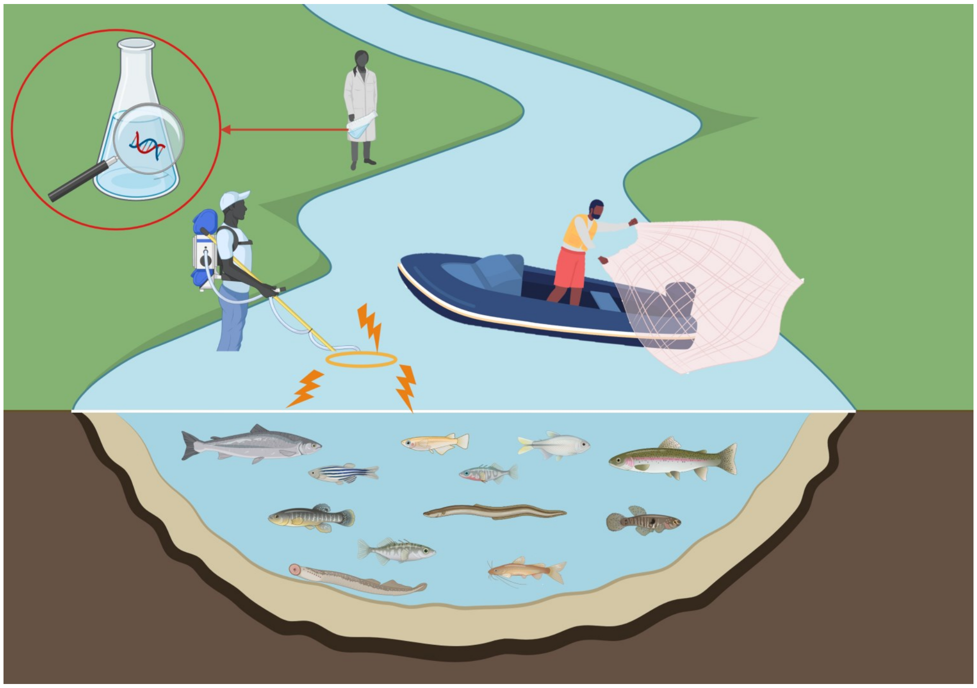
Year-Round Fish Biodiversity Monitoring with eDNA

Case Study

OBJECTIVE: Demonstrate the effectiveness of using eDNA for year-round fish biodiversity monitoring.

Background

Monitoring fish biodiversity typically relies on the capture and identification of fish specimens. In rivers and lakes, this is often done with nets or electrofishing. These methods require a lot of effort and they're difficult to use in the winter when ice covers the water surface. This makes it challenging to monitor seasonal changes in fish distributions and diversity.



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Environmental DNA (eDNA) metabarcoding is an emerging approach to biodiversity monitoring that can overcome some of the challenges of conventional sampling. Rather than capturing individual fish for identification, complete biodiversity assessments can be achieved by sampling eDNA from the environment instead. All types of organisms can be detected from the same eDNA sample and these samples can easily and safely be collected year-round, even when weather conditions do not allow conventional sampling. Wood PLC, an environmental consulting company, worked with CEGA to augment conventional surveys with eDNA to monitor fish biodiversity at a client site in both fall and winter.

What is eDNA?

Organisms constantly shed DNA into their environment (e.g. skin, scales, body fluids) and these DNA traces can be collected from the environment by sampling small amounts of water or sediment. The DNA is then isolated from the environmental material and the unique DNA sequences identify the organisms living in that environment.

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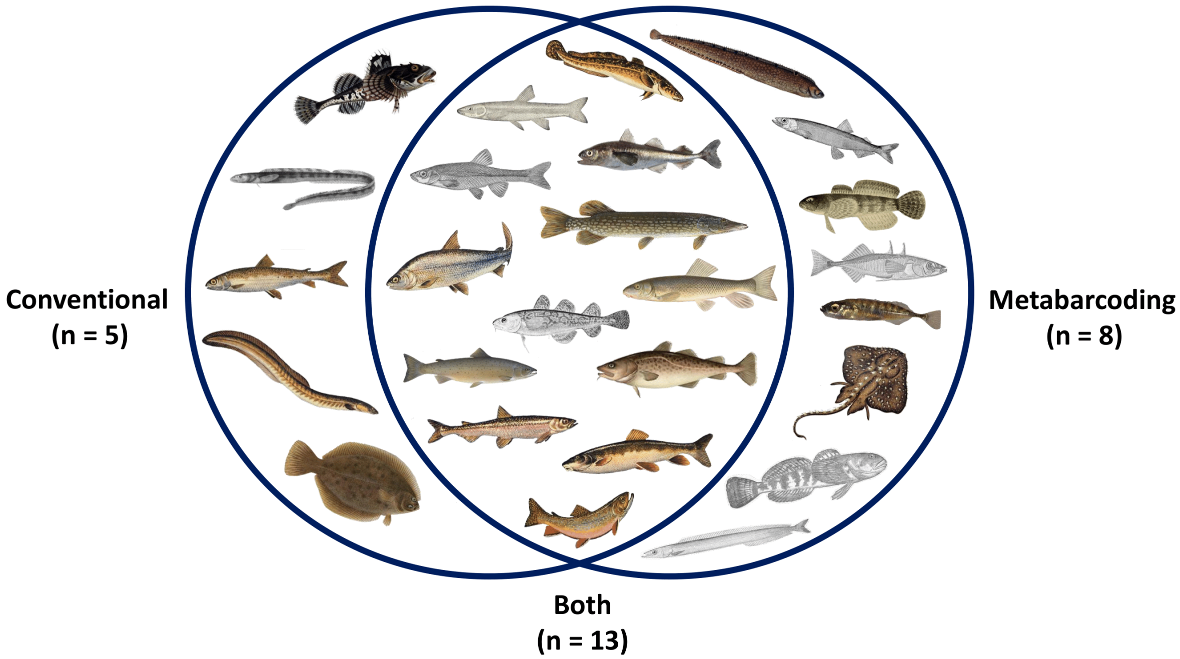
Results

An eDNA analysis of water samples revealed 21 fish species in the river system while conventional survey methods detected 18 species in the same sampling area. Most species were identified using both methods, but several species were only observed using either conventional surveys or metabarcoding. For example, eight fish species were only detected from eDNA including several fish species that could not be distinguished at the species level using conventional methods.

Beyond fish, the eDNA analysis identified 175 other animal species from the water samples, including insects, crustaceans, and worms. This additional biodiversity information is missed when carrying out standard electrofishing or netting. By using an eDNA approach, fish communities and total biodiversity can be monitored efficiently in both the fall and winter when surveying conditions can be difficult.



Venn diagram displaying the fish species detected in a river system using conventional survey methods and eDNA metabarcoding. Image attributions listed below.

CONCLUSION: An eDNA metabarcoding analysis provided a safe and efficient way to characterize fish biodiversity year-round without the need to catch fish. The eDNA approach identified a similar fish diversity to conventional methods while also detecting new fish species as well as general animal biodiversity.