



EFFECTS OF ARTIFICIAL SHORELINES



Natural shorelines, including marshes and beaches, are critical for maintaining the ecological health of estuaries by stabilizing the shoreline, reducing erosion, and providing critical habitat for commercially and ecologically important aquatic species. Over the past 30 years, Barnegat Bay has lost a greater percentage of natural shoreline to coastal development than have other estuaries in the mid-Atlantic region. Specifically, 36% of the natural shoreline in Barnegat Bay has been bulkheaded—replaced by watershed retaining barriers—representing a significant loss of natural habitat, particularly marshes and estuarine beaches.

Bulkheads extend out from the original shoreline, altering the flow of water and the deposition of sediments, especially fine sand and silt. This often leads to decreased water clarity and quality. Bulkheads also eliminate shallow aquatic habitats that are especially important as refuge areas for small organisms and the juveniles of large organisms. As a result, the areas in front of bulkheads typically have a reduced abundance and diversity of organisms that live on the bottom and in the water column. In the United States, most research on the effects of bulkheads has been done along the West Coast. There is little information on how bulkheads affect aquatic habitats or organisms in New Jersey estuaries.

THE NATIONAL ESTUARY PROGRAM IN ACTION

Barnegat Bay National Estuary Program

In the summer of 2006, with funds from the Barnegat Bay National Estuary Program, research was conducted by Rider University to compare the sediment characteristics, depth profiles, species diversity, and abundance of fish and decapods (e.g., crabs and shrimp) in front of bulkheads and two types of natural shorelines (marsh and beach) in the Little Egg Harbor portion of Barnegat Bay.

In the summer of 2007, the study was expanded throughout Barnegat Bay. Sampling site selection took into account the extent of coastal development surrounding the sampling sites, and photographs from the 1920s and 1950s were used to account for “bulkhead history” – the type of natural shoreline the current bulkheads replaced. As a result, an equal number of bulkheads that replaced marshes and



beaches were sampled in each section of the Bay.

Some important physical characteristics of the habitats in front of bulkheads were very different from natural shoreline habitats. Sediment composition differed among the shoreline types: bulkheads contained more of the largest-sized sediment than either beaches or marshes, and bulkhead shorelines contained



far less of the smallest-sized sediment than did marshes. These changes in sediment characteristics are consistent with more turbulent water flow in front of bulkheads as compared to the natural shorelines. They influence the abundance and diversity of bottom-dwelling organisms by discouraging organisms that bury in fine sediments or that prey on buried or-



organisms from occupying habitats in front of bulkheads. Faunal communities along bulkheads differed from those of natural shorelines. In each section of the estuary sampled, the total number of organisms such as fish, crabs, and shrimp at the bulkheads was lower than at either type of natural shoreline. On several occasions, nothing was caught in front of bulkheads. Species diversity was also consistently lower in front of bulkheads. The composition of the individuals captured in front of bulkheads suggests that bulkheads are poor refuge areas for small prey species and the juveniles of larger predators. Several small prey species that were never caught in front of bulkheads, including blueback herring, killifishes, menhaden, naked goby, striped mullet, and sheepshead minnow, were captured at the natural shorelines. Habitats in front of bulkheads

are significantly deeper than those of natural shorelines, and are characterized by larger individuals of both prey and predator species. Individuals of five prey species (alewife, anchovy, silverside, grass shrimp, and sand shrimp) were captured at all shoreline types. Individuals of three of those species were significantly larger in front of bulkheads than at either natural shoreline. Individuals of nine predator species (black drum, bluefish, northern kingfish, northern pufferfish, silver perch, summer flounder, tautog, weakfish, and winter flounder) were captured at all shoreline types and, on average, individuals of four of those species were significantly larger in front of bulkheads than at either natural shoreline.

These findings suggest that bulkhead habitats are not as biologically rich as natural shoreline

habitats and may function differently. In addition, if current sea-level-rise scenarios for the mid-Atlantic are accurate, bulkheads may accentuate the negative effects of sea-level rise on nursery habitats in Barnegat Bay.

Visit www.bbnep.org to learn more about this and other BBNEP efforts.

EPA's National Estuary Program (NEP) is a unique and successful coastal watershed-based program established in 1987 under the Clean Water Act Amendments. The NEP involves the public and collaborates with partners to protect, restore, and maintain the water quality and ecological integrity of 28 estuaries of national significance located in 18 coastal states and Puerto Rico.

For more information about the NEP go to www.epa.gov/owow/estuaries.