Documenting impingements to horseshoe crab (*Limulus polyphemus*) spawning in New Jersey's Delaware Bay with Esri Story Maps: A review of reTURN the Favor data

Elliott Fackler, Bloomsburg University of Pennsylvania

Each spring, Atlantic horseshoe crabs leave the safety of the sea and crawl onto Delaware Bay beaches to spawn, the site of the largest spawning concentration in the world. Ideally, these crabs would encounter gently sloping, natural beaches on which to spawn. In reality, the beaches are often steeply sloped or littered with debris and human-built structures. As crabs encounter these obstacles they become overturned and unable to right themselves, or impinged, unable to move. Either way, they are left vulnerable to desiccation and predation by large gulls.

Although an ecologically, economically, and medically important species, the horseshoe crab's population has declined drastically within the last century. To help combat this problem, a citizen science program called reTURN the Favor (RTF) was started in 2013 to rescue crabs on designated NJ Bayshore beaches. While rescuing overturned and impinged crabs, volunteers record data on their numbers and locations. From 2014–2017, 1,892 RTF walks were conducted and 69,864 crabs were rescued from impingements, 66% of which were man-made.

To document these impingements in more detail, I reviewed data collected by RTF volunteers and visited a selection of RTF program beaches from late-June to mid-July 2017, collecting photographs, notes, and GPS coordinates of hazards. I compiled the gathered information into an interactive map product called Esri Story Maps, which will be useful as an outreach and education tool for program volunteers and members of the public. Derived maps may be used as guidance for future beach restoration projects to mitigate spawning impingements and crab mortality.

Exploring Juvenile Diamondback Terrapins (*Malaclemys terrapin)* Habitat and Behavior

Sydney Godbey, Ursinus College

Diamondback terrapins are a species of turtle unique in their preference for habitat within brackish water. A moderate amount is known about adults less is known about juvenile terrapins, therefore less is understood about habitat preferences and behavior at this life stage. To address this gap in knowledge, I explored methods for locating juvenile terrapins and examined their habitat preference and behavior within the salt marsh at The Wetlands Institute in southern New Jersey. This property has numerous of nesting terrapins and microchipped head-started juveniles released annually. I adaptively selected and searched 5 m^2 plots (N=30) for juveniles during June and July 2017 and recorded vegetation composition and soil salinity. I also established two enclosed arenas in the salt marsh and tracked location and movements of head-started terrapins placed within. Individual behavior, type of habitat, and weather conditions were recorded for every terrapin encounter. I located two dead terrapins within the plots, and I found eight terrapins opportunistically throughout the property, five of which were alive. My data suggests most terrapins in the first arena remained within grasses or wrack. In the second arena it seemed most terrapins burrowed beneath mud, possibly a behavior related to thermoregulation. Arena 2 terrapins also had preference in their habitat with a *p value* of 0.00013. Although my techniques yielded mixed results, with adjustments these methods could be highly useful in understanding the early life stages of juvenile terrapins and contribute to more effective conservation of the species throughout its life span.

Temporal and spatial patterns of diamondback terrapin (*Malaclemys terrapin*) activity and road mortality along a coastal causeway

Addie Schlussel, St. Mary's College of Maryland

Road mortality, or lethal injury caused by collisions with vehicles, poses a serious threat to nesting female diamondback terrapins (*Malaclemys terrapin*). Combating road mortality can entail identifying relevant "hot spots" and "hot moments," or places and times terrapins are most likely to cross roads, respectively. Hot spots may be influenced by features like vegetation, bulkheads, and terrapin barrier fencing, while hot moments may be impacted by tide height and traffic. To aid local terrapin conservation, I sought to identify hot spots and moments of terrapin activity along Stone Harbor Boulevard, a five-kilometer coastal causeway and site of high terrapin mortality in Cape May County, New Jersey. To do so, I patrolled the Boulevard five times daily during the 2017 nesting season, adding to previous years of data on the times and locations of terrapin activity. I then analyzed the relationship between terrapin activity along the Boulevard in 2015-2017 and possible explanatory temporal and spatial factors. Terrapin activity and mortality seemed uninfluenced by speed limit and distance to nearest tidal creek but was concentrated near non-bulkheaded marsh, primarily on the eastern end of the Boulevard near The Wetlands Institute. Terrapin activity was also impacted by tide, date, and time of day ($P < 0.001$), with peaks at high tide heights and at varying times of day throughout the season. These results can inform road patrol timing, the timing and placement of flashing terrapin crossing signs, priority areas for barrier fence maintenance, and other conservation measures.

Comparing the disturbance regimes and responses of colonial beach-nesting birds at two nesting sites in Stone Harbor, New Jersey

Matthew Shippee, University of Virginia

Stone Harbor Point, a barrier beach, and Ring Island, a saltmarsh island, are two sites located in Cape May County, New Jersey that provide nesting habitat for colonial beach-nesting birds, including the Common Tern (*Sterna hirundo*) and the state-endangered Least Tern (*Sternula antillarum*) and Black Skimmer (*Rynchops niger*). Though only 3.8 km apart, different site characteristics may result in varying types and rates of disturbance. I conducted 52 thirty-minute diurnal surveys between the two sites to compare the disturbance regimes and responsiveness of the birds. I found no statistically significant difference in the presence of aircraft, watercraft, crows, Laughing Gulls (*Leucophaeus atricilla*), Royal Terns (*Thalasseus maximus*) or total disturbances; but did find significant differences in the presence of large gulls, egrets, and people between the two sites. Response indices suggest that low-flying aircraft, watercraft creating wake, and people more frequently garnered responses from the Ring Island colony, while large gulls more frequently garnered responses from the Stone Harbor Point colony. Responsiveness to Laughing Gulls, which nest in large numbers in the area, was lower than expected at both colonies. Responsiveness also seemed to vary between focal species, but may be due to the species composition of each colony. My results offer land managers context on how to better protect colonial birds from both anthropogenic and natural disturbances during their critical reproductive period. Future research incorporating nocturnal disturbances as well as early and late nesting periods would help to better characterize the disturbance regime at these sites.

Territorialism and Nest-Site Selection in the American Oystercatcher *Haematopus palliatus*

Michael Stankov
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The American Oystercatcher (*Haematopus palliatus**)*** is a shorebird common on the eastern coast of the United States. The oystercatcher is known to be highly territorial during the breeding season, aggressively defending its territory while nesting or brooding. Oystercatcher territories are not necessarily centered on their nests – instead, factors such as proximity to foraging grounds and landscape features like dunes can define their territorial borders. In an effort to better understand this phenomenon, I observed defense behaviors of seven pairs of nesting oystercatchers at Stone Harbor Point, a natural conservation area in Cape May County, New Jersey from June 27 – July 23, 2017. For each defense behavior detected during a series of 30-minute observation periods (N=37), the location and behavior of the focal bird and the perceived threats that provoked their response were recorded. The locations of these interactions were plotted in ArcGIS to model the primary conflict zones for oystercatchers – these zones were used to represent territorial borders for each nesting pair. Additionally, to better understand the habitat features that make up oystercatcher territories, data on the physical landscape features found in proximity to their defense reactions were derived from aerial images. Oystercatchers were found to defend most often (51%) over dry beach and rarely defended in proximity to extensive vegetation. Additionally, oystercatchers with chicks tended to defend closer to the water than incubating ones, but this result was not statistically significant ($P = 0.20$). These results indicate the importance of open sandy beaches in future oystercatcher conservation efforts.

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