The Lake Superior Algal Bloom Subgroup: Partnering for Nearshore Cyanobacterial Bloom Monitoring, Research, and Public Health Outreach

Gina LaLiberte
Wisconsin Department of Natural Resources
Duluth-Superior flooding June 19-20, 2012
7-10 inches of rain & 500-year storm event

Duluth, MN Event, 19-20 June 2012
Annual Exceedance Probabilities (AEPs) for Worst Case 24-hour Rainfall
Hydrometeorological Design Studies Center
Office of Hydrologic Development, National Weather Service
National Oceanic and Atmospheric Administration
http://www.nws.noaa.gov/oh/hdsc/
Map created on 12 July 2012.
Rainfall frequency estimates are from NOAA Atlas 14, Volume 8 Version1 (to be published in 2013).
Observations come from COOP, CoCoRAHS, and ASOS datasets. Not all data have been verified.

Derek Montgomery, Minnesota Public Radio
Bob King, Duluth News Tribune
Sediment plumes from June 19-20 storms. Arrow is bloom sample location on July 15.

July 15, 2012:
*Dolichospermum lemmermannii*
Known algal blooms in Lake Superior

Michelle Wheeler, WDNR
Once-In-A-Lifetime Rains Falling Frequently On Northern Wisconsin

Northwestern Wisconsin Has Seen 100-Year Rains Several Times In Last Decade

By Danielle Kaeding
Published: Wednesday, June 20, 2018, 2:00pm

In the last decade, areas of northern Wisconsin have experienced severe storms with heavy rains that are only projected to occur once in a lifetime, according to precipitation archives from the National Oceanic and Atmospheric Administration.

An official analysis of the weekend's storms in northern Wisconsin by NOAA confirms that 100 to 1,000-year rainfall events occurred in some areas of the state.
Perhaps unprecedented surface algal bloom at @LakeSuperior shore at Cornucopia, WI yesterday. We are coordinating with Apostle Islands NPS to sample today. Photo by Brenda Lafrancois. Nutrients, warming, wind, what have you done?

Algae Bloom in Lake Superior Raises Worries on Climate Change and Tourism

Scientists collecting samples of the algae. Lake Superior is one of several major bodies of water where algae blooms have drawn scientific scrutiny. Brenda Miranda Lafrancois

By Christine Hauser

Aug. 29, 2018

In 19 years of piloting his boat around Lake Superior, Jody Estain had never observed the water change as it has this summer. The lake has been unusually balmy and cloudy, with thick mats of algae blanketing the shoreline.
2019: north of Thunder Bay, ON 19-20 September
How do grab samples represent nearshore conditions?

- Distribution of blooms?
- Water quality conditions leading up to and during blooms?

2 events/month; June – Sept; 1 bloom event
Possible Detection of Saxitoxin in Lake Superior Blooms

50 µg/L Saxitoxin Standard

Sample# NPS-03688

Retention Time (Min) vs. Intensity (Counts per Second)

Todd Miller, University of Wisconsin Milwaukee (millertr@uwm.edu)
www.toddrexmiller.com
Mixture of Standard and Sample Gives One Peak

1:1 Mixture of NPS-03688 and STX Standard

Intensity (Counts per Second)

- 300 m/z -> 204 m/z
- 300 m/z -> 110 m/z

Retention Time (Min)

13.3 min

Algae Bloom in Lake Superior Raises Worries on Climate Change and Tourism

“...tests showed that none of its commonly occurring toxins were found in hazardous concentrations”

-New York Times Aug. 29, 2018

Todd Miller, University of Wisconsin Milwaukee (millertr@uwm.edu)
www.toddrexmiller.com
Presumptive Saxitoxin Concentrations

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www.toddrexmiller.com
**Where do the blooms originate from?**

Incubation studies by PhD student Kaitlin Reinl, work ongoing.

<table>
<thead>
<tr>
<th>Location</th>
<th>High molar N:P (50)</th>
<th>Low molar N:P (1.5)</th>
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<tbody>
<tr>
<td></td>
<td>15°C</td>
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<tr>
<td></td>
<td>20°C</td>
<td>20°C</td>
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<td></td>
<td>25°C</td>
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18 Combinations of Location x Nutrient x Temp

Incubated samples from three locations in different chemical and temperature conditions.

1. *Dolichospermum* grew from Harbor and River but not from Lake.

2. High conductivity and low temperatures were associated with increased potential for cyanobacteria growth.

Growth = Temp. X Cond.  
$R^2 = 0.57, p=0.00015$
Degree days (> 10 C) shows clearly how blooms occurred in warm years.

 majors: Major Bloom, Minor Bloom, No Bloom

Bloom Season

DD mean bloom season

2011 521
2012 1081
2013 550
2014 445
2015 830
2016 777
2017 809
2018 758

Bob Sterner
The 2012 and 2018 storms were truly historic

Blooms occurred 25 (2012) and 53 (2018) days after the storms.

Coincidence?
Public Health Outreach

Ad hoc group for bloom notification to tribal & local public health agencies & other interested parties

April 29, 2019 “Blooms and the Big Lake” workshop with Wisconsin Division of Public Health and Lake Superior National Estuarine Research Reserve
Blue-green algae are bacteria known as cyanobacteria and are a natural part of water bodies. With enough sunlight and nutrients, cyanobacteria can grow quickly and form a blue-green algae bloom.

- Blooms often look like spilled paint or pea soup.
- Blue-green algae can produce toxins that can make people and animals sick.

**Is it blue-green algae... or something else?**

**SCAN you before SWIM**

A blue-green algae bloom may be present. Blue-green algae can produce toxins that can make people and animals sick.

**Be alert! Avoid water that:**

- Is discolored or streaky
- Looks like spilled paint or pea soup

✓ Do not swallow lake water or touch foam, scum, or algal mats.
✓ Do not let pets swim in scummy water or lick algae off their fur.
✓ Rinse fish with fresh, clean water and throw away guts before cooking and eating.
✓ Do not swim in areas where you cannot see your feet in knee-deep water.

**Be alert! Avoid water that:**

- Has floating scum, globs, or mats
- Has small green dots floating in it

For questions, call [phone number]

To learn more about blue-green algae, visit [website]

**CAUTION**

**BLUE-GREEN ALGAE (CYANOBACTERIA) BLOOM MAY BE PRESENT IN THE WATER**

Blue-green algae can produce toxins that can make people and animals sick.

**Be alert! Avoid water that:**

- Is discolored or streaky
- Looks like spilled paint or pea soup
- Has floating scum, small green dots

✓ Do not swallow lake water or touch foam, scum, or small green dots
✓ Do not let pets swim in scummy water or lick algae off their fur.
✓ Rinse fish with fresh, clean water and throw away guts before cooking and eating.
✓ Do not swim in areas where you cannot see your feet in knee-deep water.

Call your doctor, the Wisconsin Poison Center, or your veterinarian if you or your animals have sudden sickness or signs of poisoning.

**BEACH CLOSED**

**BLUE-GREEN ALGAE (CYANOBACTERIA) BLOOM PRESENT**

Blue-green algae can produce toxins that can make people and animals sick.

**KEEP YOURSELF AND YOUR PETS OUT OF DISCOLORED WATER AND DO NOT TOUCH FOAM, SCUM, OR ALGAL MATS**

Call your doctor, the Wisconsin Poison Center, or your veterinarian if you or your animals have sudden sickness or signs of poisoning.

Wisconsin Poison Center: 800-222-1222

For questions or to report a blue-green algae-related illness, call [phone number]