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A Unique Approach to Restoring Coastal Habitats, Cap Heavy Metals, Abate Wave Energy and Allow Successful Horseshoe Crab Spawning

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Introduction

Stratford Point (Fig. 1) was home to Remington Arms Gun Club, a trap and skeet shooting range from 1926 to 1986. Years of shooting resulted in lead contamination in the intertidal zone from the accumulation of lead shot. The 12 acres intertidal is important for horseshoe crab spawning. Horseshoe crabs are economically and ecologically important worldwide, so we have conducted spawning surveys in order to collect data of their populations before and after restoration efforts.

We hypothesized that the living reef should increase the spawning densities of the horseshoe crabs at Stratford Point.

To restore the fringe marsh habitat, and allow for protection from storm events:

- 64 Reef Balls® were installed in May 2014 (Fig. 2) and 273 more were placed in November 2016.
- *Spartina alterniflora* plants were planted in the intertidal zone in June 2015 (Figure 4 & 5).
- Deployment of pressure sensors prior to storms in winter 2014 to test any decrease in wave intensity as waves pass through Reef Balls (Figure 3).

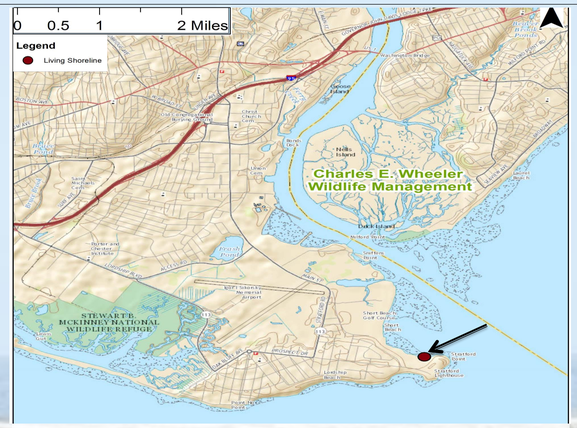

Figure 1. Location of Stratford Point Living Shoreline site.

Results

- Pilot Living Shoreline resulted in ~30% wave reduction (Figure 8).
- *Spartina alterniflora* doubled in height and density within the first six months (Figure 5).
- Over the course of three years, over 30cm of sediment was deposited behind the reef.
- Spawning horseshoe crabs were not affected by the living shoreline upon comparison of Milford Point (Figure 7).

Figure 2. Rockweed colonizing a reefball

Figure 3. Deployment of automated water sampler for sediment detection and pressure censors during a storm

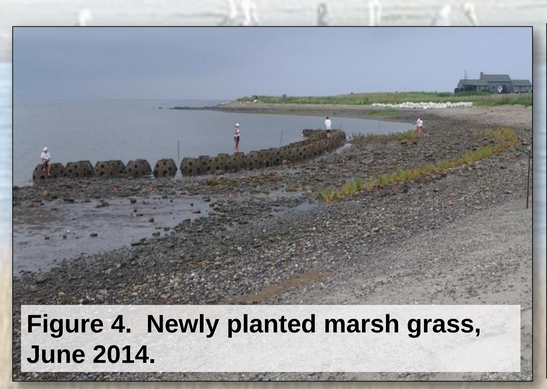

Figure 4. Newly planted marsh grass, June 2014.

Figure 5. Growth of marsh, September 2016.

Methodology

Spawning Surveys:

- Spawning surveys were conducted from May through June in order to collect census data.
- The surveys were conducted during full and new moons at night, and at high tide.
- For the beach being measured; a 3-meter transect line was walked out into the intertidal zone so we could count how many horseshoe crabs fell into that measured area.
- In order to calculate the total number of meters² that were surveyed in a year; the measured area of the beach was multiplied by the total number of surveys conducted.

Habitat Restoration:

- An artificial reef structure was installed in the intertidal zone in May 2014 containing 64 cement Reef Balls® (3 ft x 4 ft). An additional 273 were installed in November 2016.
- Over 3,500 *Spartina alterniflora* were planted behind and to the southwest regions of the artificial reef in June 2015.
- Pressure sensors were deployed prior to the winter storms that occurred in 2014 in order to measure the wave intensity, and the impact of the Reef Balls.

Figure 6. Spawning Female with Three Satellite Males.

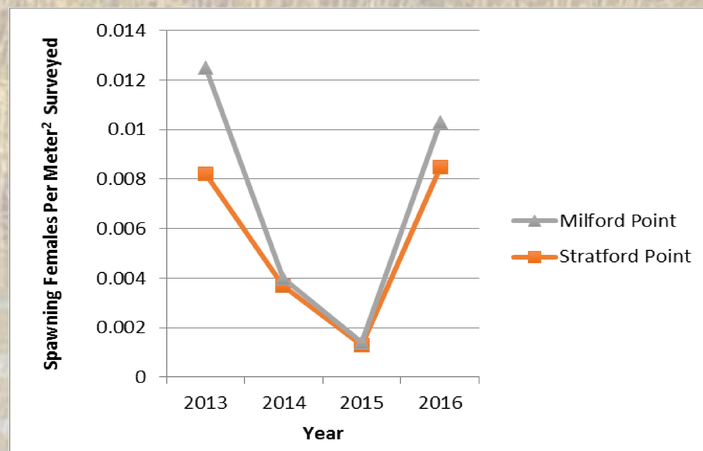

Figure 7. Spawning Females per Surveyed Meter²

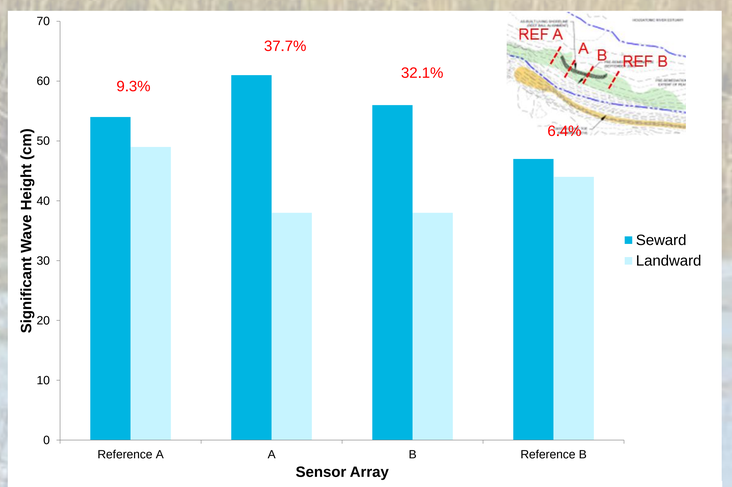

Figure 8. Reduction in significant wave height.

Conclusion & Future Directions

- Horseshoe crab spawning and their movement patterns were not disrupted by the living shoreline.
- The increase of spawning females from 2015 to 2016 is a positive trend and will be monitored over the next several of years.
- The addition of the Living Shoreline to the intertidal zone and subsequent sediment deposition could benefit egg development and juvenile survival and will be monitored in the future.

References

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Mattei, J. H.; Beekey, M. A.; Rudman, A.; Woronik, A. *Reproductive behavior in horseshoe crabs: Does density matter?* 56 (5): 634−642, 2010