What is **eDNA?**

Alison Watts

You've probably heard of eDNA, a technique used for detecting fish, invasive plants, or rare species in lakes and streams. But perhaps you've wondered what it is or wanted to know more about science and how we can apply it. Environmental DNA (eDNA) is DNA (deoxyribonucleic acid) that is collected from the environment. Fish, amphibians, plants, and other organisms constantly leave tiny traces of genetic material in the water around them. By collecting water samples, scientists can identify many of the species living in a lake without having to catch or even see them.

The process is relatively straightforward (Figure 1); water samples are collected from a lake, filtered to capture microscopic fragments of DNA, and sent to a laboratory where the DNA is extracted and analyzed. The lab methods are tailored to meet different needs: single-species analyses focus on one organism of interest, which could be a fish, a plant or a harmful bacteria, while multispecies methods provide a broad inventory of fish, amphibians, and other aquatic organisms present in the ecosystem.

What do we learn from eDNA?

The information gained from eDNA can be used in many ways. Resource managers can monitor changes in fish communities over time, detect invasive species before they become established, confirm the presence of rare or endangered species, and evaluate the effects of habitat restoration or water quality changes. Because collecting water samples is relatively easy and does not disturb wildlife, eDNA also allows lake associations, schools, and citizen scientists to contribute to monitoring efforts. Anyone can collect samples with a little bit of training. Used alongside traditional methods such as netting and electrofishing, eDNA provides a powerful new tool for understanding and protecting lakes and ponds.

In New England, eDNA has been used to detect invasive species such as northern pike and zebra mussels (Figure 2) before they become widespread, to

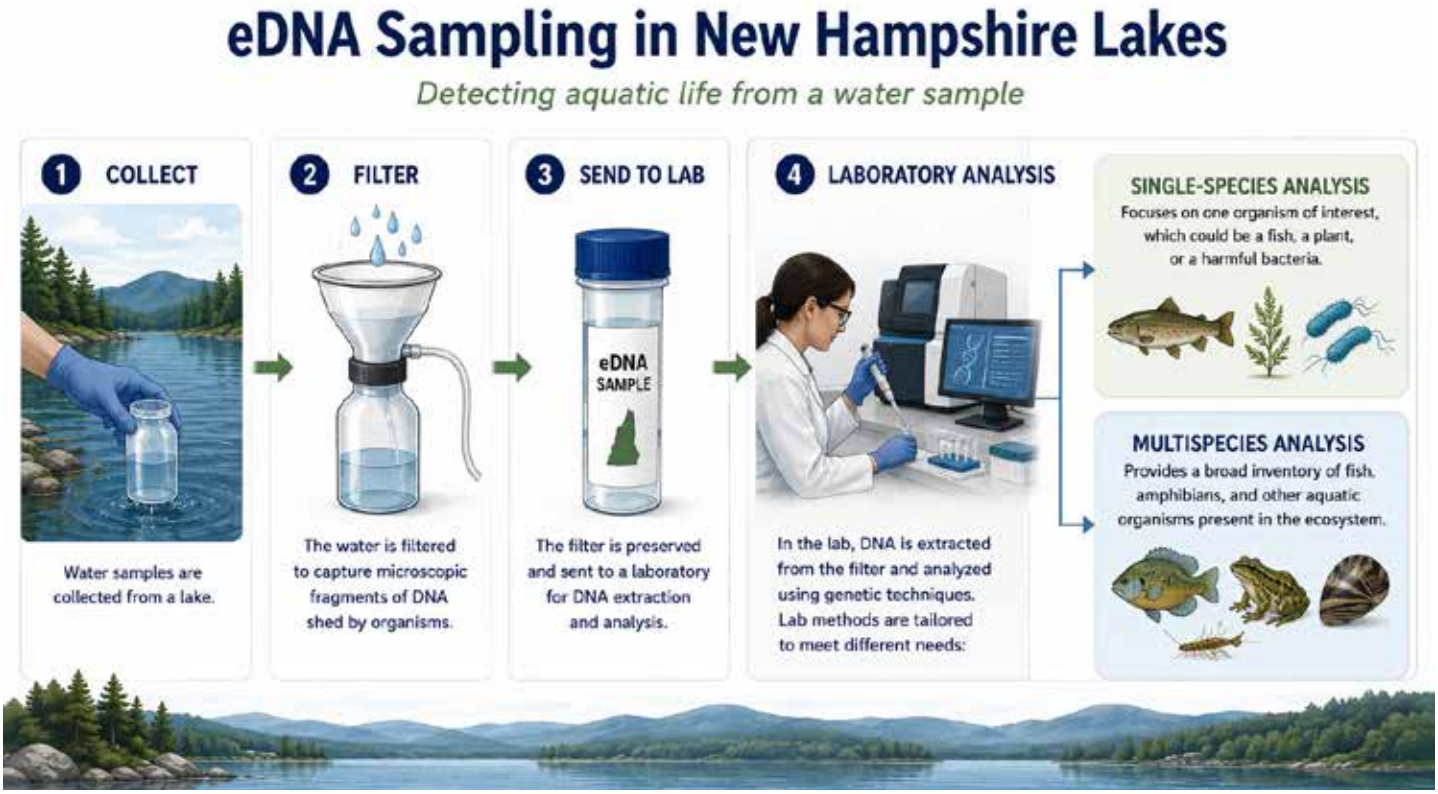

Figure 1. The process and method behind eDNA analysis.

Figure 2. Sampling for Zebra Mussels in Lake Bomoseen, Vermont.

monitor native brook trout populations, and to search for rare species. In large lakes such as Lake Winnipesaukee and Lake Champlain in the East, eDNA can reveal the presence of dozens of species providing a rapid and non-invasive way to understand biodiversity ((Figure 3).

Not a magic wand

It is important to remember that eDNA is not magic! As with any method, eDNA has limitations; a single sample will not provide detailed information for a whole lake, and multiple analyses are needed to detect the full range of species that may be present. A sampling program should be designed to provide enough coverage to capture areas where the target is likely to be present, and multiple samples will increase the chance of detection. Additional samples increase the cost of a program, so managers need to balance the value of more information with the cost (both laboratory and personnel) required to collect and process samples.

Figure 3. The author sampling for spiny water flea eDNA in Lake Winnipesaukee, New Hampshire.

Projects on the horizon

Here in New Hampshire, the state Department of Environmental Services is working with the University of New Hampshire to test eDNA methods to detect spiny water flea, a tiny invertebrate that is invading our lakes. Currently, three lakes are infested with this species, that we know of, but dozens more could potentially already harbor infestations that are yet undetected.

This summer we will collect eDNA water samples at Lake Winnipesaukee, the state's largest lake, where we know the species is present. This information will be used to compare results to net tows where we capture and enumerate individuals. We will use the results to determine how many samples are needed, and what lab methods are most effective. If we are able to successfully detect the spiny water flea, we will expand the program to do initial surveillance at other lakes with the goal of detecting these invasives before they are too established.

Want to know more about eDNA? Here's more information.

Dr. **Alison Watts** is a member of the Department of Civil and Environmental Engineering at the University of New Hampshire. Her research interests include working with regulatory agencies and resource managers to assess and remediate water resource impacts. Her current work is focused on the use of molecular methods, primarily eDNA, and includes early detection of invasive species, water quality indicators, impacts of aquaculture, and baseline assessments in coastal and freshwater systems.

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