Water WoRDs

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Are Things Looking Smeary Again Down on Lake Erie (and Elsewhere in Michigan)?

Years after Dr. Seuss first published his book The Lorax in 1971, our colleagues at the Ohio Sea Grant Program wrote to Dr. Seuss and lobbied him to remove the line, "I hear things are just as bad up in Lake Erie," from the book. They were successful in demonstrating the Lake's improvement yet water quality professionals across the Great Lakes region are again struggling with the "smeary" effects of excess nutrients in our surface waters.

Nutrients (including phosphorus and nitrogen) occur naturally in soils and water and are necessary for plant growth. Nutrients come from natural sources such as fertile soils, decomposing plant material, and wildlife wastes. Excess nutrients enter surface waters from point source discharges such as sewage treatment plants and non-point sources like lawn and agricultural fertilizer use. When excess nutrients enter a lake or stream, those nutrients may greatly increase plant or algae growth, which in turn may become harmful to aquatic life and aesthetically unappealing to humans.

Lake Erie shoreline 'muck', June 2012

Excessive amounts of plant or algae growth may be visibly different depending on conditions in a lake or stream. Some blue-green algae blooms look like spilled green, blue, or red paint. In rivers, strings of the green algae cladophora can be over 10 feet long and form dense mats that fill up most of the channel. Excess nutrients can also produce significant growths of rooted plants making swimming and boating difficult. Filamentous green algae and rooted plants, besides being an aesthetic nuisance and problem for swimming and boating, can wash up in large quantities on some Great Lakes beaches and create a harbor for E. coli and other bacteria to persist or grow. The E. coli in these rotting mats of filamentous algae and plant material is a health concern for animals and humans.

Lake Erie blue-green algae bloom, August 2013

At its worst, excess nutrients can lead to harmful algal blooms (HABs), a concentrated growth of blue-green algae. The health concerns related to HABs involve exposure to toxins (for example, microcystin) produced by blue-green algae that can sicken people and sicken or kill wildlife, pets, and livestock when touched, ingested, or inhaled. The various toxins produced by HABs can affect animal and human liver, skin, and nervous systems. Ideal conditions for HABs include sunny weather with warm air and water temperatures. Unfortunately, it is not possible to visually determine if a given HAB is producing toxins. Water samples can be collected and analyzed to determine how much microcystin is present in the water, but currently there are a limited number of laboratories doing the analyses and the price of the tests can be high.

Because information specific to individual algae blooms is often not available and many states (including Michigan) do not currently have standards for safe human or animal contact with HABs, the general recommendation is for animals, children, and adults to stay out of any large algae bloom, especially surface scums, and to rinse animals and people that have been exposed as soon as possible. It is similarly

advisable to avoid the rotting vegetation on some great lakes shorelines. The treatment of HABs (e.g. with algaecide) is generally avoided because of health concerns regarding the uncertainty around toxin production and the possible sudden release of high toxin concentrations as algae cells die due to treatment.

Control of HABs thus far has been focused on broad efforts at nutrient reductions within watersheds as well as understanding the ‘hows' and ‘whys' of bloom formation through modeling. Better understanding of HAB formation can lead to better predictions of when they might form so that, even if blooms cannot be avoided, managers of beaches and drinking water intakes (as well as the general public) can be better informed and prepared. A good example of this effort is the National Oceanic and Atmospheric Administration's experimental HAB Bulletin based on the forecasting system in place for Lake Erie.

The apparent upswing in algae in near shore areas and beach muck around various portions of the Great Lakes, not just Lake Erie, likely is the result of complex interactions and processes. As an example, research into causes of the upswing in algal blooms in Lake Erie, particularly the Western Basin, provides insight into the complexity of the issue. A combination of weather, water temperatures and currents, lake levels, nutrient inputs, and invasive species all may play part in the changes being seen in algae and plant growth.

Warm temperatures during the 2010 summer and heavy spring rainfall in 2011 have been linked as a possible explanation for the particularly extensive blooms Lake Erie experienced those years. In addition, invasive zebra and quagga mussels serve to maintain blue-green blooms by selectively feeding on different types of algae and rejecting blue-green algae. The invasive mussels, present in Lake Erie since 1988, have also been linked to concentrating nutrients (specifically phosphorus) from the water column into near-shore areas, creating nutrient-rich zones more likely to generate algae blooms.

The input of nutrients into the Lake Erie system continues to be a primary focus as well, including concerns over agricultural sources of fertilizers, land application of feedlot manure, and point-source discharges such as treated and partially treated wastewater from municipal treatment facilities. Recommendations on how to begin to fully address these sources, particularly phosphorus related, are highlighted in two recent reports, including the International Joint Commission (IJC) 2009-2011 Priority Cycle Report on Nuisance and Harmful Algae (9 MB PDF), and the Status of Nutrients in the Lake Erie Basin prepared by the Lake Erie Nutrient Science Task Group.

A number of multi-jurisdictional groups and organizations have been addressing, and will continue to address, the issue of Lake Erie's water quality condition with specific attention being paid to algae blooms and the sources contributing to their resurgence. The U.S. EPA's Great Lakes National Program Office works with Environment Canada as well as various state agencies, including the Michigan Department of Environmental Quality and Office of the Great Lakes (which coordinates the Lake Erie Lakewide Management Plan (LaMP)) to identify ecosystem goals and objectives, assess the state of Lake Erie, and identify actions to restore and protect the lake. The LaMP process brings together binational partners for addressing these environmental and natural resource issues, coordinating research, pooling resources, and making joint commitments to improve the environmental quality of Lake Erie.

What do you do in the WRD? Meet Sarah Holden and Kevin Goodwin

Kevin Goodwin has been an Aquatic Biologist for the Surface Water Assessment Section of the Water Resources Division for over 14 years. Kevin has a B.S. in Fisheries and Wildlife Biology from UMASS Amherst and a M.S. in Fisheries Science from Virginia Tech. He spends his time monitoring water quality primarily in the AuSable, Clinton, and Rouge watersheds using the DEQ's rapid assessment procedures to look at stream insects, fish, and habitat conditions. He has also been monitoring Michigan's Lake Erie shoreline the past 2 years to understand beach conditions related to algae and 'muck'. Among other things, Kevin also coordinates the DEQ's biennial reporting of statewide water quality to the USEPA through the 303(d), 305(b) Integrated Reporting process.

Sarah Holden has been an Aquatic Biologist for the Surface Water Assessment Section of the Water Resources Division for over 13 years. Sarah has a B.S. in Zoology from UW-Madison and a M.S. in Fisheries and Wildlife from MSU. She spends her time monitoring water quality primarily in watersheds that drain to Lake Michigan. Among other things, Sarah has been involved in developing a Nutrient Framework for Michigan, draft numeric nutrient criteria, and nutrient TMDLs.