Effects of bulkheads on horseshoe crab spawning and egg availability to shorebirds R/6644-001

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Research Summary

It is not uncommon to see bulkheads along the sandy shorelines of the estuaries in New Jersey. These structures provide protection to human settlements by preventing erosion and flooding. Many bulkheads are built incrementally over time and they intersect the shoreline at different elevations. Many older structures were originally built landward of mean high water but are now located on the intertidal beach due to erosion. The discontinuous alignment has created enclaves of relatively wide sandy intertidal beach between segments of exposed bulkhead. Bulkheads are considered hard protection structures because their function is to alter coastal processes by reflecting wave energy away from the shoreline. In some cases, this process increases sediment mobility. One of the criticisms of bulkheads is that they can eliminate important habitat for species that use the intertidal beach for spawning or foraging.

An example of elimination of habitat is found in Delaware Bay where the intertidal beaches are used by horseshoe crabs to spawn and by migratory shorebirds to feed. Shorebirds migrate thousands of kilometers from South America to the Arctic and stop in Delaware Bay to feed on horseshoe crab eggs, increasing their mass before their final flight to their breeding grounds. Population stress of some of the shorebird species, such as the Red Knot, have been attributed to the loss of staging habitat (sandy beaches) as well as harvesting of horseshoe crabs that have reduced spawning levels and egg availability.

Elimination of horseshoe crab spawning areas by bulkheads built low on the intertidal beach has been noted by previous investigators, but the ecological significance of bulkheads high on the beach or within non-bulkheaded beach enclaves between adjacent bulkheaded segments has not been examined. Bulkheads high on the beach may still allow for spawning lower on the beach; habitats and horseshoe crab egg sources may be retained in the sandy beach enclaves between bulkhead segments; and horseshoe crab eggs from outside bulkheaded segments may be transported alongshore seaward of bulkheads and be delivered to the sandy enclaves. This study will assess the effect of different configurations of bulkheads on horseshoe crab spawning and the degree to which mobilization and transport of sediments into and within the bulkheaded enclaves increase delivery of horseshoe crab eggs to locations where they can be consumed by shorebirds. It is hypothesized that spawning conditions are favorable in the beach enclaves between bulkheaded segments, and these enclaves serve as traps for horseshoe crab eggs that provide food for shorebirds, but discrete areas of sediment activation and erosion occur near the bulkheads, where egg exhumation is enhanced, resulting in fewer eggs remaining in the beach matrix for subsequent development as horseshoe crabs. The result is that shorelines protected by bulkheads may support shorebird populations with horseshoe crab eggs but may reduce recruitment of horseshoe crabs.