Nutrients

- **Abundant Nitrogen (esp NH$_3$??) and Phosphorus**
- **Distinct water quality @RB compared to previous years**

<table>
<thead>
<tr>
<th>Data period</th>
<th>Site name and ID (n)</th>
<th>TSS (mg/L)</th>
<th>NH$_3$ (ug/L)</th>
<th>Nox (ug/L)</th>
<th>TKN (ug/L)</th>
<th>TN (ug/L)</th>
<th>TP (ug/L)</th>
<th>N:P</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>Red Bud West 1996 (4)</td>
<td>n/a</td>
<td>41.1 ± 7.7</td>
<td>111.0 ± 42.2</td>
<td>401.0 ± 28.7</td>
<td>513.5 ± 40.6</td>
<td>26.0 ± 20.8</td>
<td>87.1 ± 72.7</td>
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<tr>
<td></td>
<td>Auditorium Shores 1252 (4)</td>
<td>n/a</td>
<td>24.1 ± 20.3</td>
<td>396.0 ± 148.0</td>
<td>404.5 ± 56.5</td>
<td>798.3 ± 200.9</td>
<td>17.7 ± 6.5</td>
<td>119.1 ± 74.3</td>
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<tr>
<td>2016-2018</td>
<td>Red Bud 5 (9)</td>
<td>2.6 ± 0.9</td>
<td>10.8 ± 8.3</td>
<td>130.8 ± 81.5</td>
<td>424.6 ± 133.6</td>
<td>555.4 ± 119.2</td>
<td>12.6 ± 9.3</td>
<td>125.4 ± 47.0</td>
</tr>
<tr>
<td>2019</td>
<td>Red Bud 5 (5)</td>
<td>2.1 ± 1.1</td>
<td>21.5 ± 22.0</td>
<td>477.9 ± 622.0</td>
<td>370.8 ± 56.1</td>
<td>848.7 ± 621.2</td>
<td>29.6 ± 17.2</td>
<td>81.3 ± 66.6</td>
</tr>
<tr>
<td>2016-2018</td>
<td>1st St. 2 (9)</td>
<td>3.7 ± 2.0</td>
<td>20.4 ± 37.3</td>
<td>247.1 ± 208.5</td>
<td>485.9 ± 206.0</td>
<td>733.0 ± 275.5</td>
<td>13.4 ± 8.2</td>
<td>153.5 ± 83.4</td>
</tr>
<tr>
<td>2019</td>
<td>1st St. 2 (5)</td>
<td>1.9 ± 0.4</td>
<td>16.1 ± 11.1</td>
<td>434.6 ± 184.0</td>
<td>388.4 ± 33.2</td>
<td>823.0 ± 213.2</td>
<td>15.7 ± 11.7</td>
<td>160.1 ± 75.5</td>
</tr>
</tbody>
</table>
The 2019 Bloom

Discharge rates

- Late July drop in discharge coincided with bloom and toxins event
The 2019 Bloom

Discharge rates

• Late July drop in discharge coincided with bloom and toxins event

• Ave was lower than previous 3-year period
Cyano. Pop. Drivers

Cyanobacteria growth follows regular seasonal cycles

- Late summer — hot, low flows, lack of rain
- Add in nutrients — recipe for a bloom
What Made 2019 Different?

- Zebra mussels? (new)
  - Alter water chemistry
  - Promote dense benthic growth

- Large flooding, runoff, depositional events? (new)
  - Altered sediment and water chemistry?

- Climate change? (new)
- Dog waste? (old)
- Low flows (old)
  - But now coupled with new drivers!
Monitoring Plan 2020

Routine Monitoring

- 9 times per year at 3 fixed sites for water chemistry
- Purpose is to see long-term trends

HAB Monitoring

- Began in June at 4 sites
- Collaboration with UT
  - DNA fingerprinting, toxin ID and content
- Water quality
  - Nutrients, water temp, pH
- Tracking discharge velocities through LBL
Some (new) Data

How about in 2020?

Similar cyanobacteria appear to be present (matching observations with 2019 DNA library)

Toxins identified earlier

Discharges declined earlier than in 2019

Nutrients still abundant

Positive 7/14
**Communication Plan 2020**

**Signage around Lady Bird Lake**

**Engage Key Stakeholders**
- Other CoA Depts (PARD, AW, APH) and Partner Agencies (LCRA)
- Concessionaires, the Trail Foundation
- Veterinary Associations, Austin Pets Alive
- Downtown Austin Alliance, Austin Visitors Bureau

**Engage Media and Social Media**
- Continue to work with media partners w/occasional news release
- Announce initial monitoring, changes in risk status using Facebook, Twitter, and Next door, listservs
Website

Most current information at austintexas.gov/algae

- Current status — low, increased, or high risk
- Summary of test results for toxins
- Information about algae present on the lake
- Information about temperatures and flow
Questions?

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