

Spatial and Temporal Patterns in Shorebird Distribution in Relation to Horseshoe Crab Eggs

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The Delaware Bayshore is a critical stopover site for several globally declining shorebirds, including the rufa subspecies of the red knot (*Calidris canutus rufa*). Shorebirds visit Delaware Bay during their northward spring migration where they forage on lipid-rich eggs deposited by spawning horseshoe crabs (*Limulus polyphemus*) to gain enough weight to reach breeding grounds in the Arctic. Horseshoe crab abundance, and consequently the eggs they lay, declined relative to historic abundances in the 1990s and was associated with declines in shorebird populations. The low crab egg availability, coupled with potential climate change-induced seasonal shifts in red knot breeding and crab spawning, place additional pressure on red knots needing to refuel quickly while stopping by Delaware Bay. Oyster aquaculture along the lower Delaware Bay occurs within some portions of the tidal flats used by migratory shorebirds and horseshoe crabs. The co-location in time and space of these two iconic and ecologically important species and oyster farm activities presents a unique socio-



economic-ecological interaction that needs to be understood for co-management of the wild species and farms activities.

Previous New Jersey Sea Grant funded projects have separately examined interactions of birds and oyster farms, and horseshoe crabs and oyster farms. The studies showed that birds responded most strongly to the presence of other shorebirds rather than farms, and that crabs were able to pass through farms to access spawning habitat. While both projects contributed important information about direct interactions of farms on these species, they did not address three-way ecological interactions among oyster farms, horseshoe crabs, and red knots. It is understood that red knot distribution in the Cape Shore region will be influenced by the distribution of horseshoe crab eggs, a high-quality food resource. It is also evident that horseshoe crab migration to spawning beaches is not impeded by farms. Thus, we expect that the distribution of high-quality red knot food resources – crab eggs on the surface of the beach – should not be affected by the presence of farms. This project aims to address whether oyster aquaculture, either the farm gear or the human activities on the farm, disrupts the bird's ability to exploit these important egg resources.

