Site Report: Fishing Battery Island

Original restoration completed in 2013

The restoration of Fishing Battery Island was the result of a partnership between the U.S. Army Corps of Engineers and U.S. Fish and Wildlife Service. This project restored 12 acres of intertidal and upland habitat on a historical man-made island in the northern reaches of Chesapeake Bay within the Susquehanna National Wildlife Refuge.

Where, What, Why

Fishing Battery Island is part of the Susquehanna National Wildlife Refuge in Northern Chesapeake Bay. This man-made island was originally created in the early 1800's to support shad fishery operations and in the mid 1880's was adapted to accommodate a shad hatchery. Fishing Battery Island is also home to the remnants of a historic lighthouse (originally commissioned in 1851). Like other islands in the Chesapeake Bay, Fishing Battery has not kept up with sea level rise and as of 2011, there was little high ground remaining. In 2013, interest by the local community in saving the lighthouse converged with a need to dredge the navigation channel adjacent to Fishing Battery Island and ultimately resulted in an effort to preserve the island. ***In addition to protecting what remained of the lighthouse, goals of the restoration included creating habitat for black ducks and Caspian terns.***

Figure 1. Left: Historical photo of Fishing Battery Light, date unknown. Right: Aerial image of Fishing Battery Light, circa 1994.

How

The restoration action involved enveloping what was left of Fishing Battery Island with a tall U-shaped berm. The berm was designed to be 125 feet wide across the top and to reach an elevation of 7 feet above Mean Lower Low Water. The berm was graded to a 10:1 slope on its outer extent. The inner edge of the berm (facing the original island) was graded more steeply (5:1) to the elevation of the existing island platform. The sediments used for this project were characterized as 95% medium grained sand. There was no structural component to the built island (i.e. no sediment containment feature or shoreline hardening). The sediment placement was completed in early spring of 2013 and the island was planted with a range of native species appropriate for each elevation zone (a total of 60,000 plants). In response to heavy human foot traffic and grazing by geese, an additional round of planting including 1600 plants and 3 acres worth of seeding was conducted in the fall of 2013. The goal of this additional effort was to protect against erosion of the shoreline and impede foot traffic across the island. Aside from this additional planting there has been no formal maintenance of this project.

Site Physical Characteristics

The average tidal range in the waters surrounding Fishing Battery Island is approximately 2.3 feet and while maximum waters depths approach 8 feet in the navigation channel that provides access to the island, the majority of the area surrounding the island is on the order of 1-2 feet at low tide. Winds in this area are variable: they blow most frequently from the SW, but winds from the W are also common and the most consistently strong (Figure 2). Wind-generated waves impacting the island (modelled using the highest 5% of wind events; Figure 2) average 26 cm (10 inches) in height. The western shoreline is further impacted by vessel wakes, the impacts of which are not quantified in the wind-wave model.

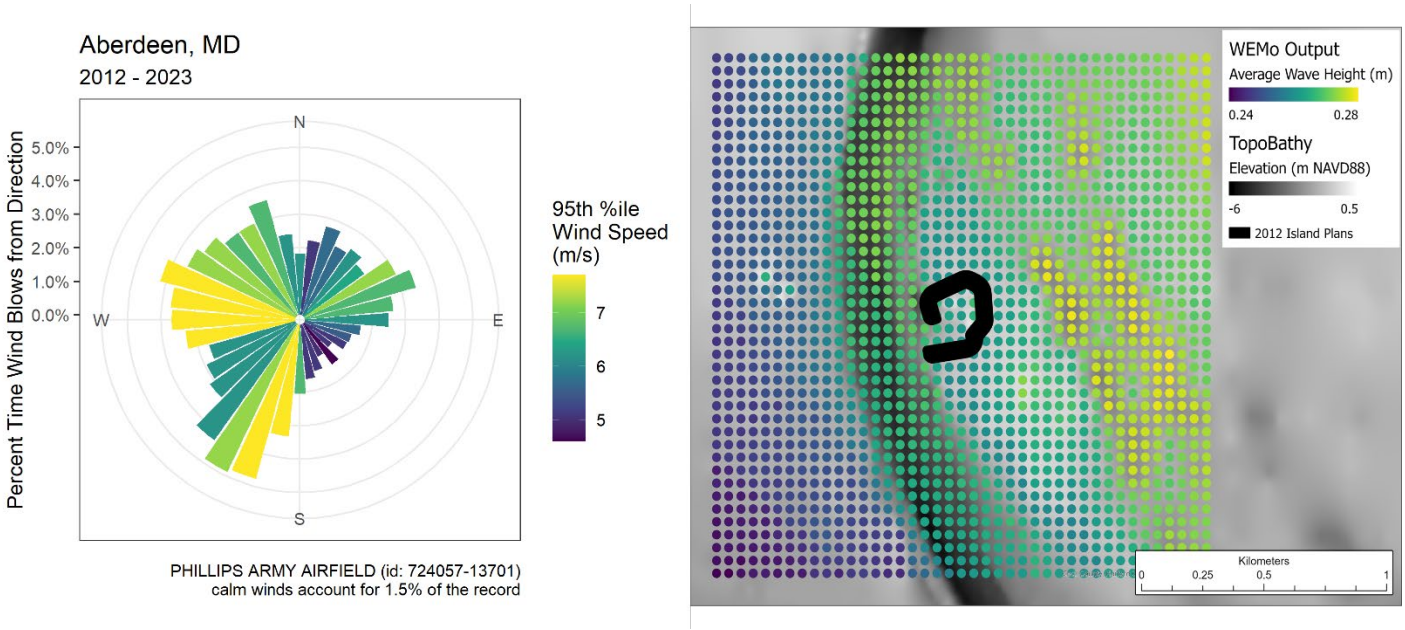

Figure 2. Average measured wind conditions over the project lifespan (left) were used to model wave energy conditions using the Wave Exposure Model (WEMo, right). Only the top 5% of wind events (intensity) were modeled. Colored points represent modeled average wave heights within a 2 x 2 km grid surrounding Fishing Battery Island. Gridded points are spaced 50 m apart. Grayscale background layer is bathymetry raster.

Performance Over Time

Comparison of Fishing Battery Island's 2013 (just after restoration) and 2023 extents indicates that much of the designed footprint has persisted since project construction (Figure 3). The exceptions are the island's northern shoreline and western-most extents (outer tips of the U shape) which have lost area due to erosion. In 2023, elevation survey data were collected along 8 transects perpendicular to the main spine of the island (Figure 3). Comparison of the surveyed elevations with the intended elevations along these transects highlights significant differences between the two. In general, 2023 surveyed elevations were ~50 cm (1.5 feet) lower than designed elevations across the high elevation spine of the island.

Figure 3. Design plan. Inner, solid polygon indicates the central spine that was designed to 7 ft MLLW. Outer polygon (dashed line) represents full spatial extent of intended project footprint. Perpendicular lines numbered 1-8 represent elevation survey transects occupied in 2023.

There was no available post-construction survey data for comparison so it is unclear how closely the final built project reflected the design, but assuming that the intended elevation was achieved, the island appears to have lost elevation over time. While the reason for such elevation loss is unclear, we hypothesize that gradual slumping of the steep slopes (likely exacerbated by human foot traffic) has played a role. The central higher elevation zone of the island is vegetated with Switchgrass (*Panicum virgatum*); which commonly occurs on dunes in this area of Maryland, indicating that despite the difference between the current and intended elevations, this portion of the island remains above Mean High Water.

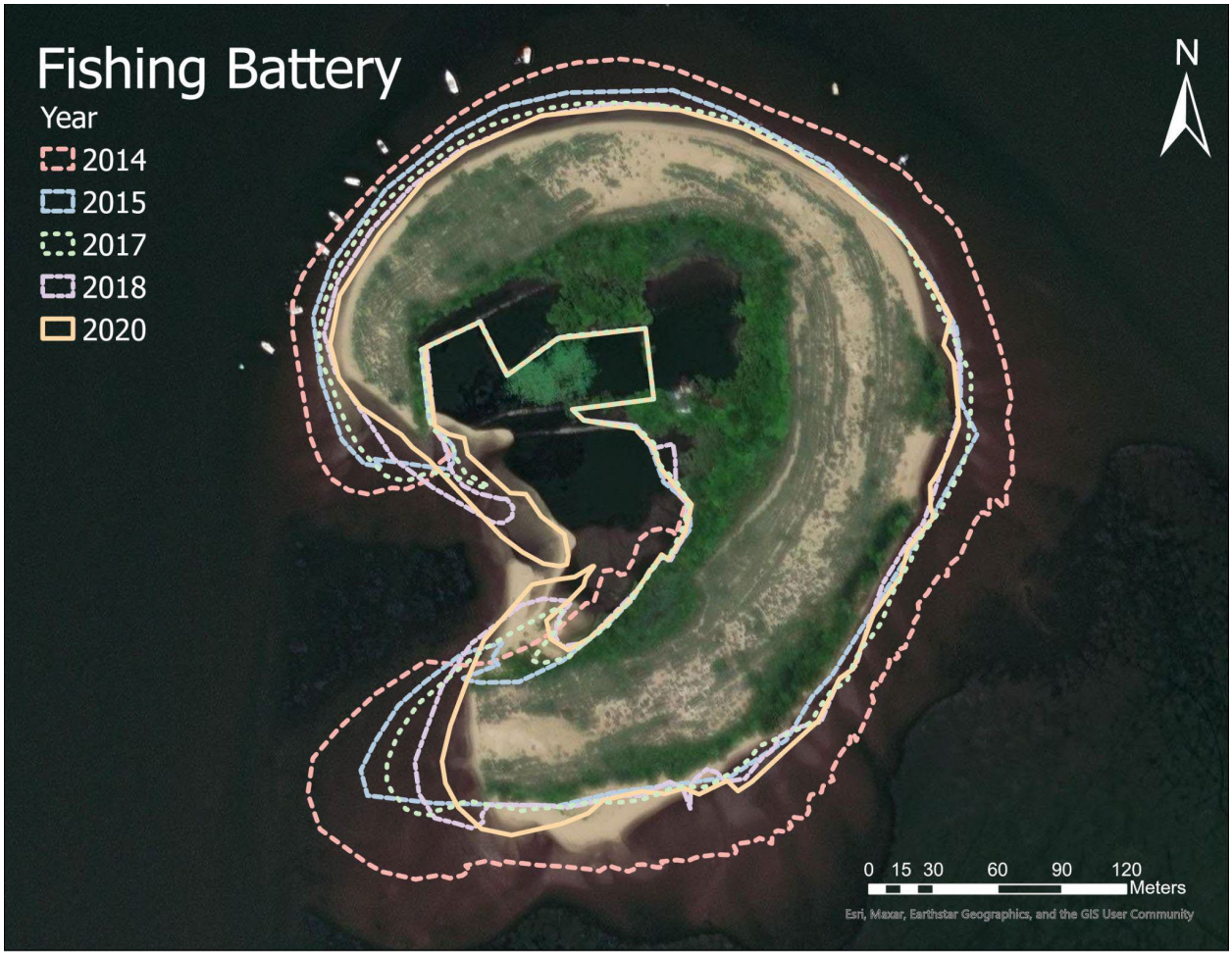

Figure 4. Shoreline position overtime as delineated from aerial imagery. Imagery used to generate these shorelines was obtained from the MD iMAP system.

In 2014, 1 year after project completion, the total areal extent of the island was approximately 16 acres. By 2015, the total area of the island had declined to 10 acres and has remained relatively stable since then. Most of the loss occurred on the western tips of the island, closest to the navigation channel.

Habitat Distribution

As of 2023, the switchgrass plantings were successful and seemed to be thriving although they had not coalesced into a dense canopy; the planting rows were still evident from aerial imagery (Figure 5). A number of tree species had recruited to the area naturally including locust, oak, sycamore and willow varietals including a dense and tall (> 30 ft) stand of trees along the southeastern shoreline, none of which were planted. The original design included planting emergent grasses in the intertidal zone along the inner shoreline of the island in an attempt to establish a marsh fringe. As of 2023, there was no evidence of the planted marsh vegetation along the inner shoreline, but most of that shoreline was densely vegetated with trees.

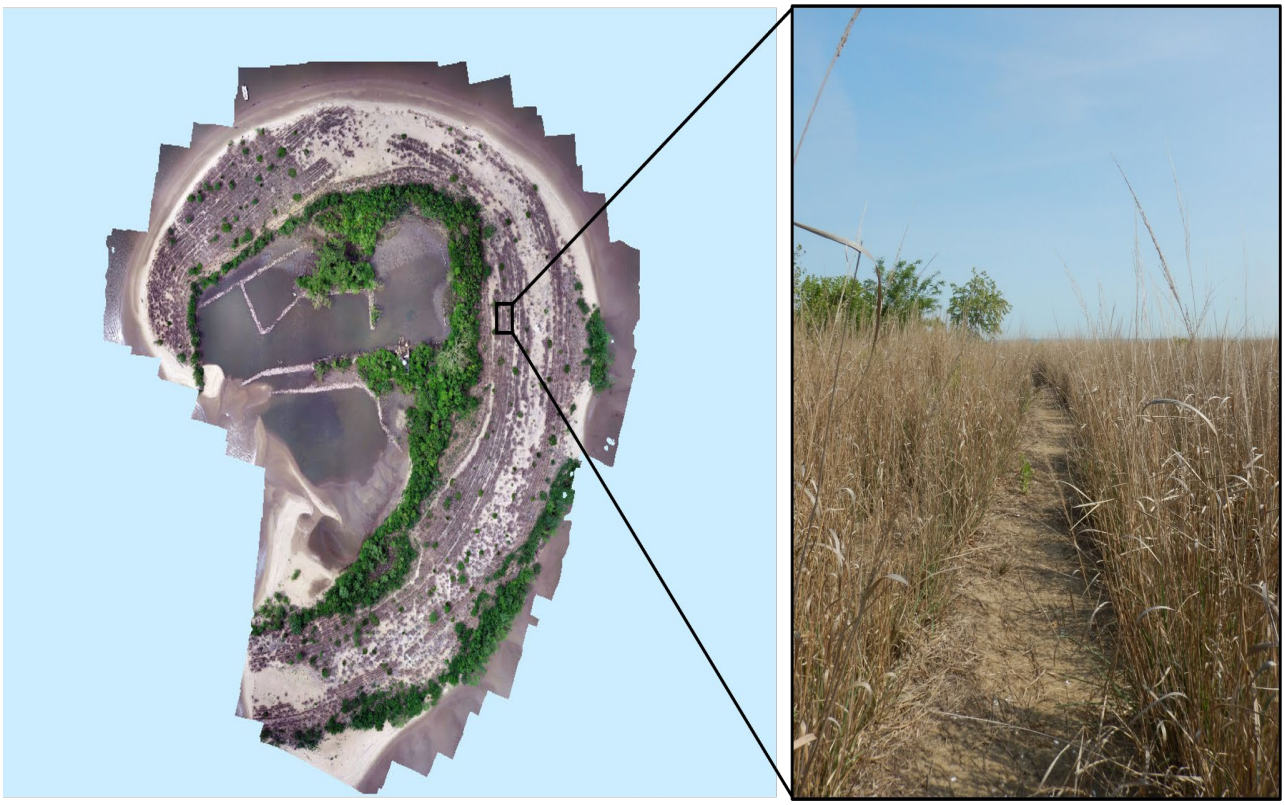

Figure 5. Composite drone imagery collected in 2023 (left) highlights the extent of vegetated vs unvegetated area 10 years post-construction. Trees and shrubs display as green, switch grass is brown and planting rows are still evident (right).

Sediments and Carbon Accumulation

The sediments used to restore Fishing Battery Island were described as 95% medium grained sand. As a result, it is reasonable to assume that the placed sediments were very low in carbon content. Sediments and soils become enriched in carbon over time through the incorporation of decaying root material into the soil matrix. The decay of plant roots is less efficient in water logged soils and thus, carbon tends to build up more rapidly in areas that are frequently inundated. The majority of created habitat on Fishing Battery Island is above the Mean High Water elevation, and as a result, not likely to accumulate carbon rapidly. In 2023, we collected sediment cores from three locations on the Island: 1) a low elevation "natural" location near the inner shoreline that was not impacted by the restoration effort, 2) a low elevation (near the water's edge) restored site, and; 3) a higher elevation (near the current crest of the island) restored site. At all sites, the soils exhibited high sand contents and relatively low carbon accumulation rates over the past 10 years (measured C accumulation ranged between 1.5 and 80 mg C m^{-2} yr^{-1}).

Performance Summary

As of 10 years post-construction, Fishing Battery Island still largely reflects the design conditions. The central ridge of the island is lower in elevation than originally planned but still above mean high water. The planted switch grass has persisted across the higher elevation regions of the island and a number of other species (mostly trees) have recruited naturally. It seems likely that lateral spread of the switchgrass has been hampered, at least in part, by human foot traffic as the planting rows are still evident after 10 years. The island is used heavily for recreation (Figure 6), which is one of the frequently cited co-benefits of nature-based solutions. Ironically, this recreational use creates a significant challenge to the long-term resilience of the created feature. Overall, this constructed island is providing both habitat and recreational benefits and protecting what remains of the historical lighthouse from wave energy.

Figure 6. Recreational boaters around Fishing Battery Island

Report Credit: Davis, J., Walker, Q., R. LeClaire, A., Bost, M and Giannelli, R (2024). Site Report: Fishing Battery Island. US DOC NOAA NOS National Centers for Coastal Ocean Science (NCCOS). Islands.