Site Report: Maryland Coastal Bay Bird Islands

Original restoration completed in 2015

The Sinepuxent and Chincoteague Bay Island projects included restoration of multiple small islands adjacent to a maintained navigation channel by the US Army Corps of Engineers Baltimore District. The performance of three of those islands: Robin's Marsh, Mark 12, and Mark 14 is documented here.

Where, What, Why

The navigation channel that runs the length of Sinepuxent Bay, connecting Isle of Wight Bay to the north with Chincoteague Bay to the south, was originally created in the 1930's in connection with the opening of the Ocean City Inlet. During initial channel construction, a number of dredge spoil islands were created along its banks. The islands became important nesting habitat for colonies of Royal terns, Least terns, and Black skimmers. It is estimated that in recent decades more than 120 acres of island habitat have been lost to erosion in the Maryland Coastal Bays[1]. As part of a navigation dredging action that began in the winter of 2014 and lasted through the summer of 2015, the Army Corps used sediments dredged from the Sinepuxent navigation channel to restore several of these eroded islands. ***The goal was to beneficially use the dredged sediments to re-create lost island habitat which provides critical nesting grounds for a number of threatened bird species.***

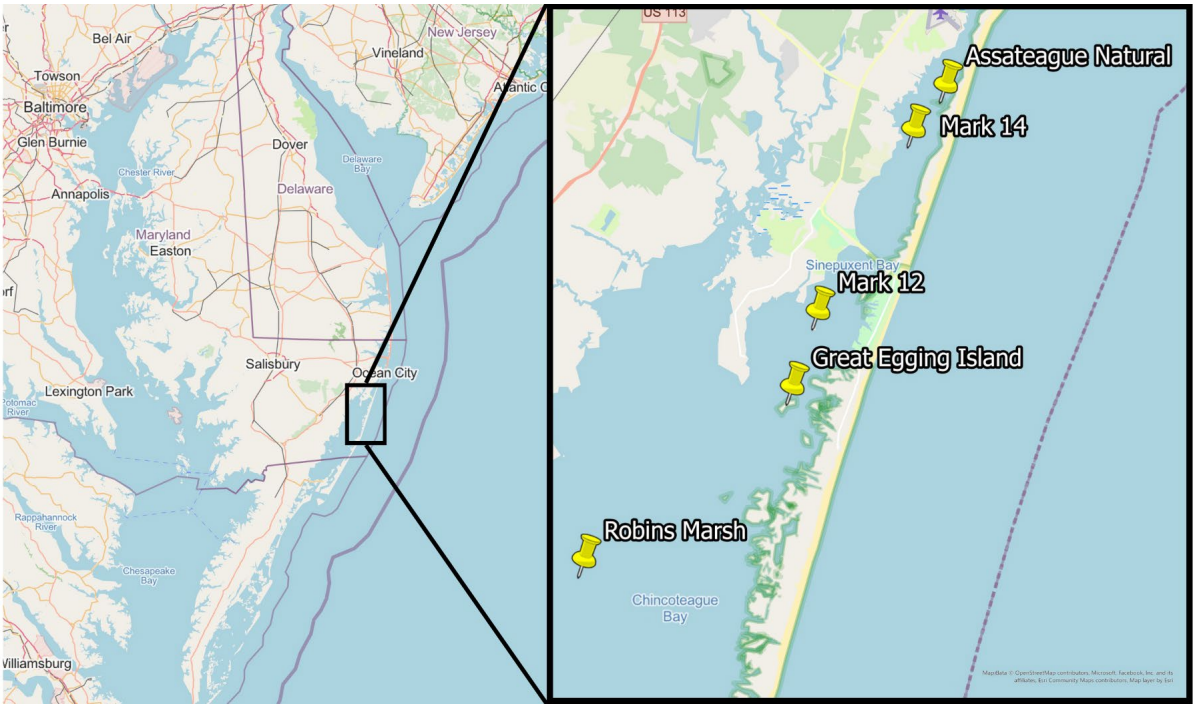

Figure 1. Location of the created and reference islands discussed here within the Sinepuxent and Chincoteague Bay system.

How

The restoration of all three islands described here was conducted in 2015 in conjunction with dredging of the channel that runs the length of Sinepuxent Bay and into northern Chincoteague Bay. Preliminary sediment sampling conducted by the US Army Corps of Engineers indicated that sediment texture varied over the extent of the channel from < 20% to > 95% sand content.

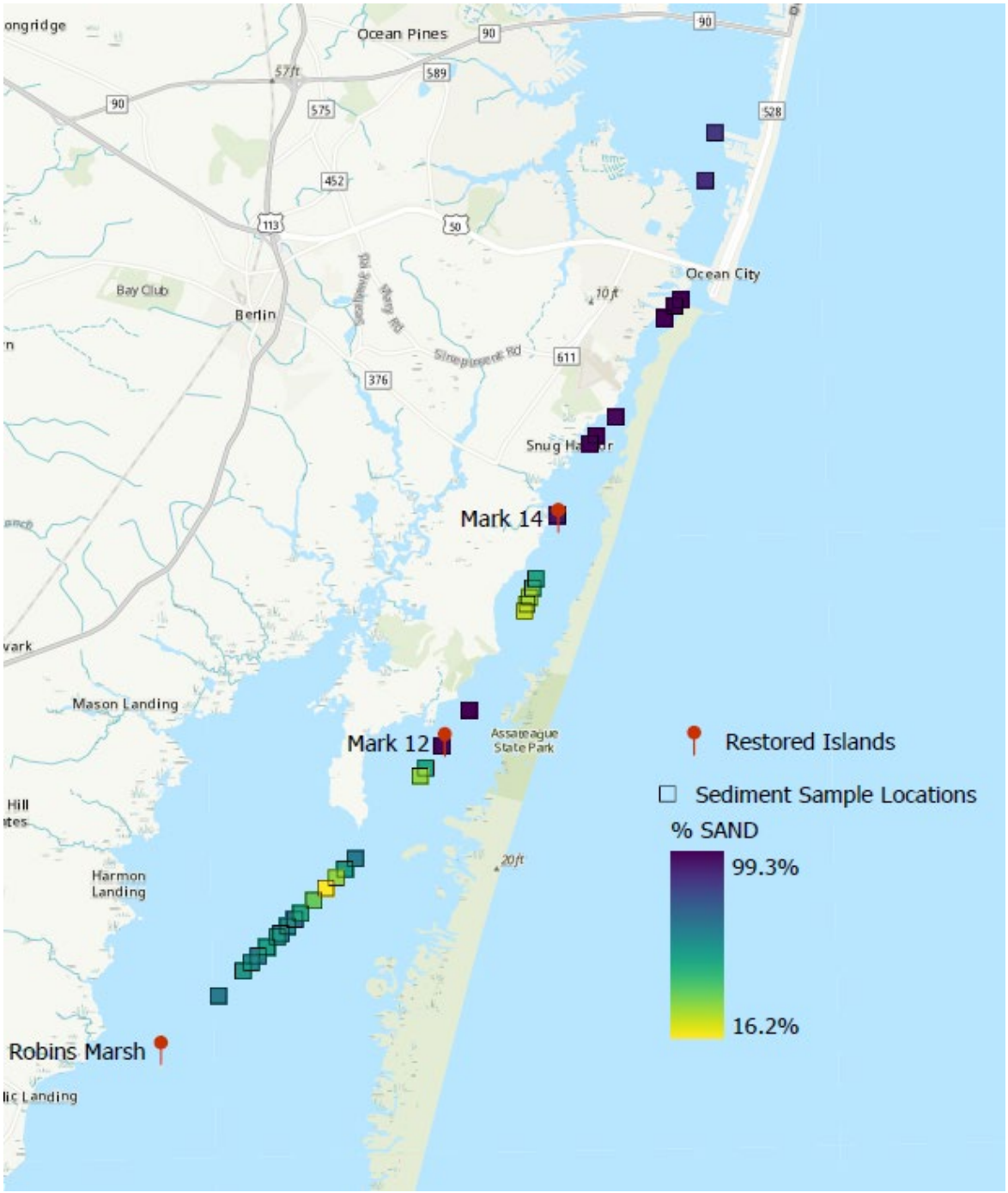

Figure 2. Location and sand content of the 48 cores collected prior to dredging. Data provided by USACE Baltimore District.

At all three project sites, hydraulically dredged sediment was pumped onto subtidal shoals that represented the remnants of previously created islands that had since been lost to erosion. The three islands evaluated here: (from north to south) Mark 14, Mark 12 and Robin's Marsh, were designed to include 2.8, 1, and 4 acres of upland (area above Mean Higher High Water), respectively. At Robin's Marsh and Mark 12, the design plan involved pumping sediment directly onto the existing shoal with a grade of 15:1 and final target elevations between 8 and 9 feet MLLW. At Mark 14, the design plan involved creating a sand containment dike to an elevation of 4 ft MLLW around the existing shoal and then filling the dike with the siltier sediments, and capping it with sand. This plan was not ultimately implemented because there was less silt recovered than anticipated during dredging. As a result, this island, like Mark 12 and Robin's Marsh was built by pumping sand directly onto the pre-existing shoal. Conversely, at Robin's Marsh, the dredged sediments were much siltier than anticipated, as a result, the finished product was roughly 1 acre in areal extent (rather than the planned 4 acres) and with a surface elevation that ranged between 1 and 2 feet MLLW.

At Robin's Marsh, coir logs were placed on the sediment surface after construction in an attempt to mitigate wave energy and help contain the placed sediments (Figure 3). At Mark 12, a wall of oyster castles was installed on the north side of the island in 2017 in an attempt to minimize erosive losses. The wall consisted of 1 x 1 x 1 ft oyster castles arranged in 5, 16-foot sections with 6 feet between each section (Figure 3). The oyster castles were arranged in a three-tiered pyramid (3 castles wide on the bottom, 2 wide on the middle, and 1 wide on the top row) and positioned ~ 30 feet offshore where the top of the oyster castle structure reached just above MHW. The north and south shorelines of Robin's Marsh were planted with *Spartina alterniflora* at elevations appropriate for its growth.

Figure 3. Left: Coir log installation and vegetation planting at Robin's Marsh (2016). Right: Oyster castle installation (3 of the five sections complete) at Mark 12.

Site Physical Characteristics

Nearshore water depths in the project areas varied from 3 to 4 ft MLLW at Mark 12 and Mark 14 respectively, to 6 ft MLLW at Robin's Marsh. The system is microtidal with an average tide range of 0.8 ft (25 cm). Winds most commonly blow from the SW in this region although the strongest winds tend to blow from the NE (Figure 4). Modeled values of wind wave energy indicate that average wave heights at Robin's Marsh range between 23 and 34 cm (9 and 13 inches), while those at Mark 12 range between 0 and 23 cm (9 inches), and those at Mark 14 range between 0 and 18 cm (7 inches).

It is important to note that due to their proximity to the navigation channel, all three sites also experience boat generated wave energy, which is not accounted for in these modeled values.

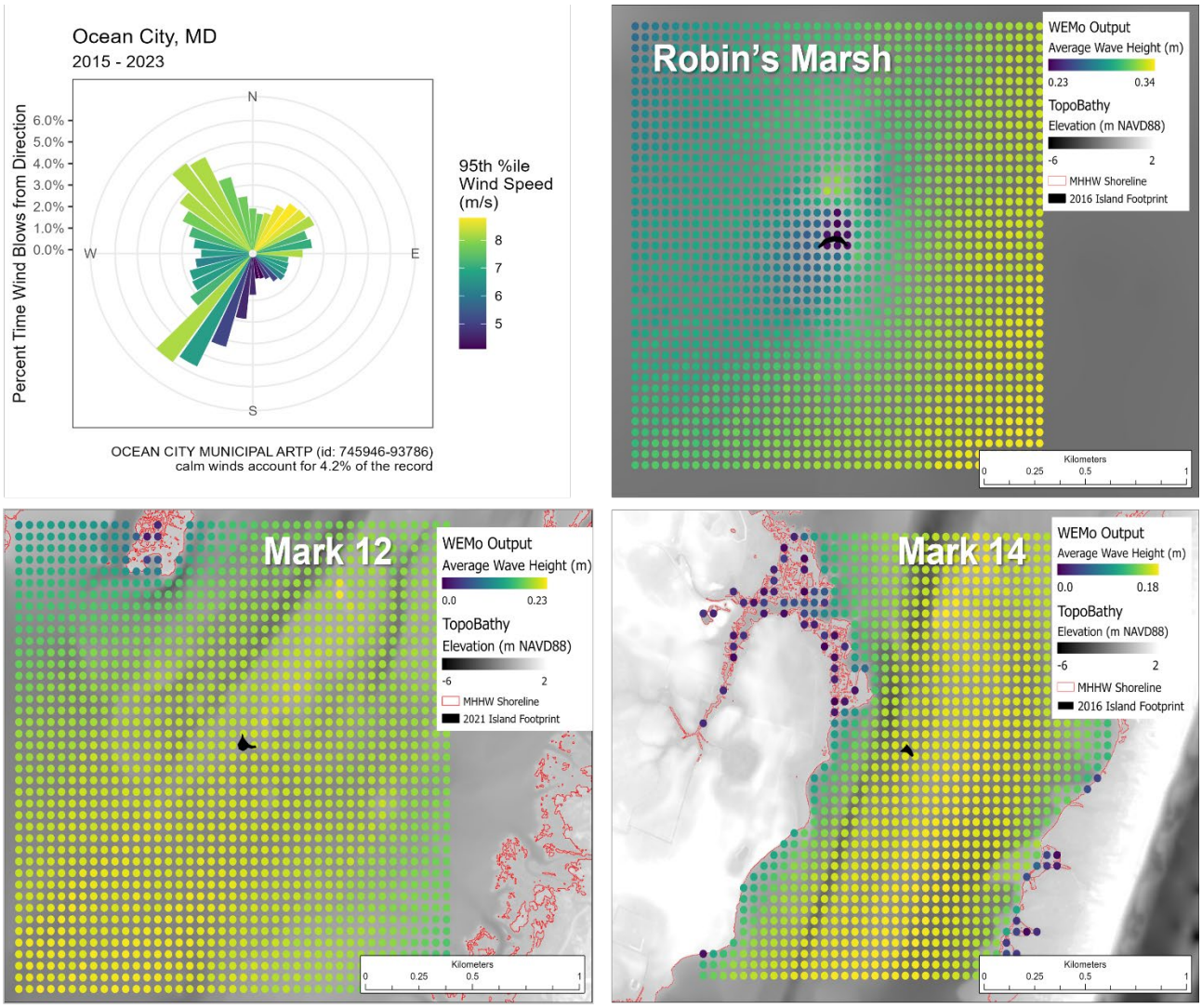

Figure 4. Average measured wind conditions over the project lifespan (top left) were used to model wave heights in the vicinity of each project area using the Wave Exposure Model (WEMo, right). Colored points represent modeled wave heights within a 2 x 2 km grid surrounding each island. Gridded points are spaced 50 m apart. The footprint of each built island is outlined in black.

Performance Over Time

Evaluation of time series satellite imagery indicates that all three restored islands suffered rapid erosive losses (Figure 5). Mark 14 was converted back to a subtidal shoal by 2018 and Robin's Marsh was quickly reshaped and ultimately, fully submerged by 2020. As of 2023, Mark 12 was fully submerged at high tide.

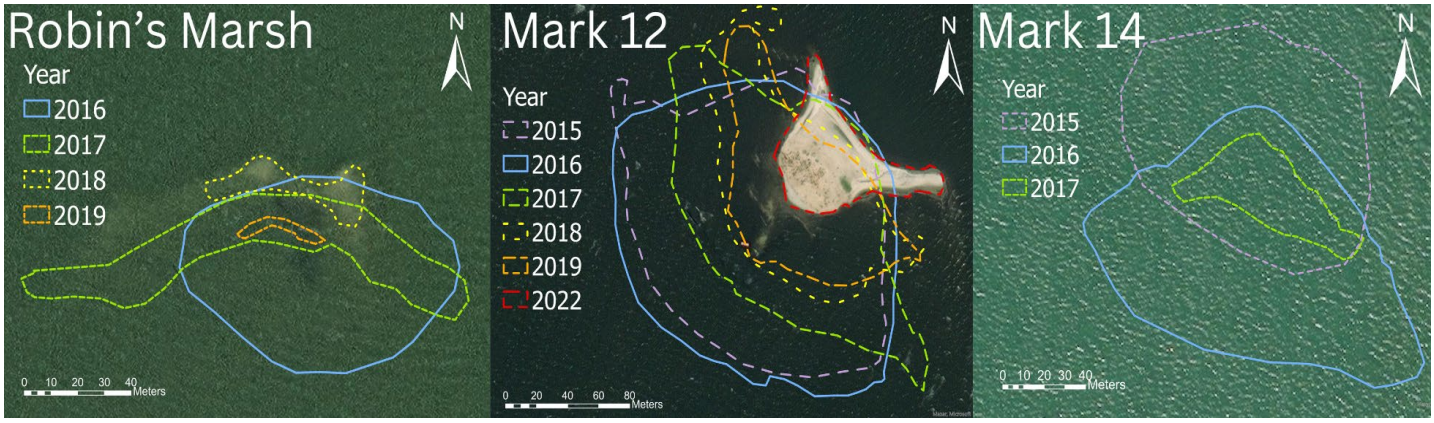

Figure 5. Shoreline positions were hand-digitized from time-series satellite imagery provided by the National Agricultural Imagery Program (NAIP) and MD iMAP: Maryland Six Inch Imagery. Imagery was accessed through ArcGIS online.

Comparison with Reference Islands

Naturally occurring islands within the Sinepuxent and Chincoteague Bays provide a valuable reference for island performance in this system. We chose two natural islands (Great Egging Island and an unnamed island that we refer to here as Assateague Natural) and evaluated changes in their

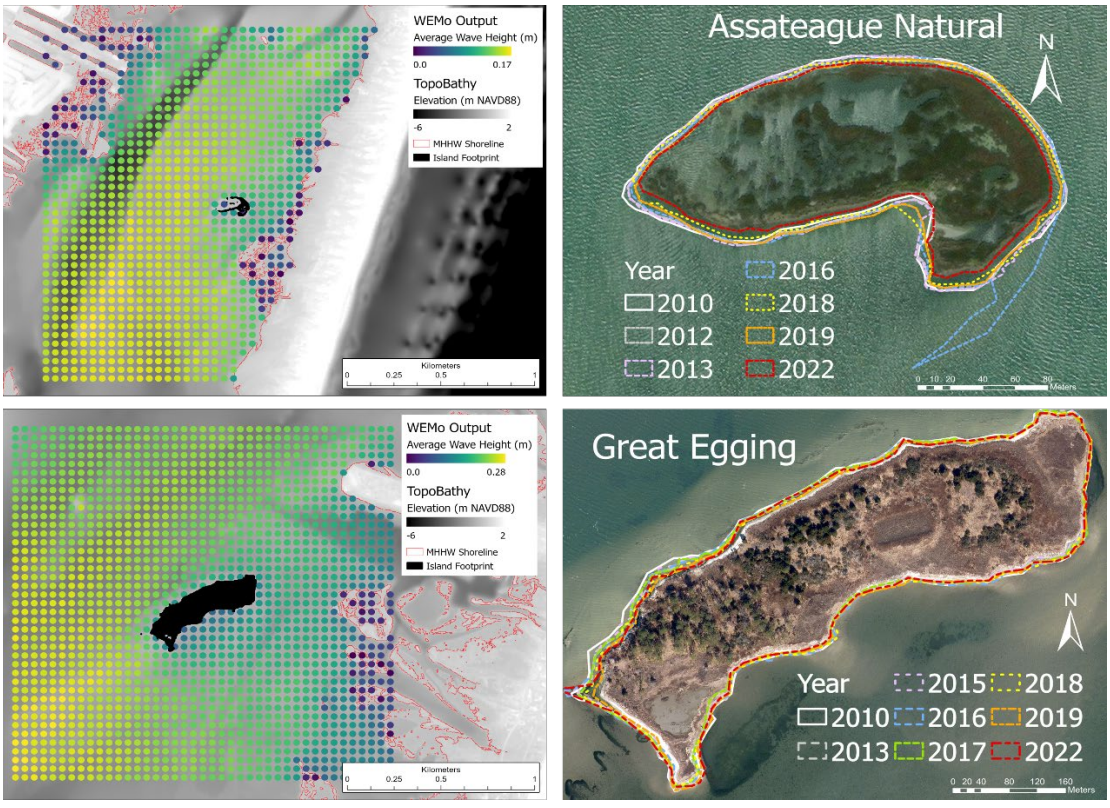

Figure 6. Left: Average measured wind conditions over the project lifespan were used to model wave heights in the vicinity of each project area using the Wave Exposure Model (WEMo). Colored points represent modeled wave heights within a 2 x 2 km grid surrounding each island. Gridded points are spaced 50 m apart. The footprint of each built island is outlined in black. Right: Shoreline positions were hand-digitized from time-series satellite imagery provided by the National Agricultural Imagery Program (NAIP) and MD iMAP: Maryland Six Inch Imagery. Imagery was accessed through ArcGIS online and Maryland Statewide Imagery Download Tool.

total extents over time as a function of modeled wave energy. Both of these islands are close to the Assateague Island shoreline and thus, relatively protected from NE winds, but experience waves on their southern and western shorelines that are comparable to those experienced by the created islands. Both of the natural islands were densely covered with native intertidal vegetation.

Performance Summary

The naturally occurring islands investigated here have maintained their areal extent over the past decade. This is in contrast to the created islands, which were either lost completely, or experienced dramatic decreases in total area within 5 years of construction. When we visited Mark 12 in 2023 its highest point was completely submerged at high tide. While the cause of the differing performance between the natural and created islands has not been conclusively determined, it is likely due to a combination of factors. First, the well-established vegetative cover of the natural islands provides protection against erosion. The above ground vegetation dampens wave energy while the belowground roots and rhizomes enhance soil cohesion helping to hold the sediments in place. Second, the created islands are near the navigation channel, and as a result, are likely impacted by boat wakes, an additional source of wave energy which is not accounted for in the WEMo model output. Performance of the natural islands suggests that establishing created islands further from the navigation channel and taking measures to enhance vegetative growth (eg. planting densely and providing temporary wave protection until young plants become fully established) would be necessary to increase their expected lifespans. Another notable lesson from these projects is that the high degree of heterogeneity of sediment types can make it challenging to meet design goals, even with an extensive amount of coring to characterize sediments prior to dredging.

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

1. Maryland Coastal Bays Colonial Waterbird and Islands Report. 2019. Audubon: Maryland-DC.