

Documenting biodiversity in remote, understudied environments with eDNA

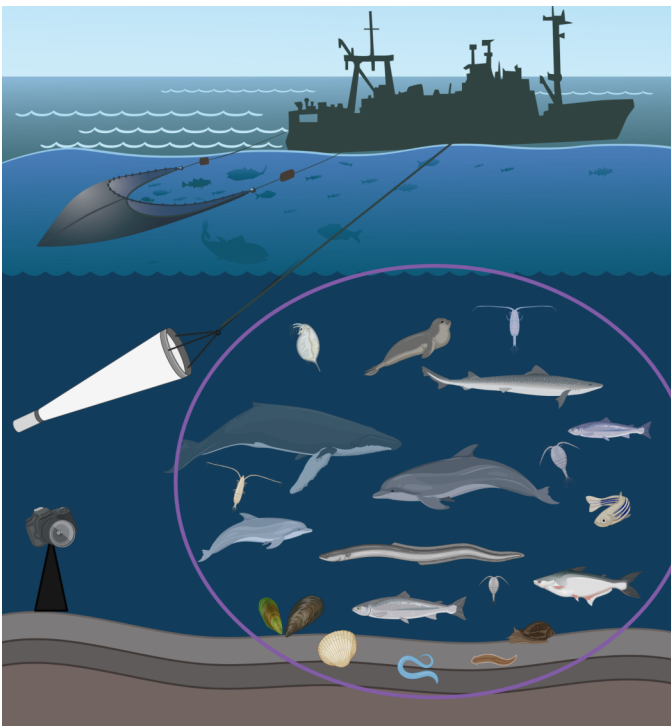
Case Study



OBJECTIVE: Characterize the animal diversity of an understudied region of the deep ocean using eDNA metabarcoding.

Background

Biodiversity assessments help us track species distributions and monitor the health and productivity of ecosystems – but obtaining biodiversity data is not always easy. Some environments, such as the deep sea, are challenging for humans to access and monitoring such remote ecosystems requires a significant investment of time, effort, and specialized equipment. Multiple conventional survey methods (e.g., trawling, longlining, and video monitoring) are needed to accurately capture the complete diversity of organisms in these environments, adding more time, cost, and effort.



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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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Environmental DNA (eDNA) metabarcoding is an emerging approach for biodiversity assessment that overcomes many of the biases and cost limitations of conventional survey methods. All organisms present in the environment, from plankton to fish to mammals, can be detected from the same samples. Characterizing the complete biodiversity using a single method can greatly improve sampling efficiency in hard-to-reach environments.

Fisheries and Oceans Canada included environmental DNA in their 2018 and 2019 survey of the deep Labrador Sea to characterize the biodiversity in this understudied and remote region of the ocean. Deep water ecosystems are inherently fragile so eDNA sampling provided a less intrusive biodiversity survey method.

Results

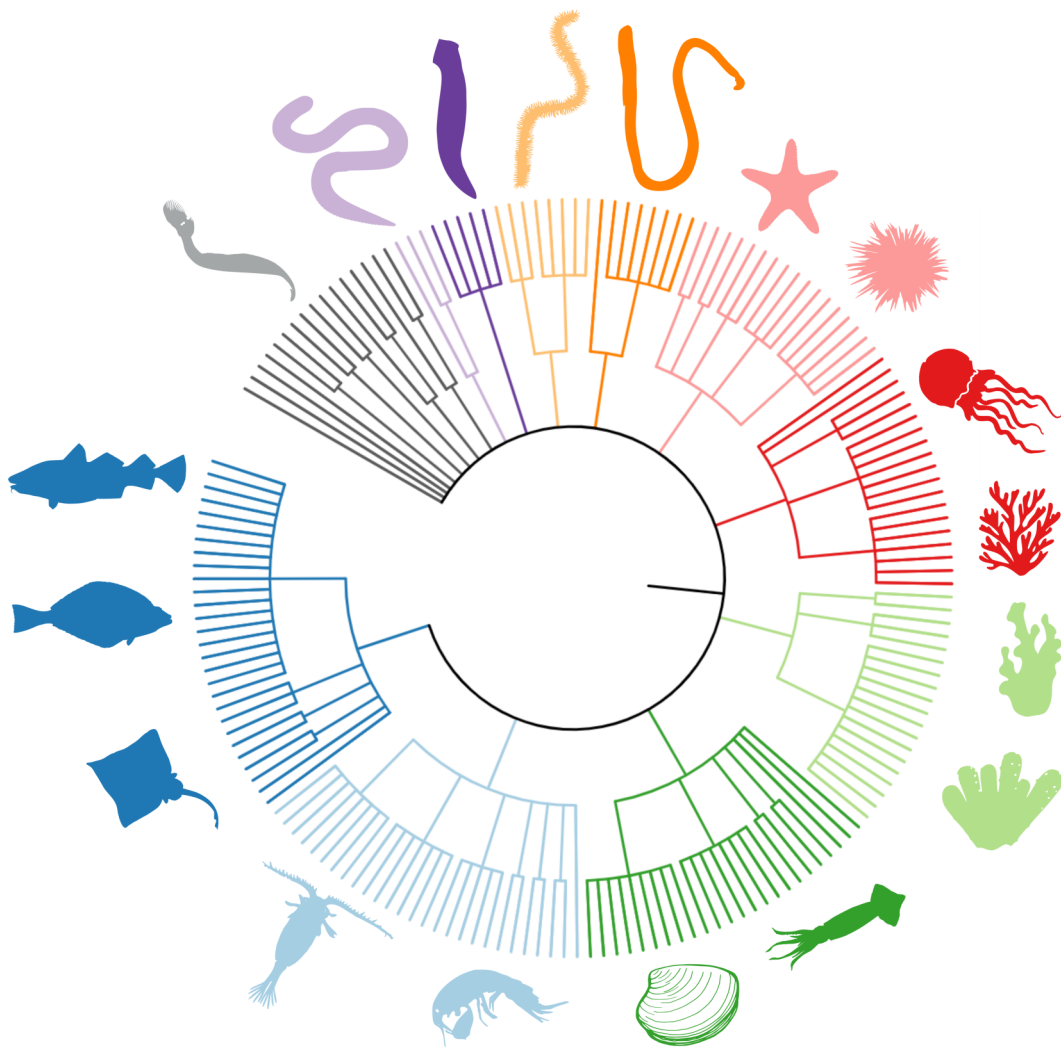
Environmental DNA metabarcoding identified 336 families and 208 animal species from water samples collected down to 2500 m deep in the Labrador Sea. Organisms from the bottom to the top of the food chain were detected, including zooplankton, fish and, squid. Several species of interest were detected in the samples including commercially harvested species, such as Greenland Halibut and Northern Shrimp, and species of conservation importance, such as Northern Wolffish and Roundnose Grenadier.

To capture this range of biodiversity using conventional methods, several tools would need to be deployed. The eDNA approach detected this diversity of organisms from non-invasive and easy-to-collect water samples.



Wolffish observed at the bottom of the Labrador Sea using traditional camera trap methods (Photo courtesy of Fisheries and Ocean Canada).

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Diversity of animal families detected in the Labrador Sea using eDNA metabarcoding of seawater samples collected up to 2500 m deep.

CONCLUSION: eDNA metabarcoding detected over 300 animal families across multiple trophic levels in the deep Labrador Sea from easy-to-collect water samples, demonstrating the utility of this approach as a comprehensive biodiversity assessment tool in remote marine environments.