

Can Indigenous Ecological Knowledge Improve Climate Understanding?

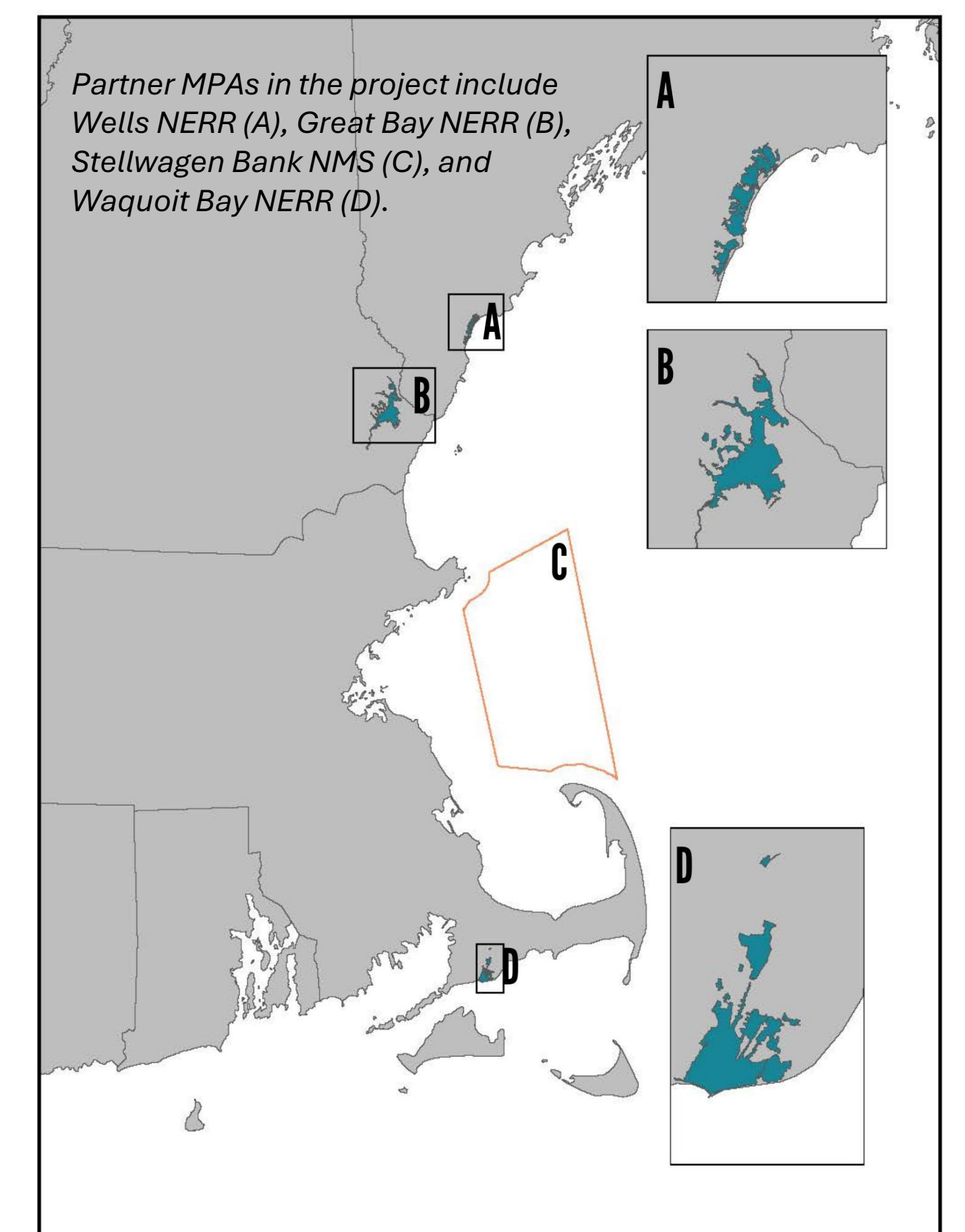
A Pilot with Marine Protected Areas in the Northeastern United States

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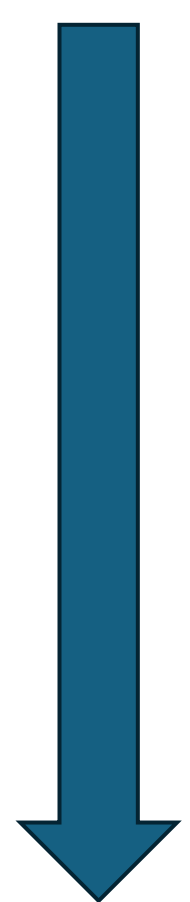
Climate change is driving a variety of physical, chemical, and biological changes in coastal and ocean ecosystems, which affect social, cultural, and economic values. Many climate impacts are characterized by large spatial scales, long timeframes, and complex interconnections among components of the ecosystem. Accordingly, coastal and ocean observing systems typically aim for scale, longevity, and a broad suite of measured variables, but in many cases struggle with the pace and uncertainty of climate impacts. Indigenous Ecological Knowledge (IEK) provides a unique perspective at landscape and seascape scales, across multiple generations, and with a clear eye to interconnectedness, yet too often is absent from ocean science and management. Guided by Wampanoag and Abenaki leaders and knowledge-keepers, we are examining whether and how IEK can complement ocean observing systems to improve understanding of coastal and ocean ecosystems, including climate drivers and impacts. To examine these questions, we are using as study sites a network of Marine Protected Areas (MPAs) in the Northeastern United States that sit on or adjacent to the ancestral lands of our Indigenous partners: Wells National Estuarine Research Reserve (NERR), Great Bay NERR, Waquoit Bay NERR, and Stellwagen Bank National Marine Sanctuary (SBNMS). Although these MPAs are a not an Indigenous construct, with boundaries and authorities that are not in line with Indigenous traditions, Indigenous partners nevertheless see them as useful tools for convening, conservation, education, research, and policy innovation.

An important lesson of the project is that IEK can contribute to the science-to-management continuum at multiple entry points, from understanding long-term context and change to goal-setting and problem specification, data collection and interpretation, and future visioning and planning. Ideally, IEK should be considered at each stage across the continuum. Notably, Indigenous people embrace the tools of western science as complementary to other sources of IEK, and in many cases rely heavily on those tools where IEK has been lost due to displacement, depopulation, and theft. We are implementing a thorough evaluation of the management plans for the four partner MPAs in this project through an Indigenous lens, while concurrently conducting the portfolio of focused studies described below that illustrate the value provided by IEK at different stages of the science-to-management process. Ultimately, this project is underscoring the unique and high value provided by IEK and its complementarity with western science in enhancing climate understanding and climate-readiness in coastal and ocean management.

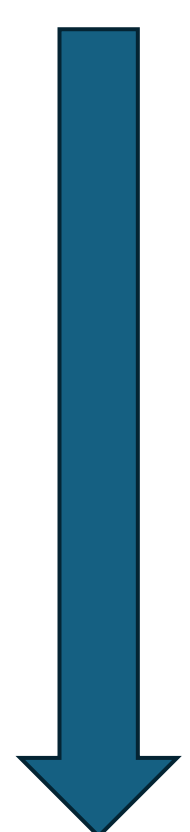


Science-to-Management Continuum

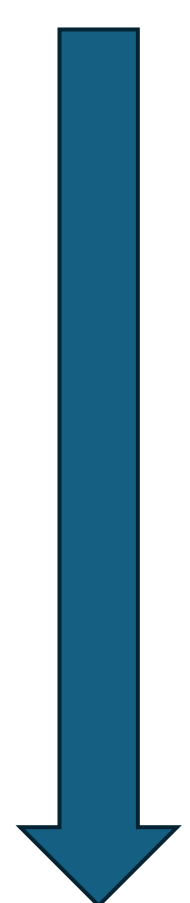
Long-Term Context & Change



Goal-Setting & Problem Specification



Data Collection & Interpretation



Future Visioning & Planning

Maritime Cultural Ecology of the Gulf of Maine

Sitting between Cape Cod and Cape Ann, SBNMS supports a wide array of uses and industries, with many more connections to the coast and Indigenous pathways revealed in the maritime cultural landscape. A maritime cultural landscape is a construct for understanding and discussing the complex, dynamic, and evolving relationships of people and the sea. During the end of the Last Glacial Period, around 12,000 years ago, portions of SBNMS were dry and home to grasslands, forests, and terrestrial animals. In fact, fishing boats have pulled up mastodon teeth two miles east of Cape Cod. Where there were animals to hunt, humans likely were close by. These submerged paleolandscapes now rest hundreds of meters below the waves, but they still connect the rich heritage, histories, and knowledge of early Wampanoag and other Indigenous peoples to the present. However, these longstanding connections and what they reveal about ecosystem change, evolving human uses, and adaptation are largely unappreciated today. Therefore, we are compiling information from IEK, archaeology, and paleontology, among other sources, to map and describe the maritime cultural landscape of SBNMS and adjacent waters of the Gulf of Maine to enhance climate-scale understanding of submerged areas and support long-term management of MPAs and human uses.



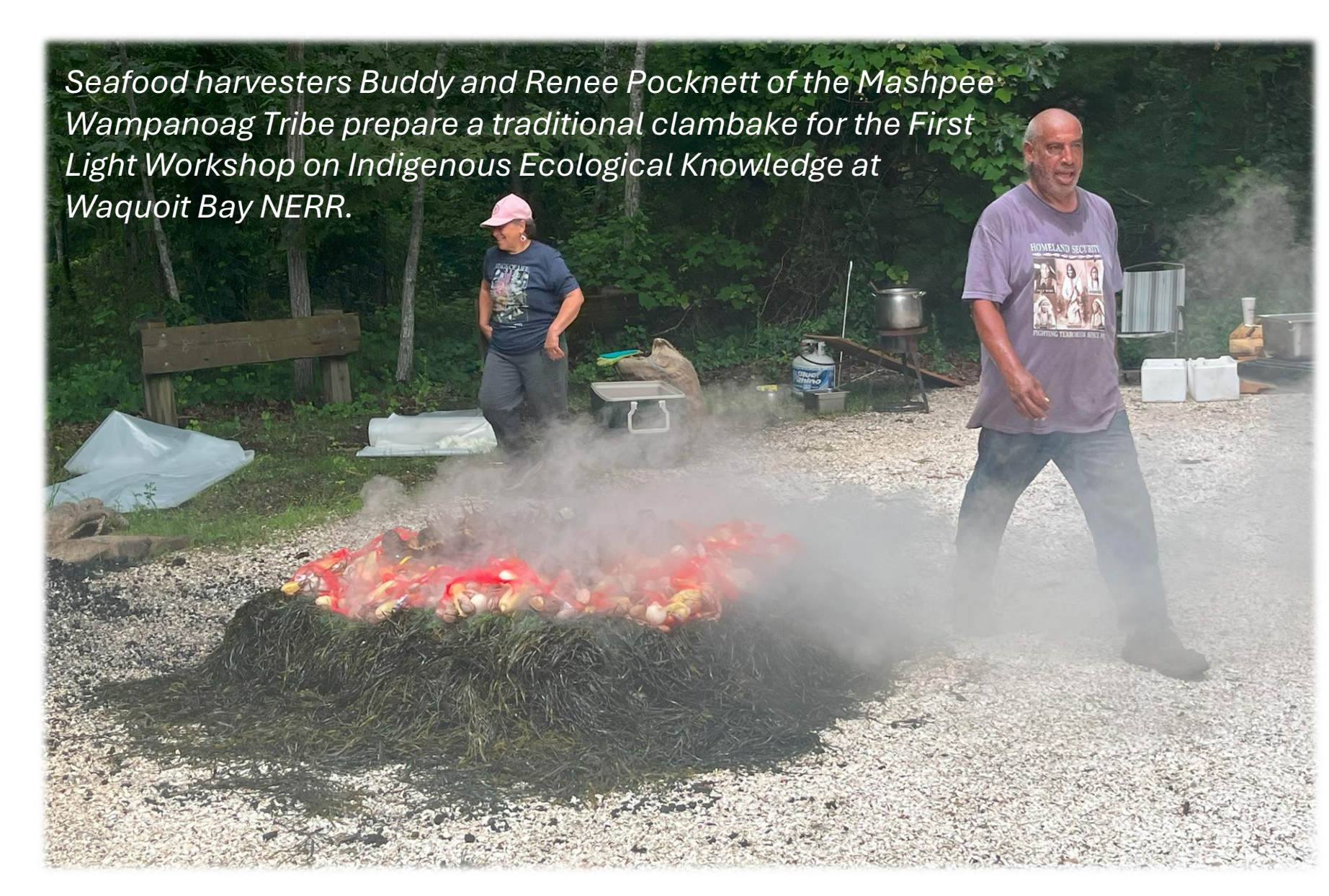
Prospects for Atlantic Salmon Recovery in Great Bay

Indigenous peoples across the Northeast work closely with partners on restoration of rivers, many of which were once home to Atlantic salmon that provided cultural, subsistence, and ecological values. Today, Atlantic salmon management is largely confined to a series of rivers in eastern Maine designated under the Endangered Species Act. In contrast, in 2013 federal agencies made the difficult decision to end restoration efforts in the Connecticut River in response to negligible improvements despite significant investments. In between these locales, policies for salmon restoration in the tributaries of Great Bay NERR are ambiguous at best: There have been no explicit decisions to abandon salmon restoration, but also no dedicated recovery efforts underway. Through this project, Abenaki knowledge-keepers have highlighted the many signs that salmon were once a vital component of the Great Bay ecosystem, including traditional place names and artifacts, and questioned whether there is hope for salmon restoration, illustrating the climate-scale perspective and resultant prioritization that emerges through IEK. Salmon recovery would be significant symbolically, while also building climate resilience through their unique trophic and energetic functions. Accordingly, we are conducting an updated assessment of habitat conditions and the potential for improvements that might allow salmon to once again run through Great Bay NERR.



Insights on Cape Cod Bays from Traditional Hunters & Fishers

Across Generations: Mashpee Wampanoag Hunting and Fishing is a collaborative effort of the Mashpee Wampanoag Tribe, supported by Mass Humanities, to create a Tribal Museum exhibit that focuses on hunting and fishing traditions, and the enduring struggle to safeguard inherent aboriginal rights. The exhibit sheds light on the challenges that Tribal members have faced in practicing these rights due to external regulations and development. The project has conducted a series of oral history interviews with Tribal hunters and fishers who share their understanding of aboriginal rights, how they exercise those rights, and how they have had to defend those rights. The IEK shared by Tribal hunters and fishers to illuminate these issues also reveals unique and nuanced understanding of coastal species, habitats, and ecosystems. We are collating these observations to inform monitoring, management planning, and public education and engagement by the Tribe’s Natural Resources and Education departments, Waquoit Bay NERR, and other partners, and planning additional interviews to expand the knowledge base. However, before any of the IEK gathered is made available to users outside of the Tribe, we are also establishing clear policies for ownership, access, use, acknowledgement, and compensation, consistent with both FAIR and CARE principles. This project also supports the *First Light* workshop, co-organized by the Tribe and Waquoit Bay NERR, that fosters understanding of IEK among K-12 educators.



Planning for a Future Blue Crab Fishery in Southern Maine

A longtime staple of Powhatan, Piscataway, and Nanticoke peoples on Chesapeake Bay, blue crabs historically were found only infrequently and episodically in the Gulf of Maine. That is changing, however, as warming waters turn the once coldwater ecosystem into an environment that is more conducive to the species. Wells NERR is building a program to track the establishment of blue crabs in the region, noting the potential for future fisheries if the species truly takes hold. Indigenous leaders emphasize that their cultures were far from static, but rather adapted through time in response to climactic, anthropogenic, and other factors. These adaptations have shaped IEK, the insights from which can not only help us look back at how ecosystems and human uses have changed over climactic time scales, but also to look forward at how we might build greater resilience in human communities and nature in the face of ongoing climate change. The prospect of a future blue crab fishery provides a unique opportunity to incorporate IEK from the outset, and we are conducting a visioning and planning exercise to determine what that integration might look like. Consideration of IEK could lead us to set different goals and risk tolerance, adopt a longer timeframe in recognition of our responsibilities to future generations, implement different management measures, and create novel scientific systems needed to support all of these dimensions.



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