STREAM Lines

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EFFECTIVE UTILITY MANAGEMENT WORKSHOP IN MARCH | SCIENCE FAIR SEASON IS COMING!

Preparing Water Resource Managers to IDENTIFY AND MEASURE TOXIC CYANOBACTERIA

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Figure 1. Thick bloom of *Microcystis aeruginosa* in Lago de Pátzcuaro, Mexico.

Harmful algal blooms (HABs; Figure 1) occur when phytoplankton uncontrollably grow in response to excessive nutrients (namely phosphorus and/or nitrogen), elevated light or temperature, reduced flow, or changes in foodwebs (e.g., removal of large predatory fish). In freshwater systems, prokaryotic cyanobacteria are the main taxa associated with HABs. In addition to producing taste and odor compounds, such as geosmin and 2-methylisoborneol, that cause muddy or musty tastes and smells in drinking water, some cyanobacteria produce secondary metabolites that are hepatotoxic (e.g., microcystin) or neurotoxic (e.g., anatoxin-a). Some of the cyanobacterial genera associated with toxic HABs include colonial *Microcystis* and filamentous *Anabaena*, *Aphanizomenon*, *Cylindrospermopsis*, and *Planktothrix*. These taxa are fairly easy to identify microscopically, and we encourage water resource managers to have the necessary infrastructure available to determine if green water is potentially bad, such as a compound light microscope (100x-400x magnification) connected to a camera to document organisms of concern and share pictures with phycologists to confirm identifications. Phytoplankton identification training events are regularly held around the country and could provide higher level capabilities, if needed.

It is also important to remember that toxigenic cyanobacteria have the potential to produce toxins, but do not always produce toxins (this is an active area of research). In other words, high algal abundance is not indicative of a HABs. There needs to be a high concentration of toxigenic cyanobacteria actively producing toxins to reach dangerous levels of algal toxins. Again, having access to a microscope can allow water resource managers to quickly confirm if there is a potential threat of cyanobacterial toxins.

The USEPA has recently set drinking water advisory thresholds for microcystin (>0.3 ug/L for children younger than six and >1.6 ug/L for people ages six and older), and cylindrospermopsin (>0.7 ug/L for children younger than six and >3.0 ug/L for people ages six and older). In 2018, UCMR 4 will require routine cyanobacterial monitoring. The USEPA has established an excellent website with many resources about freshwater HABs – *https://www.epa.gov/nutrient-policy-data/cyanohabs*. Measuring algal toxins via enzyme-linked immunosorbent assay (ELISA) is relatively easy and requires a 96-well plate reader, pipets, and ELISA kits specific to the cyanobacterial toxins of interest. USGS researchers have put together an excellent website dedicated to studying freshwater HABs, including details about sampling and analyses – *https://ks.water.usgs.gov/cyanobacteria*.

In conclusion, we want to encourage water resource managers who regularly deal with HABs to acquire the necessary tools and training to identify and measure phytoplankton, including taxa related to toxic HABs. Better understanding of special and temporal trends in our aquatic systems will improve the management of HABs.