CSMI Cooperative Science and Monitoring Initiative

Eighty Years of Tiny Lake Erie Critters

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It's easy to get excited about new science: new discoveries, cool things maybe never before seen, a solution to a problem that's evaded being solved for decades. But sometimes, it's worth taking a step back to look at what's been done before, and how that history can inform future research.

The U.S. Geological Survey (USGS) has been collecting information on Lake Erie benthos – the mollusks, snails and worms that live in sediments on the lake bottom – since the 1930s. Many of these organisms are considered indicators of how healthy an ecosystem is, so determining changes and trends over time can help management agencies like the Environmental Protection Agency (EPA) evaluate and track the effectiveness of protection strategies and regulations.

With data from 1930, 1961, 1982, 1993, 2010 and 2014, the researchers have a lot to work with, but progression in identification techniques and microscopy means that first, the information has to be adjusted to make numbers directly comparable. That means, for example, that if early data only gets as specific as the genus of a mollusk, instead of identifying it down to a specific species, scientists adjust later data accordingly, even if it's more detailed, to conform to a lowest common denominator.

While the final numbers are still being compiled and standardized, some general trends in benthos populations have already emerged. Researchers measure benthos by the number of organisms found in a square meter of sediment, and from 1930 to 1982, those numbers increased dramatically, from 2,000 to almost 146,000 on average. That increase was likely due to the major pollution and abundance of nutrients found in Lake Erie at the time – those nutrients feed algae, which in turn feed the worms that make up the majority of Great Lakes benthos.

From 1982 to 2003, benthos populations dropped by more than 80 percent, due to pollution reduction efforts that removed nutrients from the environment. But by 2014, those numbers had climbed back up, creating a zig zap pattern that closely follows trends in nutrient runoff and algal blooms in the lake.

To arrive at those population estimates, researchers took sediment samples at a number of established sampling sites across the western basin, to make sure results were directly comparable to previous years' sampling trips. They

use a ponar grab sampler, which looks a lot like a smaller version of the clamshell grab on an excavator, to pull up sediment from the lake bottom, and rinse that sample through a fine mesh screen to remove fine silt and clay. Whatever stays on the screen is preserved and taken back to the lab, where it will be further separated into the various benthic sub-groups – mollusks, worms, midges and other benthos – that the scientists are interested in.

Some of that separation can be done by hand, using tweezers and strong lighting. What's left over after that is put under a microscope to pick out the smallest organisms. Once everything is separated and preserved in individual vials, those vials are sent off to experts who can identify the collection of mussels or worms more specifically. It's a long and detailed process, but it provides valuable information to those monitoring and working to preserve the health of the Great Lakes for future generations.

One particular type of benthic organism, the mayfly, has been used as a key indicator of environmental health by agencies like the Ohio EPA and the International Joint Commission (IJC) to assess how Lake Erie and the other Great Lakes are faring over time. Mayflies require very clean water to breed and begin their life cycle in lake sediments, until the adult mayflies hatch into the swarms many visitors to Lake Erie are familiar with. In western Lake Erie, mayfly populations dropped to essentially zero between 1930 and 1961, and remained extremely low until 1993, when scientists found about twelve mayfly larvae per square meter of sediment. Most recently, those numbers have increased dramatically, to 300-400 mayflies per square meter, a testament to environmental protection efforts and improving water quality.

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The Cooperative Science Monitoring Initiative (CSMI) is an yearly coordinated monitoring program between the US and Canada to support the restoration and protection of the waters of the Great Lakes and led by the GLWQA Science Annex to address the science priorities of the Lakewide Management Annex.