

## **Sea Level Rise and the Significance of Marginal Beaches for Horseshoe Crab Spawning**

M.L. BOTTON (Fordham Univ., New York, NY, USA) and R.E. Loveland (Rutgers Univ., New Brunswick, NJ, USA)

Estuarine shorelines are dynamic features subject to increasing rates of change in configuration, particularly in habitats utilized by horseshoe crabs for spawning. Beach erosion, coupled with anthropogenic effects including shoreline hardening, has diminished the extent of optimal spawning beaches throughout North America and Asia. Horseshoe crabs, however, have been successful in their ability to track the geological changes in sea level by exploiting sandy habitats within estuaries. Specifically, fringe or marginal areas such as tidal creeks, offshore sand bars, and sandy overwash patches adjacent to salt marshes may be alternative breeding areas for spawning horseshoe crabs during this dynamic period of ocean rise. Continuing sea level rise in the Delaware Bay area has contributed to decreased horseshoe crab egg abundance between the 1980's and 2000's on several eroding open beaches, previously considered as optimal beaches. Notably, egg densities on some marginal habitats now exceed levels seen on eroding open beaches. Jamaica Bay, in New York City, is a highly urbanized estuary with limited patches of sandy beach. Yet, the bay has a substantial horseshoe crab population that survives by successfully finding and exploiting these habitats. Relative to developmental success of the eggs within these marginal habitats, common physical factors are related to beach topography, sediment composition, percolation, and temporal stability over the course of the spawning season. Sea level rise is a global phenomenon that impacts horseshoe crab habitats everywhere; as this continues, we suggest that marginal habitats may become crucial refugia enabling the survival of small populations.