

## 2026 Cape Coastal Conference

### Shared Solutions for Stronger Coasts & Communities

#### Early Career & Student Poster Abstracts Monday April 13 - 4:30PM – 6:00PM

##### **COMMUNITY ENGAGEMENT AND KNOWLEDGE SHARING TO GUIDE PROACTIVE COASTAL RELOCATION IN MASSACHUSETTS**

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Managed retreat as a coastal adaptation strategy is gaining momentum in Massachusetts, but to meaningfully plan for the future of our coast, it is essential to center the voices of coastal communities and work collaboratively across sectors. This poster will showcase the community engagement work done over the past year through the CZM-funded Proactive Coastal Relocation in Massachusetts project, by highlighting community members' insights, data collected, and the lessons learned so far. We will also share aspects of the project such as organizing and leading a peer learning network of practitioners primarily located in MA. This network engages in group project collaboration, sharing best practices/experiences, and support among community leaders considering managed retreat as an adaptation strategy. The poster will also share the resources and database research methods undertaken by the project team as well as best practices for accessing these resources.

##### **COMMUNITY-DEFINED CLIMATE RISK IN COASTAL TANZANIA: ASSESSING VILLAGE-LEVEL RISK THROUGH SOCIAL SURVEYS**

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Villages across coastal Tanzania experience increasingly frequent climate events driven by human-induced climate change, such as marine heatwaves and intensified bimodal rainfall. Ecosystem-based adaptation strategies are one way to form more resilient coastal communities, as they aim to amplify the health of marine ecosystems while protecting ocean-based livelihoods. A project led by the Wildlife Conservation Society aims to identify and implement ecosystem-based adaptation strategies in villages across coastal Tanzania with the highest climate risk. In the absence of high-resolution climate data and to support community autonomy in defining their climate experiences, data from two extensive social surveys were used to create village-level climate risk scores across Tanzania's regions of Tanga, Pemba North, and Pemba South. Each village-level climate risk score included the risk indicators of hazard, exposure, and vulnerability for five distinct climate threats. The final scores were statistically analyzed to understand geographic variation, gender and livelihood differences, and significant climate threats. The Wildlife Conservation Society targeted the villages with the highest climate risk scores for ecosystem-based adaptation projects based on the findings in this climate risk assessment, representing a first step towards coastal climate resilience.

## **A TALE OF TWO MARSHES: STRATEGIES FOR MONITORING AND COMPARING SALT MARSH HEALTH ON NANTUCKET, MA**

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Research and monitoring are critically necessary for implementing restoration strategies in salt marshes. Climate change and subsequent sea level rise are large scale processes affecting Nantucket Island, MA, and consequently, its 1,600 acres of salt marsh. In this study, we compare two marshes on Nantucket Island, Eel Point and Folger's Marsh, using vegetation data collected in the field and aerial imagery. Eel Point, located on the west end of the Island, is a dynamic dune and marsh system. Using GIS, we observed loss on the west side of Eel Point as sand shifted in the last 30 years. Folger's Marsh, located further east, is constricted by an undersized culvert that cuts through the marsh. We have observed increased inundation where the culvert restricts tidal flow, leading to vegetation loss. Part of our monitoring program involves tracking vegetation and determining if the proportion of low-to-high marsh plants are changing over time, which is an indicator of marsh migration and sea level rise. As a conservation land trust, our continued monitoring of vegetation and land-mass changes within these salt marshes will guide restoration efforts that protect these valuable ecosystems.

## **MILL POND SALT MARSH RESTORATION**

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An undersized culvert under Mill Pond Road in Truro, MA, has caused tidal restrictions and impacts to both salt marsh resources and water quality in Mill Pond. Mill Pond Road is subject to storm flooding, resulting in adverse impacts to salt marsh resources and water quality, erosion and scouring of roadway shoulders, and frequent repair of stone armor slope protection and roadway surface. Depot Road, adjacent to Mill Pond Road, is additionally in need of further improvements to stormwater drainage and bank stabilization. The goals of this project, identified by the Town and Project partners MA DER, MA CZM, NRCS, and CCCD, are to restore ecosystem connectivity, water quality, and salt marsh habitat by replacing the Mill Pond tidal crossing with a larger opening; improve stormwater drainage and roadway resiliency at Mill Pond Road and Depot Road; and enhance public access, safety, and recreation. Through this project, we also aim to prioritize public input and communications throughout the development, decision-making process, and implementation of the project.

## **FRAMING THE FUTURE: THE MASSACHUSETTS SALT MARSH FRAMEWORK**

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Massachusetts contains nearly 20,000 hectares of salt marsh—the largest extent in the Northeast—yet these ecosystems face increasing pressure from some of the fastest sea level rise rates globally. As interest in restoration grows, organizations need clear guidance to assess vulnerability and prioritize action. Mass Audubon's Ecological Restoration team is developing a Salt Marsh Framework, a GIS-based model that scores marshes across three dimensions: condition (evaluating vegetation and surrounding land use), trajectory (assessing tidal position, elevation gain, and marsh-edge exposure) and migration (identifying opportunities for landward movement). Scores are linked to restoration and management actions based on urgency and restoration potential. Additional lenses—such as marsh size, blue-carbon value, and habitat importance for birds—allow users to tailor decisions to ecological management goals. The framework offers a practical, science-based tool to guide strategic salt marsh conservation statewide.

## **SALT MARSH ZONES FOR PRE- AND POST-RESTORATION ASSESSMENT: COMPARING APPROACHES USING VEGETATION, TIDAL DATUMS, AND ELEVATION SURVEYS**

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Environmental monitoring is an important part of salt marsh restoration and essential for adaptive management approaches. Designating marsh zone for permanent vegetation plots (e.g., low marsh, high marsh, marsh border) has been shown to strengthen data analyses related to tracking change and evaluating restoration success. Marsh zone classification methods have traditionally used plant species composition as indicators of inundation to discern zone boundaries. Micro-tidal systems are dominated by *Spartina alterniflora*, making this technique difficult to execute with accuracy. An alternate method uses local tidal datums (e.g., Mean High Water) and plot elevation to determine marsh zones. The Association to Preserve Cape Cod (APCC) compared plant-based and elevation-based marsh zone designations at two salt marsh restoration project sites (Weir Creek, Dennis, MA; Oyster Pond, Falmouth, MA). Zone designations differ between methods at both sites. In some marsh zones, more than 50% of plots differ between methods. Differing results from the two methods highlight the inconsistencies and challenges associated with assessing change based on marsh zone.

## **SALT MARSH HYDROLOGIC RESTORATION: OUTCOMES AND LESSONS LEARNED**

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Salt marshes are experiencing unprecedented habitat loss due to the combined effects of historical activities and sea level rise. Hydrologic restoration is crucial for restoring important salt marsh habitat and their ecosystem services. In winter 2023, we installed shallow drainage features called runnels in a salt marsh that is part of the Waquoit Bay National Estuarine Research Reserve. Understanding the effects of hydrologic restoration is fundamental for future restoration design success. Prior to runnel installation and for two years following, we monitored sediment characteristics, water levels, and vegetation percent cover to understand how habitat loss and impounded water impact marsh functioning, and if hydrologic restoration can help restore those key properties. We found that impounded water significantly reduces vegetation cover and redox potential, while raising sediment pore water salinity. By 2025, two years after hydrologic restoration, runnels significantly drained standing water, which helped reduce sediment pore water salinity, encouraging vegetation growth without stimulating oxygen availability within the sediments. Overall, in just two years, hydrologic restoration using drainage features such as runnels can significantly improve the health of the salt marsh sediments and vegetation.

## **OPTIMIZING EARLY ESTABLISHMENT OF ZOSTERA MARINA SEEDLINGS: IN VITRO VS. AMBIENT CONDITIONS FOR SEED-BASED SEAGRASS RESTORATION**

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As *Zostera marina* meadows continue to decline, low germination and high early-stage mortality have constrained seed-based restoration success. To evaluate strategies for improving establishment, we compared germination and seedling development under two rearing approaches: optimized in-vitro culture and ambient, field-simulated conditions. In vitro seeds were grown in sterile nutrient-enriched media with controlled temperature (20°C) and constant light levels, while ambient seeds were planted in sediment with unenriched flowing seawater at winter temperatures (8°C). The in-vitro seeds outperformed the ambient seeds with 40% higher germination and 30% higher seedling establishment, with variation across seeds collected from different sites. These results suggest that informed site selection and nursery-based in vitro cultivation can substantially enhance seed-based eelgrass restoration success prior to the start of the growing season.

## **BRIDGING THE ESTABLISHMENT GAP: ENHANCING AMERICAN BEACH GRASS SUCCESS WITH DREDGED MATERIAL**

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Our goal is to strengthen coastal resiliency on Cape Cod by researching and applying evidence-based 'Cape' American Beach grass planting methods in dredged materials. We aim to connect sediment management with long-term dune stabilization by adapting and testing techniques tailored to specific sites, recognizing that dredged materials vary from the upper to the outer Cape. To achieve this, we are seeking re-use land licenses from local towns, with the intention that each town will host its own site-specific test plot based on its unique dredged soil. Additionally, we plan to create a Cape Cod-specific Nursery Network of Data to support effective planting techniques and high survivability rates for *Ammophila Breviligulata* - 'Cape' American Beach grass as our climate is changing.

## **ARE WE MEETING OUR GOALS? COMPARING NITROGEN LOADS OF TWO RIVERS IN THE WAQUOIT BAY WATERSHED AGAINST NEW TMDL THRESHOLDS**

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Excess nitrogen is a primary driver of eutrophication in estuaries around Cape Cod, including Waquoit Bay. In 2020, MA DEP and the EPA established a Total Maximum Daily Load (TMDL) plan for nitrogen in Waquoit Bay, which set goals of lowered nitrogen "load" (kg/day) thresholds for the waters flowing into the bay. Since the TMDL's establishment, the state and the towns of Falmouth, Mashpee, and Sandwich have implemented various nitrogen-control measures. This project analyzes nitrogen data from Waquoit Bay NERR's two long-term monitoring programs, SWMP and BayWatchers, at the Quashnet and Childs Rivers since 2021 to measure any potential gains or setbacks made towards the TMDL's new nitrogen-load goal. Preliminary results indicate that Nitrogen loads in the Childs River have fallen from the pre-2020 conditions reported by the MA DEP report, while Nitrogen loads in the Quashnet River are higher than the reported pre-2020 conditions.

## **LINKING HYPOXIA AND NUTRIENT TRENDS IN WAQUOIT BAY USING SWMP DATA**

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Symptoms of eutrophication in Waquoit Bay, including steady deoxygenation and macroalgal blooms, have been well described for decades. Similarly, the process of eutrophication connecting excess nutrient levels to deoxygenation in local ponds, lakes, and embayments is well documented. This project analyzes long-term water quality data (System-Wide Monitoring Program Data, SWMP) from Waquoit Bay National Estuarine Research Reserve (WBNERR) in East Falmouth, MA. We specifically describe and characterize the deoxygenation occurring there and to illustrate the known process of eutrophication, more explicitly linking nitrogen levels with deoxygenation. This research emphasizes the importance of citizen science efforts, long-term data analysis, municipal policy, and regulatory measures to the health of estuarine systems and their associated watershed.

## **BIOINDICATOR SPECIES ON CAPE COD**

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For my projects in coastal ecology class, we traveled to various beaches around Cape Cod and took qualitative and quantitative data, particularly around the different species we observed at these locations. My presentation is about how bioindicators can be used to screen the health and qualities of an environment. The sole presence of a bioindicator can only tell us so much. The activity, behavior, and population sizes give us a deeper intelligence to what is really happening within an environment. Beyond that, there are different things a species can be a bioindicator of, from pollution, to ecological factors, to other species.