Aquatic invasive species are more widespread in Wisconsin than previously thought

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Watermilfoil and and algae float near the water's surface where Dorn Creek Marsh flows into the northern edge of Lake Mendota during summer on July 29, 2015. The aquatic plants and the lake's ecosystem health are frequently studied as part of ongoing research conducted by the Center for Limnology at the University of Wisconsin–Madison. Credit: Jeff Miller

A report on more than 40 years of research on Wisconsin lakes is highlighting some of the lessons scientists have learned about aquatic invasive species, including that far more ecosystems are playing host to non-native species than previously thought.

However, the researchers note, those species aren't necessarily detrimental to their new habitat and, in some cases, the negative "impacts of invasive species control may be greater than the impacts of the invasive species" themselves.

That doesn't mean scientists aren't concerned about different species moving into new ecosystems, says Jake Vander Zanden, director of the University of Wisconsin–Madison's Center for Limnology and lead author on the report.

"There are many examples where an invasive species has remarkable ecosystem impacts. They can result in fisheries decline, water quality decrease and more, which negatively impacts humans and the environment," Vander Zanden says.

But ecological destruction is far from a foregone conclusion in invasive species stories.

The researchers, who recently published their analysis in the journal *BioScience*, highlight several lessons learned through four decades of data collection, research and experiments conducted by the North Temperate Lakes Long-Term Ecological Research program.

Research grants typically fund a few years of work, Vander Zanden explains, "But that would never allow you to detect these types of changes. It's only through long-term research that we can get insights into these big questions like where invasive species are, how they are changing our ecosystems and how it all connects to things like climate change."

One such insight is that the presence of non-native aquatic species in Wisconsin lakes is more widespread than scientists and resource managers initially thought.

The long-term research program has helped inform Wisconsin Department of Natural Resources maps and datasets on six target species since the 1990s: Eurasian watermilfoil, zebra mussels, spiny water fleas, rusty crayfish, Chinese mystery snail and the banded mystery snail.

Combining long-term monitoring records on its 11 core study lakes with field-based research and community-based science on dozens of other water bodies, researchers revealed that existing estimates of about 8% of Wisconsin lakes containing one or more of the six species was way off. In fact, the number is closer to 39%.

Additionally, certain invasive populations have been in waters much longer than initially thought. For example, researchers detected spiny water fleas in Lake Mendota in 2009, but scientists combing through sediment cores and old samples discovered that the disruptive invasive species had been present in the lake at least a decade sooner, with populations only erupting due to favorable changes in climate that summer. These findings suggest that invasive species are often simply present in an ecosystem without triggering negative impacts.

What's more, when invasive species do result in negative impacts, those impacts are often tied to existing problems, according to Jake Walsh, a co-author of the new paper and postdoctoral associate in the University of Minnesota's Department of Fisheries, Wildlife, and Conservation Biology.

"Lake Mendota was especially primed for large, costly effects from spiny water flea," says Walsh. "They worsened water quality problems that were already present and tied to excess nutrients in the lake."

Seeing this fuller picture was only possible through long-term research, Walsh adds. "As long as we have this long-range program, invasions are experiments that can teach us about how ecosystems work and how we can best manage them," he says. This has given us a deep understanding of the water quality issues facing Lake Mendota and a 'road map' to follow for offsetting spiny water flea's impact."

Long-term science doesn't just help scientists piece together the history of environmental change, Vander Zanden adds. With it, researchers can also highlight looming questions and design studies to answer them. From using environmental DNA, to exploring long-term invasive species removal benefits, more discoveries are on the horizon.

And it's not just the science that benefits from this long-term, interdisciplinary approach. Undergraduate field technicians who spent their summers sampling the same sites over and over have gone on to become professors overseeing their own research projects and managing their own students. Data scientists and staff dedicate huge chunks of time to making their datasets publicly available and accessible to other researchers in the freshwater sciences.

It's a spirit of collaboration and exploration that, Vander Zanden hopes, can extend to other fields.

"I wonder if some of these patterns that we see from long-term data could be relevant to somebody who studies soil, or grassland flowers, or marine biology," he says. "If invasive species are already there and more widespread than we think they are, things like human activity and climate change could soon be triggering more population shifts."

More information: M Jake Vander Zanden et al, Nine Lessons about Aquatic Invasive Species from the North Temperate Lakes Long-Term Ecological Research (NTL-LTER) Program, *BioScience* (2024). DOI: 10.1093/biosci/biae062

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