CSMI Cooperative Science and Monitoring Initiative

# Watching Mussels Grow: More Important Than You May Think

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Researchers at SUNY Buffalo State's Great Lakes Center are monitoring life at the bottom of the Great Lakes to see how environmental changes such as pollution and harmful algal blooms affect these organisms.

Alexander Karatayev and Lyubov Burlakova have completed analyzing data on zebra and quagga mussels – collectively known as dreissenids in scientific circles – from their 2014 sampling trip in Lake Erie aboard the EPA vessel *R/V Lake Guardian*, supplemented by sampling excursions into shallower waters using SCUBA divers and the Great Lakes Center's research vessel.

The scientists are now working on the rest of the bottom-dwelling organisms they collected in more than 400 samples, which require expert input to be classified correctly, but the dreissenid data have already given them interesting insights into how things like hypoxia affect these invasive species.

Hypoxia, an area of low-oxygen water, develops in the central basin of Lake Erie during the summer and early fall. It's caused when bacteria at the lake bottom decompose dead algae (both regular algal growth and harmful algal blooms) and use up oxygen in the process faster than it can be replenished from the surface or from photosynthesis. When combined with the formation of a thermocline – a sharp border between an upper warm layer and a cold bottom layer of water – that region of the lake becomes hypoxic (low in oxygen) or even anoxic (no oxygen). This can lead to fish kills and other negative impacts on the ecosystem.

The central basin is one of three distinct parts of Lake Erie's depth profile, which also includes the shallow western basin and the much deeper eastern basin. Because the central basin's average depth is only about 18 meters, and the thermocline tends to form at around 15 meters of depth, it's the most prone to developing hypoxia that impacts life at the bottom of the lake.

One question the researchers asked in their data analysis was whether they could use the distribution and size structure (an indicator of mussel age, as older mussels grow larger) of zebra and quagga mussels as a way to map hypoxia in the central basin. They combined sampling data with information from automated loggers that track dissolved oxygen in the water (part of another CSMI project), and found that there is a very good match between where the mussels live and where loggers registered hypoxia.

It turns out that dreissenids are very sensitive to low-oxygen conditions and tend to simply die off and disappear from a given area if hypoxia persists for more than a few days, so if mussels aren't present in an area where they'd usually appear, it's likely that hypoxic conditions are common there. Populations with mussels from multiple years occurred only in the deep eastern basin, an area not affected by hypoxia. Dreissenid populations in both the western and central basin were largely represented by small (young) individuals, indicating that survival beyond two years was limited, most likely by hypoxia. The researchers suggest that monitoring of dreissenid distribution can be an effective tool in mapping the extent and frequency of hypoxia.

To the scientists, this is not just about scientific curiosity though. Understanding what goes on in the Great Lakes affects fisheries, drinking water and recreation for almost 30 million people, and continued monitoring efforts like this one help ensure that changes are noticed before they become too big to address.

Part of that continued monitoring is making sure that samples taken at the same site years apart are still comparable to each other, and to other samples in the study. When comparing newer data to information collected in 2002, results indicated that there had been a decline in mussel populations in the eastern Lake Erie basin during that time, but the researchers weren't quite sure if it was an actual decline or if different sampling methods just gave that impression. The 2014 samples helped confirm that both explanations were partly correct, and going forward, new scientists will have standardized sampling protocols that ensure future data is easily compared to historical trends.

Zebra and quagga mussels also have different habitat preferences and requirements, which means observations in a small area may not account for the overall lake environment at all. Zebra mussels can only live in shallow areas down to about 20 meters and require hard substrate to attach to, so while their range is limited, they appear in areas where people are most likely to notice them. Quagga mussels, on the other hand, have been found as deep as 200 meters and don't mind settling on soft surfaces. So even if the presence of invasive mussels isn't obvious from the shore, regular monitoring is needed to stay on top of the population and its effects on the entire environment.

Those effects can include the potential for more severe harmful algal blooms, as dreissenid mussels don't eat cyanobacteria, which cause the blooms. Instead, they remove green algae and other phytoplankton that compete with the cyanobacteria, giving them more access to the nutrients and sunlight they require to grow.

At the same time, growth tends to slow at the deeper locations where quagga mussels thrive, due to cold and lack of sunlight. How that slower growth balances out a potentially increased population really isn't known yet, so careful monitoring and reacting to changes quickly currently seems to be the only way to stay on top of two aggressive invasive mussel species that could change the entire Great Lakes ecosystem. Projects like the Cooperative Science and Monitoring Initiative do just that.


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.