Establishing higher ground for nesting birds in coastal marshes of New Jersey through dredged material placement

Lisa Ferguson, Samantha Collins, Brittany Morey, Allison Anholt, Lenore Tedesco, Metthea Yepsen*
The Wetlands Institute, Stone Harbor, New Jersey USA; *NJ Dept. of Environmental Protection (NJ DEP), Division of Science and Research, Trenton, New Jersey USA; lferguson@wetlandsinstitute.org

Projects tailoring sediment management practices to modify or add bird nesting areas during routine dredging of navigable channels and inlets are being explored in New Jersey to augment habitat for coastal species that has been limited by development and recreational use of barrier island beaches and salt marshes, and is further constrained by increasing sea levels and flood frequency.

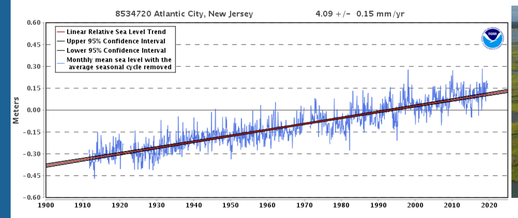

Fig.1. Relative sea level trend, Atlantic City, New Jersey 40 km from study site. NOAA: tidesandcurrent.noaa.gov; accessed 10/28/2019.

Fig.2. Ring Island elevated nesting habitat, Cape May County, NJ. 2015.

Location: Ring Island is a tidal marsh island owned by New Jersey DEP; sand was used to create an elevated nesting habitat in August 2014. Sea level rise rates in mid-Atlantic are at a higher rate than global average (IPCC Climate Change 2013).

Elevation targets: We examined predicted tides based on local tide gage, 3 years; actual water elevations, 3-5 years prior; spring tide, annual calculation; tidal datum based on 18 year record.

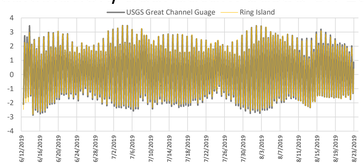

Fig 3. Water levels (ft, NAVD88) measured over time by two gages within 0.7 km of study site.

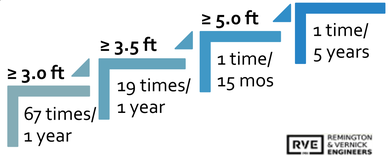

Fig 4. Local average flooding occurrence at water elevation (ft, NAVD88 based on 2003-2018).

Table 1. Elevation targets for construction of Ring Island elevated nesting habitat.

Construction considerations	NAVD88
Set target above MHHW	2.1 ft
Habitat above spring tide	3.6 ft
Habitat above storm flood elevations	5.5 ft
Allow dewatering, compaction, elevation loss	6.0 ft

What nesting species responded to elevated habitat?

Target species: Black Skimmer is an endangered species in New Jersey that nests on barrier island beaches and marshes. The site was constructed for skimmers but use was anticipated by American Oystercatcher and other shorebird and tern species.

Table 2. Number of nests and apparent hatch success by species on Ring Island elevated nesting habitat.

Species	2015		2016		2017		2018		2019	
	Nests	Hatch Success	Nests	Hatch Success	Nests	Hatch Success	Nests	Hatch Success	Nests	Hatch Success
Black Skimmer (BLSK) *Rynchops niger*	0	-	0	-	~51	~25.5%	~13	23%	0	-
Common Tern (COTE) *Sterna hirundo*	0	-	0	-	~100	~32%	~200	~42.5%	115	0%
Least Tern (LETE) *Sternula antillarum*	2	100%	16	56.3%	~33	~57.6%	6	0%	0	-
American Oystercatcher (AMOY) *Haematopus palliates*	3	66.7%	2	50%	6	50%	3	100%	0	-
Great Black-backed Gull (GBBG) *Larus marinus*	1	100%	1	100%	2	0%	0	-	0	-
Willet (WILL) *Tringa semipalmata*	0	-	1	100%	2	0%	1	100%	3	0%
Clapper Rail (CLRA) *Rallus crepitans*	0	-	1	100%	0	-	0	-	0	-
Seaside Sparrow (SESP) *Ammodramus maritimus*	0	-	0	-	1	0%	0	-	0	-

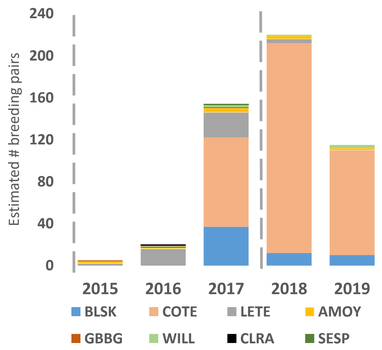

Fig. 5. Total number of breeding pairs on elevated habitat for each species by year. Dashed vertical bars indicate addition of sediment.

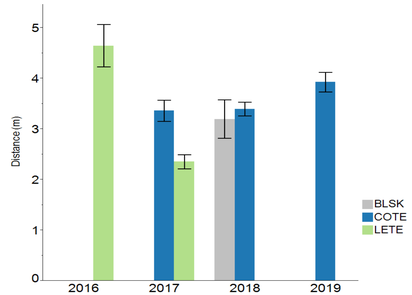

Fig. 6. Mean (SE) distance between nests for colonial nesting species on elevated habitat by year. Locations were not recorded for all nests or species in every year, including single GPS point indicating centroid of BLSK nesting locations in 2017 and two LETE nests in 2015 that were 11.3m apart.

How did elevation affect nesting bird use of the site?

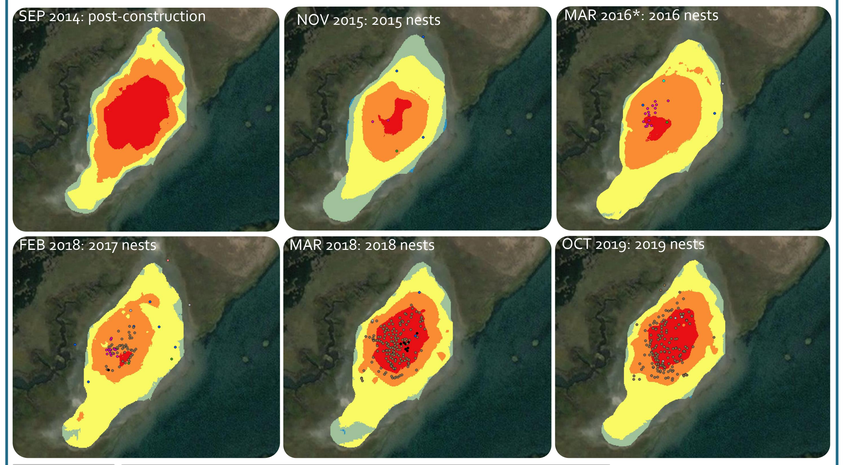

Fig. 7. Elevation models (ft, NAVD88) and nest locations on Ring Island elevated nesting habitat over 5 years. Images labeled by 'Elevation data month year: nest data year'
Sediment added to site prior to SEP 2014 and MAR 2018. Nest displayed by species, collected by Garmin GPS or Trimble GPS. Elevations modeled from RTK data (surveyed by USACE and Princeton Hydro) using Empirical Bayesian Kriging tool in ArcGIS, all years except 2016. *2016 elevations modeled from LiDAR data, provided by USACE, modeled by Princeton Hydro.

Continued assessment, management, and enhancement

- Habitat was provided for multiple species and taxa for nesting, foraging, and resting
- Elevation to reduce flooding risk was maintained; no nest loss above spring tide target
- Site requires management: vegetation, predators, disturbance, periodic reapplication of material
- Continue monitoring site as it matures to understand management needs and conservation potential

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