Site Report: J Cove

Original restoration completed in 2010

The J Cove restoration project was implemented by Texas Parks and Wildlife Division with funding from NOAA through the American Recovery and Restoration Act (ARRA). Project partners included the Texas General Land Office and Galveston Bay Estuary Program. The entire project footprint (including subtidal regions between mounds) encompassed 130 acres within which approximately 35 acres of intertidal habitat was created.

Where, What, Why

Jumbile Cove (the larger embayment in which the J Cove project occurred) in West Galveston Bay had suffered extensive losses of intertidal marsh in the latter half of the past century due to a combination of wave-induced shoreline erosion and relative sea level rise (Figure 1). Aerial imagery-based estimates suggest that between 1930 and 1995 roughly 50% of the intertidal marsh and 70% of the tidal flat habitat in Jumbile Cove had converted to open water. The J Cove project involved restoration of estuarine habitat complex through the creation of multiple, circular marsh mounds from locally-sourced dredged sediments. **The use of multiple circular mounds was intended to maximize marsh edge and to result in the creation of shallow subtidal areas between mounds that are protected from wave energy to promote seagrass colonization.** The entire complex of mounds was intended to baffle wave energy to protect the landward shoreline marsh from further erosion and provide habitat for blue crab, red drum, southern flounder and brown shrimp.

Figure 1. Change in extent of marsh habitat in the western portion of Jumbile Cove over time.

How

The project was constructed by hydraulically dredging material from a nearby borrow site and using it to create multiple, distinct mounds. The sediments used for mound creation were described as a fine-grained sand with silt/clay contents ranging from 10-30%. The design and placement of marsh mounds was intended to allow unrestricted ebb and flow of tidal waters and ingress and egress of aquatic organisms. Building on lessons learned from previous mound creation projects in the area, this installation involved a seaward line of sacrificial “perimeter” mounds. Perimeter mounds were installed in lieu of a permanent rock breakwater and were intended to provide a wave break for long enough for vegetation to become established on the interior mounds. Perimeter mounds were designed to a higher elevation (+0.76 m [2.5 ft] NAVD88) than interior mounds (+0.67 m [2.2 ft] NAVD88). In total, at J COVE there were 19 perimeter mounds that protected 76 interior mounds. Design elevations were determined based on the elevation distribution of nearby natural shorelines. The goal was to target elevations appropriate for upper intertidal marsh and the salt pan habitat that is common in this area at elevations just above of that of regularly flooded marsh. The initial diameter of individual mounds (measured by the extent of intertidal area) varied between ~ 30 and 36 m (100 and 120 ft).

Planting efforts were focused on the perimeter of each mound at elevations between 0.24 and 0.43 m (0.8 and 1.4 ft) NAVD88. The center, higher elevation zone of each mound was left to colonize naturally. In total, 73,846 *S. alterniflora* plugs were planted over the course of 5 separate planting events between July 2011 and August 2012. Initial monitoring efforts (conducted through 2012) documented changes in mound elevation profiles and vegetative success and provided a baseline against which to quantify longer-term changes.

Site Physical Characteristics

Average nearshore wave energy since project implementation was modeled with the Wave Exposure Model (WEMo) using wind data available from the nearby airport (GLS). These data illustrate that the site most commonly experiences southeasterly winds but the strongest winds blow from the NNW. While average wave heights along the shoreline are < 30 cm, maximum values reach 50 cm (Figure 2). The presence of the mounds clearly reduces wave energy reaching the upland shoreline.

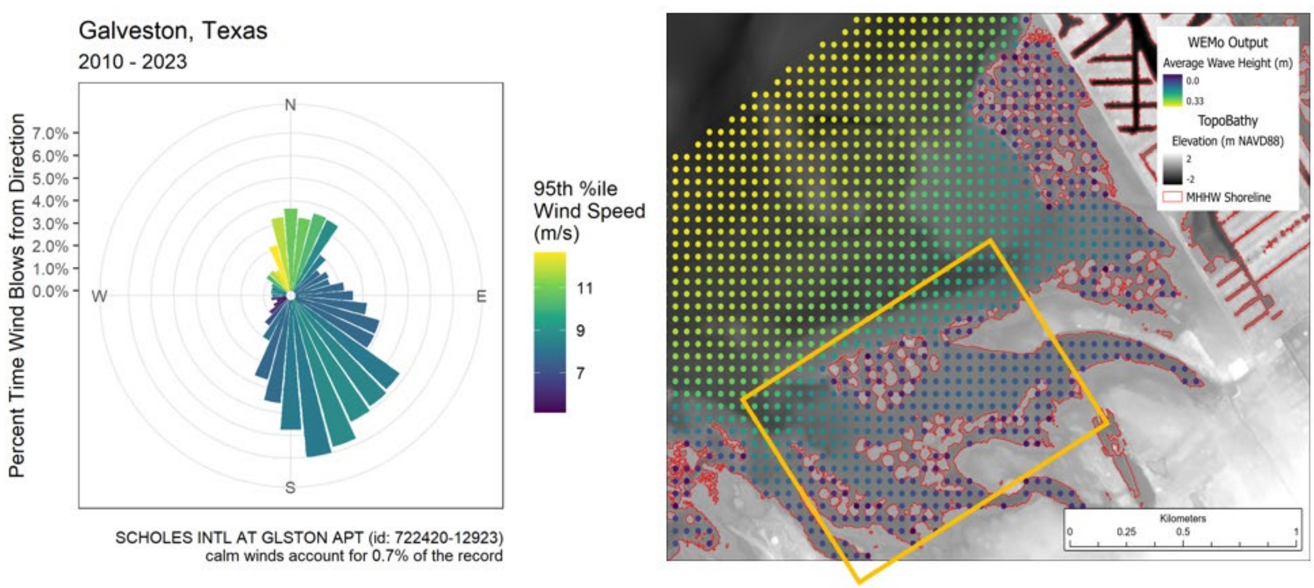

Figure 2. Average measured wind conditions over the project lifespan (left) were used to model wave energy conditions using the Wave Exposure Model (WEMo, right). Yellow box in the right panel outlines the approximate project footprint.

Performance Over Time

Initial monitoring data were collected for two years post-construction (through 2012). Monitoring parameters included repeat elevation surveys across a subset of the mounds, image collection at numerous fixed photo stations within the project site, and documentation of the species present. In 2023, researchers from NCCOS re-visited this site to evaluate changes since 2012.

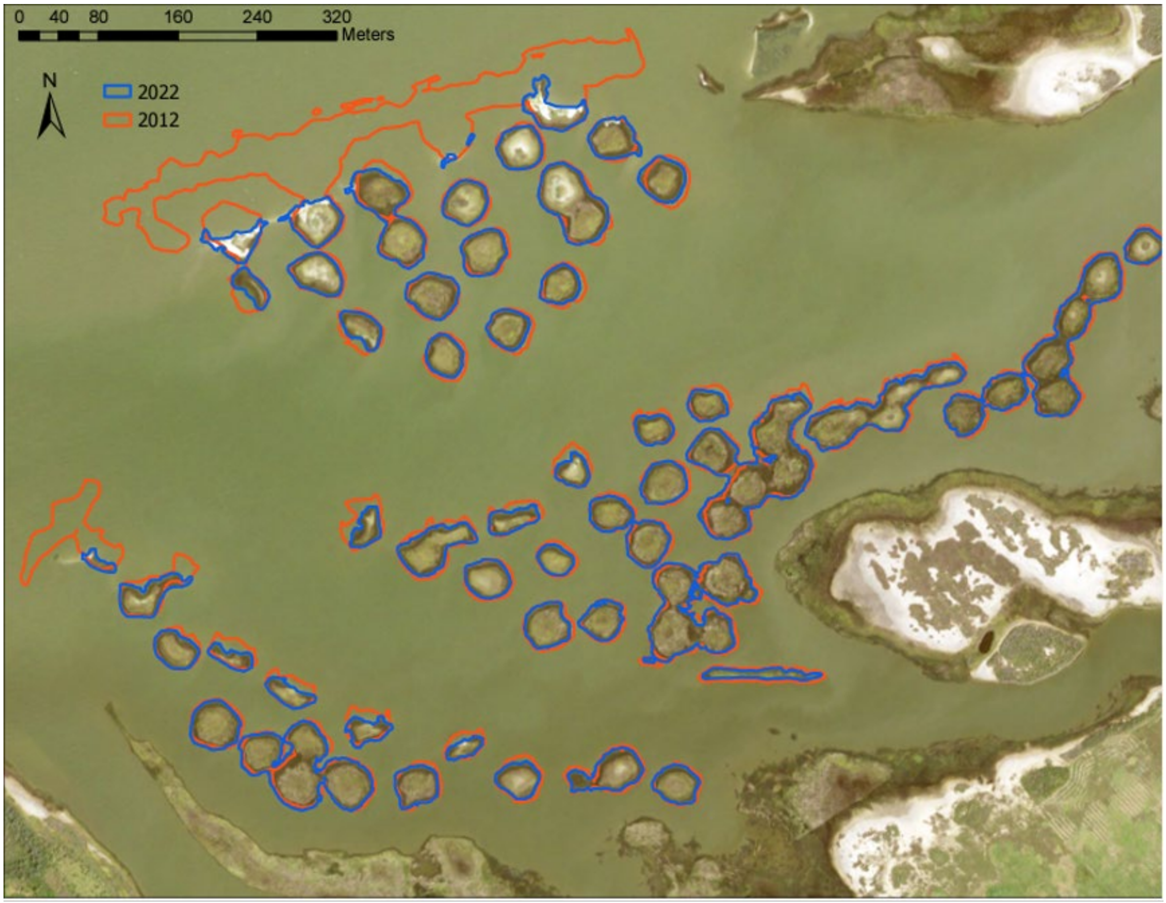

Figure 3. Digitized shorelines from 2012 and 2022 (using imagery available from the Natural Agriculture Imagery Program; NAIP). Shoreline position was defined by the outer extent of vegetation on each mound.

As of 2023 (13 years after project construction), 0 of the 19 perimeter mounds and 69 of the 76 interior mounds were still present. The perimeter mounds initially coalesced into a continuous ridge as their bayside shorelines were rapidly reshaped by waves within the first year. This wave action resulted in a steepening of the wave exposed shorelines as documented by the initial monitoring efforts, and ultimately, a total loss of the perimeter within 5 years of construction (based on visual analysis of google earth imagery). Several interior mounds, initially protected by the perimeter, on the leading edge of the complex, have either been significantly reshaped by waves or lost completely after perimeter collapse. Between 2012 and 2022, the total extent of created habitat that is at intertidal or greater elevation decreased from 34 acres to 24 acres (30% loss; Figure 3 below). Erosion of the sacrificial perimeter accounted for the bulk of the area lost.

Comparison of 2023 elevation survey data with 2011-2012 data collected shortly after installation indicates the interior mounds maintained, and in some cases even increased in elevation over time (Figure 4). Presumably, the growth of these mounds is at least partially driven by the capture of sediment that was eroded from the perimeter and outer mounds.

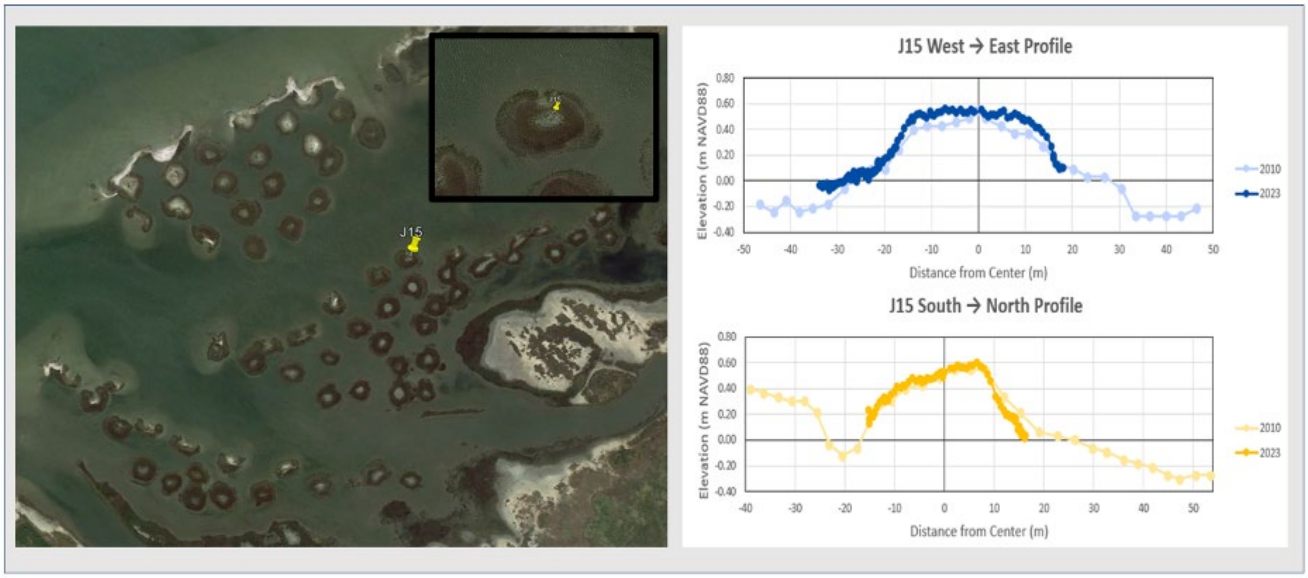

Figure 4. Survey profiles collected on interior mound (J15) just after project completion and again, 13 years later illustrate relative stability in mound topography over time.

Current Habitat Distribution

As of 2023, J Cove marsh mounds were characterized by a dense ring of monospecific *Spartina alterniflora* at lower elevations (upper extent of monospecific *S. alterniflora* growth ~ 0.4 m [1.3 ft] NAVD88). At higher elevations, the vegetative cover transitioned to a mixed community of short-form *S. alterniflora*, *Salicornia sp*. and *Batis maritima*. Several small patches of SAV were identified from aerial imagery (0.15 acres in total; Figure 5). This is likely a conservative estimate of the total SAV present due to water clarity limitations during image collection. The SAV is presumed to be *Halodule wrightii* based on positive confirmation of a patch with similar spectral characteristics at a nearby site.

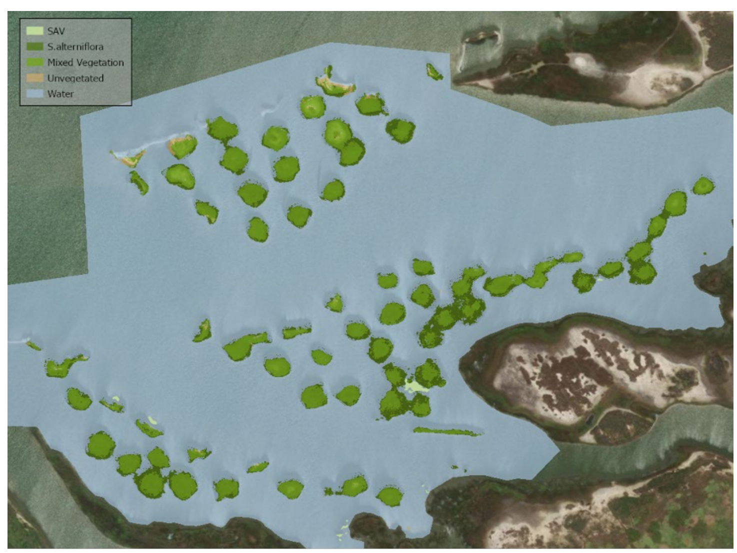

Figure 5. Distribution of dominant vegetated habitats as of October 2023 based on analysis of drone-collected imagery

Sediments and Carbon Accumulation

Just after construction, each mound was essentially a pile of dredged sediment with a texture and composition very similar to that of the nearby subtidal bottom from which it was dredged. As the site has matured, the mounds have accumulated fine grained sediments (silt/clay) and organic matter from the production and turnover of plant roots. The slow accumulation of organic matter alters both the texture and carbon content of the sediments within the active root zone (10-20 cm deep). As of 2023, shallow sediment of the *Spartina alterniflora* dominated zone (lower-elevation regions that are more regularly flooded) of mounds was characterized by silt/clay contents of 35-70%. For comparison, silt/clay content at depths below the active root zone ranged between 1 and 6% while those in surface sediments of nearby natural marshes ranged between 44 and 80%. As the mound sediments become more typical of a natural marsh they are also accumulating carbon. A back-of-the-envelope estimate calculated by multiplying the average carbon stock in the top 15 cm by the total area of intertidal habitat suggests this site has accumulated approximately 46,727 Kg of sediment-associated carbon since construction.

Performance Summary

As of October 2023 (13 years after project completion), 60% of the created intertidal habitat is still present. The majority of the loss has been from erosion of the outer perimeter mounds which were designed to provide a temporary wave break, allowing the vegetation on the interior mounds to become fully established. This strategy appears to have been largely successful based on the persistence and dense vegetative cover of the interior mounds. Further, it seems likely that erosion of the perimeter mounds served as a source of material for the interior mounds. Although the mounds do not appear to be building elevation fast enough to keep pace with local relative sea level rise, they have been effective at providing intertidal marsh habitat and buffering the remaining natural shoreline marsh from waves.

Report Credit: Davis, J., LeClaire, A., Bost, M., Walker, Q., & Giannelli, R. (2024). Site Report: J Cove. US DOC NOAA NOS National Centers for Coastal Ocean Science (NCCOS). Marsh Mounds: