What are harmful algal blooms?

- A quick growth of algae in lakes and rivers
- They are actually bacteria, not algae. The scientific names is “cyanobacteria”
- These small bacteria have chlorophyll, like plants, which give them a green or blue-green color. They are photosynthetic bacteria.
- Ecologically important
  - Nitrogen cycle
  - Symbiotic relationships
    - Plants, fungi
Algae Blooms

- Abundant nutrients, proper light conditions, and warm, stagnant water
- Typically occur in late summer/early autumn
- Often float to the surface and form scums
- Accumulate along shorelines
Harmful Algae Blooms (HABs)

- Negative impact on aquatic life
  - Block sunlight
  - Deplete dissolved oxygen
  - Produce toxins

- Indicators of toxic blooms
  - Fish kills
  - Dead waterfowl and other animals in close proximity to the water
What are cyanotoxins?

- Diverse group of natural toxins
  - Cyclic peptides (hepatotoxins)
  - Alkaloids (neurotoxins, cytotoxins, dermatotoxins)
  - Irritant toxins (lipopolysaccharides)
- Biological function unclear
- Harmful concentrations during blooms
- Microcystins
  - Commonly occurring in fresh water; produced by several genera of cyanobacteria
Monitoring Program Structure

- **Sampling design**
  - Focus has been on recreational waters, primarily state park beaches
  - Weekly samples for total microcystins

- **Survey with rapid turnaround**
  - Public health decisions
  - Action threshold of 20 µg/L total microcystins

- **Samples collected Monday/Tuesday**
  - Results available Thursday afternoon
  - Resample results by Friday, if needed
Sampling Protocol

- Visual assessment
  - General appearance
  - Scums

- Sample collection
  - Composite
  - Discrete

- Transferred in coolers in dark conditions
Cyanotoxin Advisory Policy

- Three-tiered advisory policy
  - Based on results from both composite and discrete samples
  - **Stage 1** (no algal toxin-related advisories)
  - **Stage 2** (advisory) - sample result exceeds 20 µg/L total microcystins
  - **Stage 3** (closure) – toxin result > 2000 µg/L; reported health case(s).
Informing the Public

- General information signs
- Park staff notified; post advisory signs
- Iowa Department of Public Health HAN
- IDNR Beach Monitoring website
- Beach Monitoring Hotline
- Press releases
Microcystin Poisoning

- Exposure to elevated levels of microcystin can cause health impacts from different routes of exposure
  - Dermal exposure (swimming and wading in water)
  - Ingestion (drinking water, mostly incidentally for humans)
  - Inhalation (breathing – boating, water skiing)

- Health impacts are related to exposure amount
  - A low dose where no adverse health impacts are seen
  - Increasing dose causes increasing adverse health impacts
Health Impacts from Microcystin Poisoning

- Dermal Impacts
  - Skin irritation
  - Rash
  - Blistering

- Ingestion Impacts
  - Gastrointestinal distress
  - Muscle weakness
  - Liver impacts (hepatitis)
  - High doses can cause liver failure

- Inhalation Impacts
  - Slight respiratory distress
  - Severe allegoric response
Illness Surveillance

- The Iowa Department of Public Health (IDPH) is responsible for tracking illness in humans attributed to microcystin poisoning.
- Reporting of suspected cases of microcystin poisoning required of health care providers.
- The IDPH works cooperatively with local health care partners in this tracking process:
  - Local county environmental health
  - Local network of health care providers
How Illness Surveillance Works

- Mandatory reporting requires all suspected cases to be reported to IDPH
- Results from IDNR monitoring indicates elevated microcystin toxin at state beaches
- Reports of suspected cases of microcystin poisoning come from health care providers, local county health, individuals
- Reports of cases are investigated further by IDPH staff and cases entered into database.
Summary of Elevated Levels of Microcystin

- Top 10 Locations and Weeks of Elevated Microcystin Levels (2011-2016)
  (Showing County and HUC 8 Watershed)

  - Black Hawk Lake (Sac) (North Racoon)  25 Weeks
  - Green Valley Lake (Union) (Platte)    21 Weeks
  - Lake of Three Fires (Taylor) (One Hundred and Two)  11 Weeks
  - Union Grove Lake (Tama) (Middle Iowa)  10 Weeks
  - Lake Geode (Henry) (Skunk)          10 Weeks
  - Pine Lake (Hardin) (Upper Iowa)     9 Weeks
  - Big Spirit Lake (Dickinson) (Little Sioux)  7 Weeks
  - Lake Keomah (Mahaska) (South Skunk)  6 Weeks
  - Rock Creek Lake (Jasper) (North Skunk)  4 Weeks
  - Viking Lake (Montgomery) (West Nodaway)  4 Weeks
Summary of Elevated Levels of Microcystin

- Lake-Weeks* of Elevated Levels of Microcystin (2011-2016)
  - 2011  10 Lake-Weeks
  - 2012  12 Lake-Weeks
  - 2013  21 Lake-Weeks
  - 2014  21 Lake-Weeks
  - 2015  34 Lake-Weeks
  - 2016  37 Lake-Weeks

* Lake-week is defined as a week in which an elevated level of microcystin was noted at a particular lake
Suspected Cases of Microcystin Poisoning

Number of suspected cases reported

- 2011: 10 cases *
- 2012: 2 cases
- 2013: 2 cases
- 2014: 4 cases
- 2015: 8 cases
- 2016: 2 cases

* Four cases were at triathlon
Suspected Cases of Microcystin Poisoning

- Most common adverse symptom complaints
  - Diarrhea: 8 complaints
  - Stomach or abdominal pain: 7 complaints
  - Rash: 7 complaints
  - Fever: 5 complaints
  - Headache: 5 complaints
  - Fatigue: 4 complaints
  - Nausea: 4 complaints
  - Shortness of breath: 3 complaints
  - Vomiting: 3 complaints
Thank You! Questions?

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