

3.5 Raritan Bay and the Hackensack Meadowland, New Jersey

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Species and habitats in the tidal marshes of Raritan Bay and the Hackensack Meadowlands are potentially at risk because of sea level rise. Raritan Bay is part of the Raritan Bay–Sandy Hook Bay habitat complex at the “apex” of the New York Bight. The apex is where the east-west oriented coastline of New England and Long Island intersects the north-south oriented coastline of the mid-Atlantic at Sandy Hook. This is very significant ecologically, because the two coastlines tend to concentrate species migrating between the two areas.³¹¹

Based on existing literature and the knowledge of local scientists, this brief literature review discusses the coastal species in the region that could be at risk because of further habitat loss resulting from sea level rise and shoreline protection (see Map 3.2). Although it is possible to make qualitative statements about the possible impacts if sea level rise causes a total loss of habitat, our ability to discern what the impact might be if only a portion of the habitat is lost is more limited. A total loss of habitat is possible if shores are protected with hard structures and the wetlands are unable to keep pace with sea level rise.

Tidal Marshes

Tidal marshes in this region are mostly estuarine marsh or saline fringing marsh, with small areas of freshwater tidal marsh along South River and Raritan River. According to a panel of accretion experts, the dominant accretionary processes in these marshes are peat accumulation and inputs of river sediments, both of which they anticipate will increase in the future depending on marsh type and local conditions.

As a result of the high productivity and the potential for peat accumulation of tidal freshwater marshes in the region, the accretion panel believes that freshwater tidal marshes along the South and Raritan rivers will accumulate sufficient sediment to accrete and even expand as sea level rise increases, even with a 7 mm/yr increase in the current rate (Section 2.1).

However, the accretion panel anticipates that peat accumulation in estuarine and saline fringe marsh will increase only up to a threshold level, which is currently unknown. The panel projects that beyond that threshold these marshes will become marginal if the rate of sea level rise increases by 2 mm/yr, and will not survive if the rate increases by 7 mm/yr. Even at the modest rate of increase of 2 mm/yr, these marshes will be lost if hardened shorelines prevent migration or the marshes are degraded by human activities (see Section 2.1).

The shorelines of Raritan Bay have the most natural estuarine and saline fringing marsh remaining in the region. The southern portion of Raritan Bay includes large tracts of fringing salt marsh at Conaskonk Point and from Flat Creek to Thorn’s Creek.³¹² Local planners expect that much of the region’s shoreline will be protected from sea level rise; in developed areas, bulkheading is already common. Therefore, migration of brackish and saline fringing marsh will not be possible along most, if not all, of the shoreline.

As estuarine and saline fringing marshes are lost, there will be increasing competition for habitat among the species found in these marshes, and eventually all of the marsh inhabitants that

³¹¹USFWS, 1997, p. 553 in Raritan Bay-Sandy Hook Bay Complex, Complex #17 (see note 172).

³¹²Ibid.

depend on these marshes for nesting and other critical activities will need to move to similar habitat elsewhere to survive. Marsh loss will also eliminate the high primary production and detrital food web of the marsh, which are important for secondary production throughout the surrounding estuary.³¹³

These marshes are critical for numerous nesting and migrating bird species. The salt marsh at Conaskonk Point provides breeding areas for green heron, clapper rail, willet, American oystercatcher, marsh wren, seaside sparrow, and saltmarsh sharp-tailed sparrow, as well as feeding areas for herons, egrets, common tern, least tern, and black skimmer. In late May and early June, sanderlings, ruddy turnstones, semipalmated sandpipers, and red knots feed on horseshoe crab eggs near the mouth of Chingarora Creek.³¹⁴ Diamondback terrapin feed in the marshes and creeks in this area.³¹⁵

Saltmarsh along the backside of the Sandy Hook spit is dominated by low marsh cordgrass.³¹⁶ Characteristic fauna of low marsh include invertebrates such as ribbed mussel and marsh fiddler crab, and resident marsh fish species such as mummichog and sheepshead minnow.³¹⁷ The young of a number of marine fish species find forage and protection in low marsh, including winter flounder, Atlantic menhaden, bluefish, and striped bass.³¹⁸ Characteristic bird species of the low marsh also inhabit the area, including clapper rail, willet, and marsh wren.³¹⁹

New Jersey's Hackensack Meadowlands, in Hudson and Bergen counties, are renowned for containing the largest single tract of estuarine

tidal wetland in the New York/New Jersey Harbor Estuary.³²⁰ Before European settlement, the area included a combination of fresh, brackish, and saline wetlands as well as large areas of forest. Subsequently, the Meadowlands were dramatically altered by a variety of human activities. Of the remaining wetlands in Hudson and Bergen counties, only about 1,928 ha (4,763 ac) are tidal wetlands.

The tidal marshes that remain provide regionally significant habitat for a number of federally or state-listed species. Diamondback terrapin, a federal species of concern, is common in the Sawmill Wildlife Management Area.³²¹ The state-listed endangered least tern, black skimmer, and pied-billed grebe use Kearney Marsh as a feeding area.

Much of the tidal marsh of the Meadowlands are dominated by the invasive common reed (*Phragmites*), a species found in degraded wetlands with decreased tidal flow.³²² As a result of recent restoration activities, parts of Harrier Meadow and the Riverbend Wetlands Preserve now support a mixture of open water and native high saltmarsh vegetation.³²³

One result of sea level rise in the Meadowlands may be conversion of some *Phragmites*-dominated marshes into salt marshes dominated by the native cordgrass, *Spartina alterniflora*. This may benefit some bird species, because the dense physical structure of *Phragmites* limits access to the marsh surface by foraging shorebirds, waders, waterfowl, and other taxa.^{324,325}

³¹³Teal, 1986 (see note 10).

³¹⁴Barnes, S., n.d., New Jersey Audubon Society, Sandy Hook Bird Observatory, *Guide to Birding in Raritan Bay*. Available at: <http://www.njaudubon.org/Centers/SHBO/Conaskonk.html>.

³¹⁵USFWS, 1997, p. 556 in Raritan Bay–Sandy Hook Bay Complex, Complex #17 (see note 172).

³¹⁶USFWS, 1997, p. 554 in Raritan Bay–Sandy Hook Bay Complex, Complex #17 (see note 172).

³¹⁷USFWS, 1997, pp. 554–555 in Raritan Bay–Sandy Hook Bay Complex, Complex #17 (see note 172); Rader, D.N., 1984, Saltmarsh benthic invertebrates: Small-scale patterns of distribution and abundance, *Estuaries* 7(4A):413–420.

³¹⁸Boesch, D.F., and R. E. Turner, 1984, "Dependence of fishery species on salt marshes: The role of food and refuge," *Estuaries* 7(4A):460–468, p. 465.

³¹⁹USFWS, 1997, p. 556 in Raritan Bay–Sandy Hook Bay Complex, Complex #17 (see note 172).

³²⁰USFWS, 1997, p. 595 in Hackensack Meadowlands, Complex #19 (see note 172).

³²¹USFWS, 1997, p. 599 in Hackensack Meadowlands, Complex #19 (see note 172).

³²²USFWS, 1997, p. 597 in Hackensack Meadowlands, Complex #19 (see note 172).

³²³See, for example, Seigel, A., C. Hatfield, and J. M. Hartman, 2005, "Avian response to habitat restoration of urban tidal marshes in the Hackensack Meadowlands, New Jersey," *Urban Habitats* 3:87–116. Available at: <http://www.urbanhabitats.org>.

³²⁴Seigel et al., 2005, p. 88 and references therein (see note 323).

³²⁵However, George Frame, 2/20/07 email (see note 251), noted that common reed provides habitat for some species, e.g., birds such as red-winged blackbirds and spring peepers (*Hyla crucifer*) and other amphibians and reptiles.

Estuarine Beaches

A local marine biologist with the National Marine Fisheries Service reports that there are small areas of estuarine beach all along the shorelines of this region where there is no shoreline hardening or marsh, except in low current areas where mud flats predominate.³²⁶ Portions of the estuarine beaches of Sandy Hook are bulkheaded or armored.³²⁷ Sandy beaches are common along the shores of Staten Island from Tottenville to Ft. Wadsworth, whereas hardened shores are more common on the New Jersey side of Raritan Bay. The southern shoreline of Raritan Bay includes a number of beaches along Sandy Hook Peninsula and from the Highlands to South Amboy. There are also beaches on the Perth Amboy side, some of which (e.g., Keansburg) are popular summer amusement beach areas. Other beaches are found on some of the shorelines around small islands within the Shrewsbury-Navesink River system.³²⁸

The estuarine beaches in the region are extremely important spawning areas for horseshoe crabs, and the dry, upper beach is used by nesting terrapins. Many other coastal birds such as terns, gulls, and black skimmers use the open sandy areas of beaches for resting and some nest on the beaches as well.³²⁹ The New Jersey Audubon Society reports that its members have observed gulls and terns at the Raritan Bay beach at Morgan on the southern shore, including some rare species such as black-headed gull, little gull, Franklin's gull, glaucous gulls, black tern, sandwich tern, and Hudsonian godwit.³³⁰ Recently, area beaches, especially those on Sandy Hook Bay, have become important resting places for several species of seals that frequent the area during the winter.³³¹

Beaches are also important foraging grounds for birds, especially migrating shorebirds such as sanderlings, yellowlegs, and oystercatchers looking for clams and other invertebrates. Red knots, ruddy turnstones, and laughing gulls feed on horseshoe crab eggs in the sand of area beaches.³³² Mud snails are common on estuarine beaches, and beach wrack contains insects, isopods, and amphipods. The abundance of shorebird species is positively correlated with the abundance of beach wrack and associated invertebrates.³³³ Recent research indicates that beach wrack traps horseshoe crab eggs, making them more available for shorebirds.³³⁴

Local planners anticipate that most of the shoreline along the beach/dune systems of Raritan Bay and Sandy Hook are almost certain to be protected as sea level rises. However, it is uncertain whether beach nourishment or shoreline armoring will be more common.

If the beaches are armored, beaches will erode and sediments will not be available for natural replenishment of sand.³³⁵ This will eliminate the beach nesting areas of terrapins and horseshoe crabs and the forage provided to birds by small beach organisms. The loss of horseshoe crab eggs will be especially critical for red knot, which feed almost exclusively on crab eggs during their spring migration.

If beaches are nourished, their geomorphic characteristics may be altered in ways that some scientists believe are unsuitable for many beach invertebrates, including horseshoe crabs.³³⁶ Sandy Hook is considered almost certain to be protected using approaches that retain natural shores. The Park Service is currently planning to build a sand bypass system to replenish a narrow section of the spit.

³²⁶Frank Steimle, National Marine Fisheries Service marine biologist. In July 14, 2006 email to E. Strange, Stratus Consulting, entitled "Comments on draft report on HRE-Hackensack/Raritan Bay," describing the area's estuarine beaches. Frank Steimle has closely observed the New York/New Jersey Harbor Estuary for over two decades.

³²⁷George Frame, 2/20/07 email (personal visual observations) (see note 251).

³²⁸Frank Steimle, 2006 email to E. Strange (see note 326).

³²⁹Ibid.

³³⁰Barnes, n.d., New Jersey Audubon Society (see note 314).

³³¹USFWS, 1997, pp. 555–556 in Raritan Bay–Sandy Hook Bay Complex, Complex #17 (see note 172).

³³²Frank Steimle, 2006 email to E. Strange (personal visual observations) (see note 326).

³³³Dugan et al., 2003, p. 32 (see note 127).

³³⁴Jackson et al., 2002, p. 418 (see note 139).

³³⁵Nordstrom, 2005 (see note 153).

³³⁶Jackson, et al., 2002, p. 420 (see note 139), reviewing the findings of Nelson, W.G, 1993, "Beach restoration in the southeastern U.S.: Environmental effects and biological monitoring," *Ocean and Coastal Management*, 19:157–182, and Rudloe, A., 1981, Aspects of the biology of juvenile horseshoe crabs, *Limulus polyphemus*. *Bulletin of Marine Sciences* 31:125–133.

Tidal Flats

We have been unable to find any papers analyzing whether the tidal flats in this region could keep pace with accelerated sea level rise. Therefore, in this discussion we consider the species that would be at risk if the flats are unable to keep pace.

The area's flats are known foraging grounds for numerous bird species, diamondback terrapin,³³⁷ and horseshoe crabs.³³⁸ The thousands of birds that pass through or reside in and around Raritan and Sandy Hook bays depend on intertidal invertebrate food resources as well as the many small adult and juvenile fishes that feed in these areas.

The south shore of the Raritan and Sandy Hook bays, from the confluence of the Shrewsbury and Navesink rivers west to the mouth of the Raritan River, consists of a narrow band of salt marsh habitat, tidal creek, beaches, dunes, and remnant forests. Some 1,460 ha (3,600 acres) of intertidal flats extend offshore from these habitats an average of 0.4 km (0.25 miles).³³⁹ The flats are important foraging and staging areas for

migrating shorebirds, averaging more than 20,000 birds, mostly semipalmated plover, sanderling, and ruddy turnstone.³⁴⁰ Tidal flats are also habitat for hard and soft shell clams, which are important for recreational and commercial fishermen where not impaired by poor water quality.

The flats at the mouth of Whale Creek near Pirate's Cove (see Map 3.2) attract gulls, terns, and shorebirds year-round.³⁴¹ The intertidal and shallow water macroalgae beds provide forage for brant and dabbling ducks.³⁴² Midwinter waterfowl surveys indicate that an average of 60,000 birds migrate through the area in winter.³⁴³

Shallow Waters and Submerged Aquatic Vegetation (SAV)

Little eelgrass is found in this region, primarily because of poor water quality resulting from high levels of nutrients and suspended solids.³⁴⁴ Therefore, in this region sea level rise is not an impact of concern for SAV. Sea lettuce and other algae substitute for eelgrass as an important food for Brants and as habitat for invertebrates and small fishes.³⁴⁵

³³⁷Dr. Russell Burke, email to E. Strange (personal visual observations of terrapins) (see note 226).

³³⁸Frank Steimle, July 14, 2006 email to E. Strange (personal visual observations of numerous species) (see note 326).

³³⁹USFWS, 1997, p. 553 in Raritan Bay–Sandy Hook Bay Complex, Complex #17 (see note 172).

³⁴⁰USFWS, 1997, pp. 553 and 556 in Raritan Bay–Sandy Hook Bay Complex, Complex #17 (see note 172).

³⁴¹Barnes, n.d. (see note 314).

³⁴²Frank Steimle, July 14, 2006 email to E. Strange (personal visual observations) (see note 326).

³⁴³USFWS, 1997, p. 556, Raritan Bay–Sandy Hook Bay Complex, Complex #17 (see note 172).

³⁴⁴USFWS, 1997, p. 559, Raritan Bay–Sandy Hook Bay Complex, Complex #17 (see note 172).

³⁴⁵George Frame, 2/20/07 email (personal visual observations) (see note 251).