

3.11 The Chesapeake Bay Shoreline near Hampton Roads

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Overview

The shores of Chesapeake Bay to the south of Hampton Roads⁵²¹ are dominated by the north-facing sandy beaches of Virginia Beach and Norfolk. To the north, the shores of Hampton, Poquoson, and York counties are mostly tidal marsh. The marshes and the species that depend on them are potentially vulnerable to sea level rise. The bay beaches, by contrast, appear likely to survive.

Virginia Beach will be greatly affected by continued local anthropogenic actions, which may or may not follow historical patterns that resulted in the current beach configurations. City planners anticipate that the shoreline of the City of Virginia Beach is almost certain to be protected through armoring or beach nourishment. Sandy beaches may be retained in various protected areas owing to nourishment projects, but will otherwise be eroded in front of protective structures. A 2002 beach management plan includes recommendations for long-term replenishment programs at Chesapeake, Ocean Park, and Cape Henry beaches.⁵²² If beaches are

lost in other localities to sea level rise, the few plants that are well adapted to the harsh beach environment in these local areas will be lost. Habitat for invertebrates (e.g., sand diggers, sand fleas, horseshoe crabs, and mole and ghost crabs) will be lost. Shorebirds that rely on beaches for forage and nesting (e.g., turnstones, sanderlings, and plovers) will face more limited resources.⁵²³

Current rates of sea level rise in the Poquoson marshes and some Hampton areas are converting marsh to open water; these marsh areas will be inundated as sea level rise accelerates, converting marsh areas to tidal flats and then open water (Section 2.1). Inundation will eliminate habitat for many marsh inhabitants such as crustaceans, mollusks, and other invertebrates. Turtles (e.g., diamondback terrapins) and birds (e.g., ducks, rails) that forage on the invertebrates will therefore also lose food sources. Habitat for fish (described subsequently) that spend portions of their lives in wetlands will be lost, as will habitat for birds that nest exclusively in marshes (known as marsh-obligates). In this region, the dozens of bird species that use Plum Tree Island marsh will be impacted by continued marsh loss. The ecosystem functions of flood control, erosion buffering, and nutrient and contaminant filtering will be lost as wetlands are submerged.⁵²⁴

⁵²¹Hampton Roads is the large harbor between the confluence of the James and Elizabeth rivers and Chesapeake Bay. We did not look at the tidal habitat of Hampton Roads or its tributaries. In general, as indicated in ESI 2005, the northern shores of the harbor are hardened with riprap and other artificial structures, while the riparian shores of the Nansemond river are tidal marsh. See Map 3.8 for indication of level of detail provided by location.
⁵²²Virginia Beach, Beaches and Waterways Advisory Commission, 2002, Virginia Beach Beach Management Plan, accessed on July 25, 2007, at:

http://www.vbgov.com/file_source/dept/planning/beach_management_plan.pdf.

⁵²³Lippson and Lippson, 2006, pp. 26–42 (see note 2).

⁵²⁴Lippson and Lippson, 2006, pp.201–239 (see note 2).

Let us now examine the habitat vulnerable to sea level rise and the species that depend on it, from south to north.

City of Virginia Beach

Sandy beaches with dune systems compose the Chesapeake Bay shoreline of the City of Virginia Beach. The sands reach from Cape Henry (CBIM location 1 on Map 3.8) on the northeastern edge of the county to the inlet at the mouth of the Lynnhaven River, past the Chesapeake Bay Bridge and Tunnel and Little Creek to the mouth of the James River.⁵²⁵ Net longshore transport on Virginia Beach's Bay side is to the west. Overall trends in the last century show the dunes east of the Lynnhaven inlet advancing into Chesapeake Bay (CBIM location 2). West from the inlet, erosion, beach nourishment, and fill operations as well as condominium development and shoreline armoring have affected the accretion and erosion patterns. Dredging activity for navigation in the Lynnhaven inlet may also be affecting accretion and erosion, temporarily adding sediment to the longshore transport system; some Chesapeake shoreline beaches, such as those at Ocean Park, have required nourishment multiple times to maintain their area. The Virginia Beach resort area on the ocean shore has received beach fill material since the mid-1950s.⁵²⁶ Given the extensive patterns of nourishment and shoreline protection in place today, minimal additional ecological change from accelerated rates of sea level rise is anticipated.

Studies of beach nourishment indicate that the practice may have minimal biological effects if projects are properly designed, but that projects also have unknown effects related to changing beach slopes, sediment characteristics (e.g., grain size of new material may be different than that of the native material), and potential loss of bay-bottom habitat when beaches are extended

⁵²⁵Hardaway et al., 2005, Shoreline Evolution, Chesapeake Bay Shoreline, City of Virginia Beach, Virginia. Virginia Institute of Marine Sciences, College of William and Mary, Gloucester Point, VA.

⁵²⁶Hardaway et al., 2005, p. 9 (see note 525).

waterward.⁵²⁷ Studies that evaluate long-term effects on biota are not common.⁵²⁸

City of Norfolk

The sandy beaches found in the City of Virginia Beach continue westward along the Chesapeake shoreline in the City of Norfolk (CBIM locations 3–4). The rate of erosion is generally low, and beach accretion occurs along much of the shore. However, just west of City Beach Park, erosion potential is higher. Banks up to 10 feet high line the City Beach Park coast, with breakwaters at portions of their bases (CBIM location 3). Groinfields and breakwaters protect the shore going west across Willoughby Bay (CBIM location 4).⁵²⁹ The areas protected by groinfields and breakwaters have been deemed “relatively stable” by Hardaway et al.⁵³⁰ As evidenced by the heavily armored status of the shores today, planners anticipate that shoreline protection is almost certain along the entire bay side of Norfolk. Unnourished sandy beaches lacking protection may be eroded, narrowed, and eventually lost,⁵³¹ eliminating the habitat they provide today for invertebrates and shore birds.

City of Poquoson and City of Hampton

The City of Poquoson is located at the eastern tip of Virginia's Hampton Roads peninsula (CBIM locations 5–7). Planners indicate that the developed portion of the city is almost certain to be protected, whereas Plum Tree Island Marsh (also known as Big Salt Marsh, CBIM location 6) and adjacent areas east of the city are already experiencing loss to erosion and rising sea levels (Section 2.1). Plum Tree Island Marsh, the largest saline marsh in the Lower Chesapeake, covers 4,100 acres, or 44 percent of Poquoson's 9,395-acre total area, and contains salt marsh and

⁵²⁷Jackson et al., 2002, p. 420 (see note 139).

⁵²⁸Nordstrom, 2005, p. 216 (see note 153).

⁵²⁹Berman, M.R., Berquist, H., Killeen, S., Hershner, C.H., Rudnick, T., Schatt, D.E., Weiss, D., and H. Woods, 2002, City of Norfolk Shoreline Situation Report, Special Report in Applied Marine Science and Ocean Engineering No. 378, Comprehensive Coastal Inventory Program, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA.

⁵³⁰Hardaway et al., 2005, p. 9 (see note 525).

⁵³¹Nordstrom, 2005, p. 215 (see note 153).

remnant forested dune hummocks.⁵³² The Plum Tree Island National Wildlife Refuge has very limited human access because of the quantities of unexploded ordnance on the island from its prior use as a bombing range. The relative isolation of the area has made it a haven for more than 100 different species of birds, including northern harrier (*Circus cyaneus*), black duck (*Anas rubripes*), sedge wren (*Cistothorus platensis*), sharp-tailed sparrow (*Ammodramus caudacutus*), bald eagle, peregrine falcon (*Falco peregrinus*), black-necked stilts (*Himantopus mexicanus*), and little blue heron (*Egretta caerulea*). A variety of mammals (muskrats, red fox, white-tailed deer) use the higher ground of the refuge. Endangered sea turtles, primarily the loggerhead, use the nearshore waters. Oyster, clams, and blue crabs use the shallow waters and mudflats, and striped bass, mullet, spot, and white perch, among other fish, have been found in the nearshore waters and marsh.⁵³³ Across from the marsh in Hampton is the Grandview Beach Nature Preserve (CBIM Location 5), which has more than 2 miles of beach shoreline on Chesapeake Bay and is home to a population of northeastern beach tiger beetles (*Cicindela dorsalis dorsalis*), federally listed as threatened.⁵³⁴

Tidal wetlands with varying degrees of erosion are present throughout the area, and some beaches with low erosion rates line the many small north-facing islands and higher areas such as Ware Stick Island (CBIM location 7) and Cow Island.⁵³⁵ The highest elevation within the long-established portions of Poquoson is only 10 feet above sea level.⁵³⁶ Reed et al. in Section 2.1 indicate wetlands loss in Poquoson even with the

current rate of sea level rise. The City of Poquoson's Multi-Hazard Mitigation Plan identifies sea level as a threat to the area, noting in particular that over time there is potential for increased storm surges, erosion, and loss of coastal zone land area, including wetlands.⁵³⁷ Loss of coastal zone areas may lead to loss of the crustaceans, mollusks, and other invertebrates that live in close association with the wetland vegetation. Habitat for fish that use the mudflats and marshes will be lost, as will nesting habitat for marsh-obligate birds and the protection provided by the refuge for the numerous resident and migrating birds (described previously).

York County

Fringing tidal marshes line much of the York County bay shoreline, and the Goodwin Islands (CBIM location 8) at the extreme northeast of the county are made up of extensive marsh areas.⁵³⁸ The Goodwin Islands are protected as a National Estuarine Research Reserve (NERR). Covering 315 ha (777 acres), they are surrounded by intertidal flats, extensive SAV beds (121 ha; 300 acres of eelgrass and widgeon grass), and shallow open estuarine waters.⁵³⁹ The salt marshes are dominated by salt marsh cordgrass (*Spartina alterniflora*) and salt meadow hay (*Spartina patens*). Forested wetland ridges are dominated by estuarine scrub/shrub vegetation, with a primarily loblolly pine (*Pinus taeda*) overstory, and wax myrtle (*Morella cerifera*) shrub layer. Mixed oak and pine communities, including red oak (*Quercus rubra*), loblolly pine, black gum (*Nyssa sylvatica*), and cottonwood (*Populus deltoides*), are found on upland ridges located on the largest island.⁵⁴⁰ As

⁵³²City of Poquoson Comprehensive Plan, 1999, Environmental Element, accessed on July 17, 2006, at: <http://www.ci.poquoson.va.us/>.

⁵³³Profile of the Plum Tree Island National Wildlife Refuge, accessed on July, 20 2006, at <http://www.fws.gov/refuges/profiles/index.cfm?id=51512>.

⁵³⁴USFWS, 1994, p. 6 (see note 158).

⁵³⁵Berman, M.R., Berquist, H., Dewing, S., Glover, J., Hershner, C.H., Rudnicki, T., Schatt, D.E., and Skunda, K., 2001. City of Poquoson Shoreline Situation Report, Special Report in Applied Marine Science and Ocean Engineering No. 369, Comprehensive Coastal Inventory Program, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA.

⁵³⁶City of Poquoson Comprehensive Plan, 1999 (see note 532).

⁵³⁷AMEC Earth and Environmental Inc., 2004, City of Poquoson, Virginia, Multi-Hazard Mitigation Plan.

⁵³⁸NOAA, 2005, Environmental Sensitivity Index digital data for Virginia, obtained from the NOAA Office of Response and Restoration.

⁵³⁹Chesapeake Bay National Estuarine Research Reserve in Virginia, Goodwin Islands, accessed on November 20, 2006, at

<http://www.vims.edu/cbnerr/reservesites/goodwin.htm>.

⁵⁴⁰Chesapeake Bay National Estuarine Research Reserve in Virginia; Virginia Department of Game and Inland Fisheries. Goodwin Islands National Estuarine Research Reserve. Accessed on November 20, 2006, at <http://www.dgif.state.va.us/wildlife/vbwt/site.asp?trail=1&site=CLP06&loop=CLP>.

of 2002, bald eagles nested on the Goodwin Islands.⁵⁴¹ Presumably, these marsh islands will experience similar effects as those described for other marsh islands, and the surrounding tidal flats and SAV will possibly migrate inland, or eventually be lost (see Section 3.1 for a general description of marsh island, tidal flat, and SAV responses to sea level rise). Reed et al. in Section 2.1 indicate that most lower bay marshes and the fringing marshes along the York River are currently keeping pace with sea level rise through peat accumulation, but would be marginal with a 2 mm per year increase and lost with a 7 mm per year increase.

Wrapup

Continued nourishment and breakwater protection are anticipated for the majority of Hampton Roads beaches, limiting the likelihood of additional ecological change.⁵⁴² At the current rate of sea level rise, Plum Tree Island marsh is losing area. With any increase in rates of sea level rise, continued loss of area is expected because of the unprotected status of the majority of the shoreline.⁵⁴³ The numerous bird species that frequent it will therefore face

reduced resources. Vegetation and associated fauna may migrate inland as land is lost, but the developed portions of the city may eventually limit their migration and survival.⁵⁴⁴ Though the York County marshes (including Goodwin Islands) are keeping pace with the current rate of sea level rise, it is not known that they will continue to do so with increased rates of sea level rise; they may become marginal under a midrange increase (2 mm per year), and are likely to be lost under a high-range scenario (increase of 7 mm per year).⁵⁴⁵

⁵⁴¹Watts, B.D., and C. Markham, 2003, The influence of salinity on diet, prey delivery, and nestling growth in bald eagles in the lower Chesapeake Bay: Progress Report, Center for Conservation Biology Technical Report Series, CCBTR-03-06, College of William and Mary, Williamsburg, VA, p. 1.

⁵⁴²Author's analysis from Hardaway et al. 2005 (see note 525), Nordstrom 2005 (see note 153), and Jackson et al. 2002 (see note 139).

⁵⁴³Author's analysis based on Section 2.1, and AMEC Earth and Environmental Inc. 2004 (see note 537).

⁵⁴⁴Nordstrom (2005) notes that "fixed human development on eroding shores prevents natural landward migration of coastal landforms" p. 215 (see note 153).

⁵⁴⁵Author's analysis based on Section 2.1.