Researchers measure fish abundance in a lake using a few water samples

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Researchers from Université Laval and Quebec's Ministry of Forests, Wildlife and Parks have shown that the DNA suspended in lake water can be used to effectively estimate the abundance of fish living in it. The details of this new approach, which could revolutionize how fish stocks are managed in lakes, are presented in a recent issue of the *Journal of Applied Ecology*.

The team supervised by Professor Louis Bernatchez of Université Laval's Faculty of Science and Engineering and postdoctoral researcher Anaïs Lacoursière-Roussel demonstrated this technique using lake trout populations in 12 southern Quebec lakes. The researchers had access to lake trout population estimates obtained through the traditional approach used by their colleagues at Quebec's Ministry of Forests, Wildlife and Parks. This method consists of estimating entire lake populations by extrapolating from the number of fish captured using nets deployed in different parts of the body of water. This method is often time and labor intensive, in addition to having a potentially negative effect on fish populations.

The DNA used by the researchers is known as environmental DNA (eDNA) and is made up of genetic material present in free state in the water. "This DNA comes from cells that have come off the skin of fish," professor Bernatchez explains. "Since this biological material degrades after a few days, its abundance gives a very up-to-date picture of the species in the lake," adds the researcher, who also holds the Canada Research Chair in Genetic Conservation of Aquatic Resources.

To measure the concentration of lake trout eDNA, the researchers took approximately 10 one-liter samples of water from different areas of each lake studied. They then filtered the water and subjected the particles retained to genomic analysis techniques to accurately measure the quantity of lake trout DNA.

The results obtained show a strong correlation between population estimates obtained using the traditional approach and those based on the eDNA concentration. "What's more, the variations in eDNA abundance in different parts of each lake are similar to those reported for net catches," says Bernatchez. "Therefore, eDNA provides a reliable and accurate indication of the number of lake trout and their distribution in a lake, at a much lower cost than the traditional method. We are continuing our work to produce genomic tools targeting several species that are of interest for fishing, including walleye, sauger, brook trout, Arctic char, and northern pike, but also for a number of rare or threatened species as well as invasive exotic species."

Applications for eDNA are not limited to fish populations in lakes. As Louis Bernatchez notes, "We could also adapt this approach for river fish, including salmon."

The article published in the *Journal of Applied Ecology* is coauthored by Anaïs Lacoursière-Roussel, Guillaume Côté and Louis Bernatchez from Université Laval, and Véronique Leclerc from Quebec's Ministry of Forests, Wildlife and Parks.

Provided by Laval University