

# Developing DNA Methods to Monitor Invasive Species and Biodiversity in Estuaries

## Overview

Biological monitoring programs are essential foundations for effective management of estuaries and coasts, but they can be expensive to conduct and may be traumatic for the target species. Advancements in DNA methods now make it possible to identify the organisms in an area by the DNA they leave behind. Environmental DNA (eDNA) comes from feces, gametes, scales, and cells that an organism sheds, and is easily collected from water and sediment samples. Rapid reductions in analytical costs now allow scientists to analyze eDNA in water samples and identify dozens of species without having to capture live animals or plants.

This project will work collaboratively with resource managers in Oregon, Maine, and New Hampshire to pilot and refine DNA-based monitoring protocols that can be applied to specific issues and species of interest in estuarine ecosystems.

## Anticipated Benefits

- Project participants from several estuary reserves will gain a greater understanding of best practices and appropriate applications for eDNA methods, and will have the tools and training needed to incorporate eDNA techniques into monitoring programs.
- Locally tested eDNA protocols will be available to characterize biodiversity and improve invasive species management through early detection and targeted interventions.
- eDNA methods will be compared to traditional monitoring methods to provide guidance on how both methods can be deployed to complement and strengthen existing resource management programs.

## Project Location

Great Bay National Estuarine Research Reserve, New Hampshire

South Slough National Estuarine Research Reserve, Oregon

Wells National Estuarine Research Reserve, Maine

## Project Duration

November 2017 to October 2019

## Project Lead

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## Project Type

Collaborative Research – generating science that informs decisions

## Project Partners

- Great Bay National Estuarine Research Reserve, New Hampshire
- New Hampshire Fish and Game Department
- Oregon Department of Fish and Wildlife
- South Slough National Estuarine Research Reserve, Oregon
- Wells National Estuarine Research Reserve, Maine

## Project Approach

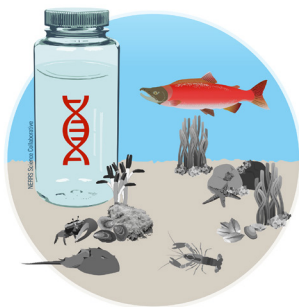
The project team will design and implement a pilot eDNA program at several National Estuarine Research Reserve sites. Scientists and staff from Great Bay, South Slough, and Wells Reserves will work with researchers at the University of New Hampshire and a technical advisory team to develop eDNA sample collection and analysis protocols. The group will engage local natural resource managers, stakeholders, and end users to identify a list of estuarine species to target using eDNA methods, and eDNA sampling will be conducted in coordination with existing traditional monitoring programs to allow direct comparison and verification between methods.

Our collaborative team will support a Learning Community of Practice, composed of academic researchers, staff and scientists at multiple research reserves, and other natural resource managers who have expressed interest in the program. This project will assess the value of eDNA monitoring at research reserve sites, and will provide end users with key training to support informed decisions regarding the implementation and use of eDNA monitoring in estuarine systems.

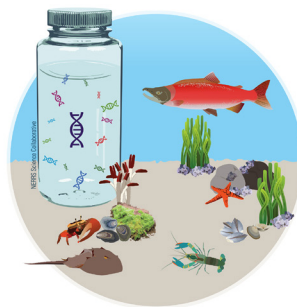
## Targeted End Users and Anticipated Products

- Research products will be developed to support the work of estuarine resource managers and state fish and game departments in New Hampshire, Maine, Oregon, and elsewhere. Comparisons between eDNA and current monitoring methods will help agencies determine if, when, and how to integrate new DNA-based approaches;
- Validated eDNA methods and detailed protocols will be developed for identifying species of interest and characterizing biodiversity in estuarine habitats;
- An expanded library of DNA barcode sequences will allow current estuarine species of interest to be detected by eDNA methods; and
- Training opportunities, tested protocols, and resources for using eDNA methods will be shared with researchers and managers within and beyond the reserve system.

### eDNA Methods



**Single Species PCR**



**Metabarcoding**

*The project will apply two types of eDNA methods. (Left) Single species Polymerase Chain Reaction (PCR) assays are a rapid, low cost method of identifying a single species in a sample, such as a particular invasive or rare species of interest. (Right) Metabarcoding identifies multiple species, but is more complex to analyze.*

### About the Science Collaborative

*The National Estuarine Research Reserve System's Science Collaborative supports collaborative research that addresses coastal management problems important to the reserves. The Science Collaborative is managed by the University of Michigan's Water Center through a cooperative agreement with the National Oceanic and Atmospheric Administration (NOAA). Funding for the research reserves and this program comes from NOAA. Learn more at [coast.noaa.gov/nerrs](http://coast.noaa.gov/nerrs) or [graham.umich.edu/water/nerrs](http://graham.umich.edu/water/nerrs).*