# The National Estuary Program translates your research into action.

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## Abstract

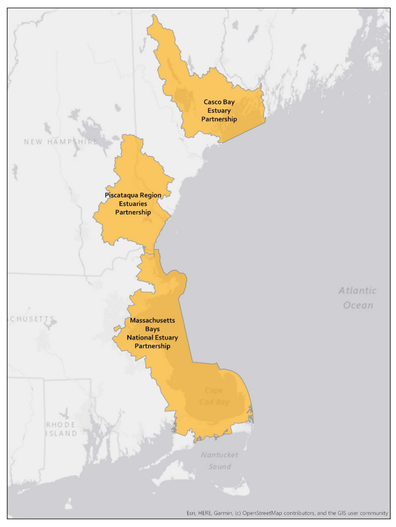
The Gulf of Maine hosts three NEPs centered on “estuaries of national significance:” Casco Bay, the Piscataqua Region, Massachusetts Bays.

The NEPs have no regulatory authority, despite our status as an EPA-funded program. We don’t have large endowments: we offer only mini-grants and in-kind support to local partners. We don’t bring large stables of lawyers or scientists to the table: our three programs have an average of 3 in-house staff.

Instead, we develop partnerships with local decisionmakers and institutions, including nonprofits and schools. We leverage our small funds to support subsequent, more substantial investments by others. We convene management conferences made up of scientists, planners, business people, communications experts, and community members.

In short, NEPs align stakeholders and resources to identify complex problems, and employ local data and scientific research to identify and implement innovative and positive solutions to those problems.

## Three Gulf of Maine NEPs




The National Estuary Program (NEP) is an EPA-supported, place-based program to protect and restore the water quality and ecological integrity of estuaries of national significance. The non-regulatory program was established and authorized by Congress through §320 of the Clean Water Act in 1987 and reauthorized in 2016. Currently, 28 estuaries located along the Atlantic, Gulf, and Pacific coasts and in Puerto Rico are designated under the Act as Estuaries of National Significance.

The three NEPs in the Gulf of Maine encompass a significant subset of coastal resources in the region. Nearly 2000 linear miles of coastline include islands, barrier beaches, rocky shores, tidal mudflats, and salt marshes. These habitats support multiple commercial fisheries, serve as barriers to storm surge and flooding, and provide nesting places and rest stops for shore and migrating birds. Our missions all point to the same vision: a networked system of healthy, resilient habitats that will support communities – both human and wild – into the future.

We carry out our work toward this vision in partnership with researchers, educators, businesses, and policymakers, crossing barriers to promote local progress on regional challenges.

## Resources for Collaboration

- Joint funding proposals
- In-kind support
- Small grant programs
- Letters of support
- Co-location of monitoring/research equipment
- Data sharing agreements
- Coordination of monitoring and research
- Regional scientific meetings
- Identifying applied research needs
- Stakeholder engagement

## Current Research Partners

- NERACOOS
- University of New Hampshire
- UMass Boston
- Salem State University
- University of Southern Maine
- University of Maine
- Northeastern University
- Boston University
- MIT Sea Grant
- EPA Office of Research & Development, Office of Science & Technology
- Great Bay NERR
- Friends of Casco Bay
- The Nature Conservancy
- NH Fish & Game
- Mass Division of Ecological Restoration
- Mass Division of Marine Fisheries
- Maine DEP, Mass DEP, NH DES

## Case Study: New Hampshire’s Coastal Watershed

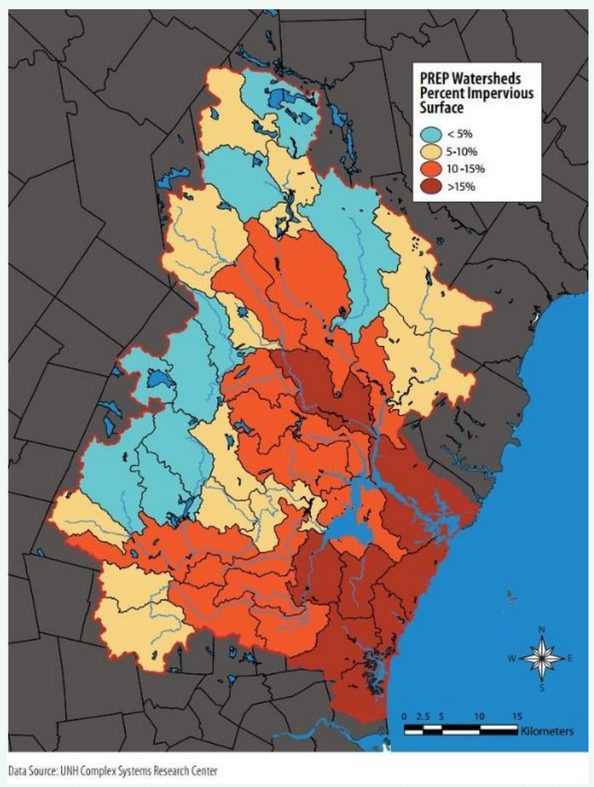
### Responding to Development & Land Use Issues

With Boston only 60 miles to the south, the Seacoast region of New Hampshire and Southeastern Maine is a hot spot for new development. Impervious surface cover throughout the Region has rapidly increased at an average rate of **1,700 acres per year** since 1990, resulting in almost 50,000 acres of impervious cover, or 5.6% of the land area in the watershed.

Highly developed watersheds in the Piscataqua Region experience further degradation of water quality due to **increased stormwater volume and pollutant loading**.

In 2009 and 2013, PREP completed the Piscataqua Region Environmental Planning Assessment (PREPA), a comprehensive survey of municipal land use regulations and planning practices in the watershed, to inform management efforts aimed to protect the estuaries. PREPA results provide a snapshot of current practices and serve as a baseline for evaluating successes from improved land use regulations and conservation initiatives. Based on assessment results, PREP develops strategic targets for improving the quality and consistency of environmental protection throughout the Region. The next PREPA will be published in 2020.

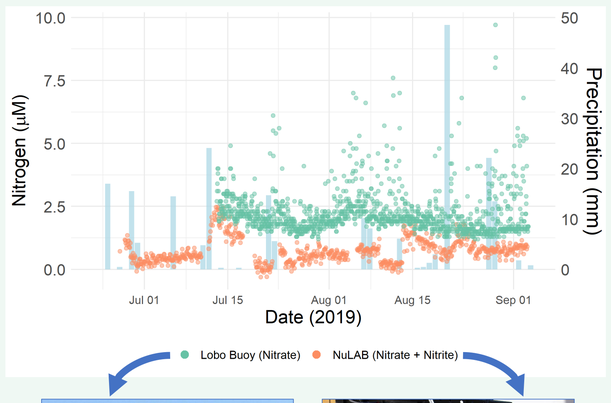
Development and impervious cover in the watershed are increasing, but steps are being taken to reduce pollution. In 2017, 15.5% of land in the watershed had been conserved; an increase of 5.5% from 2011.



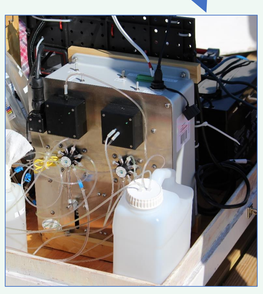

*Impervious surface cover in Piscataqua Region subwatersheds*

## Case Study: Maine’s Casco Bay

### Advancing nutrient management







High-frequency data from two sensors shows elevated nitrogen in Casco Bay following rainstorms and CSO events.

Casco Bay is experiencing what are thought to be preliminary ecological effects of excess nutrients, including algae blooms, damage to eelgrass beds, and coastal acidification. Population growth, warming waters and increased precipitation are likely to make the problem more severe. Maine’s cool waters, the Bay’s strong tides, and the relatively low human population of the watershed have made Casco Bay resilient to the nutrient loads of the past, but there are limits to that resilience.

Through the “Casco Bay Nutrient Council”, Casco Bay Estuary Partnership (CBEP) has been advancing understanding of the causes and consequences of excess nutrients in the Bay - summarizing available science, facilitating conversations about policy alternatives, testing novel technologies, and supporting research – to address this threat to water quality and marine life.

A principal outcome of the Nutrient Council has been expansion of nitrogen monitoring and science in Portland Harbor. Significant increases in monitoring both of nitrogen and of eelgrass are providing insights into nitrogen sources, mixing, and impacts. CBEP and the University of Maine deployed high frequency nitrate sensors in the Harbor in 2019. Results showed a close association between elevated nitrate levels and both rainfall and Combined sewer overflow events.

Better nutrient science is critical to developing effective and cost-effective policy responses to coastal nutrient enrichment. Casco Bay communities invest millions in water quality protection annually. Wise policy needs to be based in part on understanding of how and when nutrients enter the Bay, how quickly near-shore loads are dispersed, and how the metabolism of the Bay is affected by shifting abundance of macronutrients.

## Case Study: 47 Massachusetts embayments

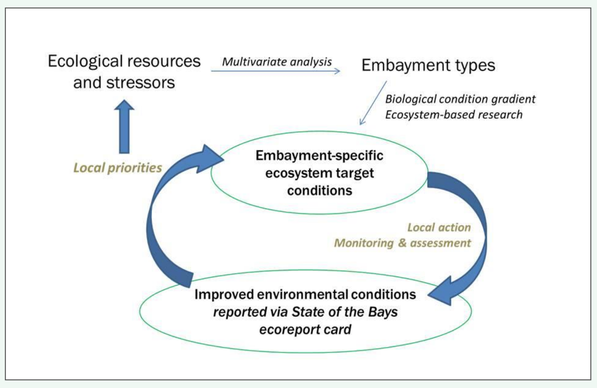
### Setting targets for future conditions

From rocky Cape Ann to sandy Cape Cod, from the eelgrass beds in Duxbury Bay to the oyster beds in Wellfleet Harbor, from Rumney Marsh in Revere to the Great Marsh in Newbury, Mass Bays’ region is a complex mosaic of ecological resources and human uses. To manage this conglomerate of systems, MassBays has taken up an ambitious goal: setting environmental targets for managing the 47 harbors, bays, and coves delineated along the coastline.

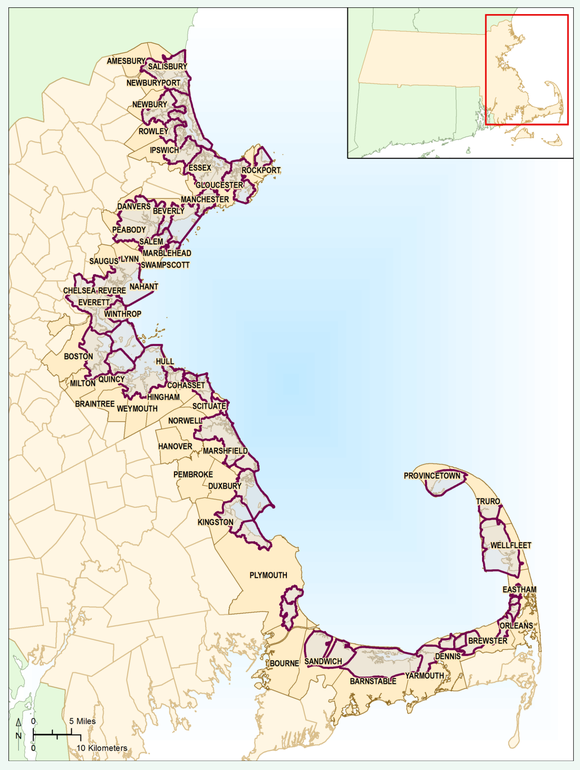
Using statistical analyses (K-means clustering, PCS, and SIMPER) coupled with regression analysis, Northeastern University researchers have categorized the individual embayments into four classes based on physical and biological factors that offer the strongest predictors of type.

Now, EPA scientists are working with MassBays’ science advisors and local stakeholders to develop a framework that highlights the benefits that accrue from these resources as well as the watershed stressors threatening them.

MassBays will use the framework to inform management objectives and promote actions at the local level to restore and protect coastal habitats, and improve the wellbeing of communities dependent on them.




Researchers, citizen scientists, and local stakeholders are partners in MassBays’ effort to set targets for improved habitat conditions in estuaries from Salisbury to Provincetown.




## Partner with the NEPs

We have many questions:

- How do freshwater inflows influence carbonate chemistry in New England's inshore coasts and bays?
- How does nutrient enrichment influence coastal acidification in New England?
- Does existing seasonal, diurnal and spatial patterns of coastal acidification have negative effects on wild shellfish?
- What are the predominant sources of sediment to the Great Bay Estuary?
- What controls the rate of sediment accretion in tidal marshes in Maine's intertidal glacial valleys?
- How will rising seas and its influence on the base elevation of groundwater affect the distribution of salt, and thus dominant vegetation, in intertidal wetlands?
- How does offshore circulation in the Gulf to Maine influence inshore water chemistry, ecosystem processes and mixing dynamics?
- How important is remineralization of nutrients from the sediments as a long-term source of nutrients to New England's bays?
- What is the cumulative effect of climate change, eutrophication, and pollution on coastal habitats?
- Can we model coastal habitat vulnerability to storms?
- Does herbicide application in spawning ponds impact larval and juvenile river herring?