

## 3.17 Upper Chesapeake Bay Shoreline

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### Overview

The “Upper Bay” region encompasses Harford, Cecil and Kent counties, from the Gunpowder River to the Chester River. The region is primarily rural, with several small cities (Aberdeen, Havre de Grace, Perryville, and Elkton) along the coast and tributaries.

This brief literature review discusses species that could be at risk because of further habitat loss resulting from sea level rise and shoreline protection. Existing literature and knowledge of coastal scientists in the area appears to be sufficient in many cases to make qualitative statements about the possible impact if sea level rise causes a total loss of habitat, which might be expected if shores are protected with hard structures and the wetlands are unable to keep pace with sea level rise. Our ability is more limited, however, to say what the impact might be if only a portion of the habitat is lost. Overall effects of sea level rise may include the following:

- Most marsh areas will be retained through accretion. On Eastern Neck, some areas are being lost, but efforts are under way to restore the shoreline using protected *S. alterniflora* marshes. Upper Chesapeake Bay will continue to provide spawning and nursery habitat for crabs and fish, as well as provide nesting and foraging habitat for migratory and residential birds, including bald eagles and large numbers of waterfowl.
- The cliff areas at Elk Neck State Park and the Sassafras River NRMA will be left to erode naturally. The cliff swallows and Puritan tiger beetle (federally listed as threatened) will continue to use the unique habitat. Cliff areas surrounding Grove Point and the

Puritan tiger beetle population inhabiting them may be impacted because without nourishment shoreline stabilization may result in loss of beach areas.

- Although some of the beaches may require nourishment for retention, the general lack of shoreline protections will minimize interferences with longshore sediment transport. Beaches are likely to remain intact throughout much of the region.

The Susquehanna, located on the border between Harford and Cecil counties, provides a large (though variable) influx of sediment to upper Chesapeake Bay, as well as almost half of Chesapeake Bay's freshwater input.<sup>660</sup> Much of this sediment is retained above the mixing zone (the estuarine turbidity maximum or ETM), generally above the Chesapeake Bay Bridge.<sup>661</sup> This sediment source provides material for accretion in the tidal wetlands of the region. The other upper Chesapeake Bay tributaries characteristically have large sediment loads as well, and currently receive sufficient sediment to maintain wetlands and their ecological function.

Freshwater tidal wetlands are spread throughout upper Chesapeake Bay, particularly in the upper reaches of the tributaries. Key rivers in the areas include the Susquehanna, the Elk, the Sassafras, and the Chester. With the exception of the Susquehanna, with headwaters in New York that are not considered in this report, all of the rivers

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<sup>660</sup>Bay Trends and Indicators, Chesapeake Bay Program, accessed at: [http://www.chesapeakebay.net/status/status\\_dev.cfm?SID=201&SUBJECTAREA=INDICATORS](http://www.chesapeakebay.net/status/status_dev.cfm?SID=201&SUBJECTAREA=INDICATORS).

<sup>661</sup>Chesapeake Bay Program, 2002, The Impact of Susquehanna Sediments on the Chesapeake Bay, Scientific and Technical Advisory Committee Workshop Report, May 2000.

in upper Chesapeake Bay have tidal wetlands at their head. The high eroding cliffs characteristic of Chesapeake Bay are also found in the region, particularly at the mouths of the Susquehanna, Elk, and Sassafras rivers. The remaining shorelines are primarily a mix of narrow muddy and sandy beaches and low vegetated banks.

## Harford County

The Harford County shoreline is predominantly marsh. Aberdeen Proving Ground (CBIM location 44) is its defining feature, constituting approximately a quarter of the county's area and the majority of its Bay shoreline, from the Gunpowder River north almost to the Susquehanna River.<sup>662</sup> The proving ground is primarily within 5 meters of sea level and contains a large concentration of tidal wetlands (20,000 acres). The extent of shoreline protections is uncertain given the military nature of the site.<sup>663</sup> Structural shoreline protections throughout the proving ground shoreline would eliminate the potential for wetland migration. The wetlands may accrete sufficient sediment to meet a 2 mm per year increase in sea level rise rates, but a 7 mm per year increase would result in loss of the tidal marshes and associated ecological functions. In particular, the large bird populations (bald eagles, great blue herons, double-crested cormorants) that migrate through and nest in these marshes would be affected.<sup>664</sup> If structural shoreline protections are minimal, a combination of sediment accretion and inland migration may occur, and wetlands function are likely to be retained at approximately current

<sup>662</sup>A portion of the Aberdeen Proving Ground is located within Baltimore County.

<sup>663</sup>"Aberdeen Proving Ground Pioneers Approach to Wetland Mitigation," available at: <http://aec.army.mil/usaec/publicaffairs/update/win04/win0420.html>. Although some protections are required at the site under CERCLA actions to prevent migration of contaminated sediments, the majority of the shoreline is extensive wetlands. National Priorities List Fact sheet for Aberdeen-Edgewood available at: <http://www.epa.gov/reg3hwmd/npl/MD2210020036.htm>, and [http://www.apg.army.mil/apghome/sites/directorates/restor/PDF\\_Files/carrolis.pdf](http://www.apg.army.mil/apghome/sites/directorates/restor/PDF_Files/carrolis.pdf).

<sup>664</sup>Maryland DNR Bald Eagle Fact Sheet, accessed on May 23, 2006, at <http://www.dnr.state.md.us/wildlife/baldeagle.html>.

levels. The headwaters of the Bush River, inland of the Proving Ground, are tidal and nontidal wetlands. Large portions of the associated shoreline are almost certain to be protected, which will prevent migration of the wetlands. Accretion in the upper parts of the tributaries may be sufficient to meet an accelerated sea level rise (high range estimate of 7 mm per year above current rates). At the mouth of the Susquehanna, the shoreline of Havre de Grace is mostly developed and armored, with minimal beach or marsh area.

## Cecil County

Across the Susquehanna, in Cecil County, the city of Perryville also has an armored shoreline. Cecil County comprises minimal low-lying land, with most areas above the 20-ft elevation. The majority of the shoreline is not protected, particularly along the Sassafras and Elk rivers, and planners indicate that undeveloped areas are unlikely to be protected in the future. Cliffs line the mouth of the Elk River at Elk Neck State Park (CBIM location 45); despite continuing erosion, planners indicate shore protection is unlikely.<sup>665</sup> The headwaters of the Northeast and Elk rivers are tidal freshwater wetlands, with shore protection considered likely because of the developments on adjacent land. Tidal flats in the Northeast River's upper reaches and adjacent wetlands become important fish spawning areas in the spring.<sup>666</sup> Accretion is expected to be sufficient to meet an accelerated sea level rise because of the large sediment inputs in the Upper Bay, but significant armoring in the developed headwaters could interfere with sediment transport. If accretion rates are not sufficient, wetland migration would be difficult in Cecil County owing to the upland elevation adjacent to the shorelines; consequently, loss of the large tidal fresh marshes could occur. The marshes of the upper reaches of the Elk River are a spawning and nursery area for striped bass and a nursery area for alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), hickory shad

<sup>665</sup>Maryland Shoreline Changes Online, from the Maryland Department of Natural Resources, Available at [http://shorelines.dnr.state.md.us/sc\\_online.asp](http://shorelines.dnr.state.md.us/sc_online.asp).

<sup>666</sup>NOAA, 1994, Environmental Sensitivity Index Maps.

(*Alosa mediocris*), and white perch, as well as a wintering and breeding area for waterfowl.<sup>667</sup>

## Kent County

At the southern border of Cecil County is the Sassafras River, shared with Kent County. Near the mouth of the river are narrow sandy beaches, backed by low bluffs to high cliffs. Because of high sediment input and limited shoreline armoring, beach loss caused by sea level rise is likely to be minimal. Shore protection is unlikely throughout most of the river. Portions of beach and cliff habitat supporting a population of the Puritan tiger beetle (federally listed as threatened) at and around Grove Point, however, may be stabilized resulting in loss of habitat.<sup>668</sup> In contrast, on the southern shore, one section of cliffs at the Sassafras Natural Resource Management Area (Sassafras NRMA, CBIM location 46) has a population of the Puritan tiger beetle. For this reason, the cliffs in the Sassafras NRMA are allowed to retreat naturally. On the bay shore south of the Sassafras River, Kent County has a higher energy shoreline, with agricultural areas leading down to more generally developed shorelines. Groins, jetties, and bulkheads are all in use along portions of the county's Chesapeake shoreline, but the majority of the shoreline is unlikely to be protected. Sandy and rocky shorelines predominate (e.g., Gratitude, Rock Hall) along with forested riparian buffers. Tidal wetlands are rare along the coast, except in sheltered coves. Shoreline migration can readily occur in the unprotected agricultural areas, minimizing ecological losses. In the sheltered areas near Rock Hall, tidal wetlands may be lost because of the almost certain armoring along the developed areas. Loss of wetlands diminishes habitat for the crustaceans, mollusks, and other invertebrates that feed on and provide nutrients for marsh vegetation and the turtles (e.g., diamondback

terrapins) and birds (e.g., ducks, rails) that forage on them. Spawning and nursery areas in marshes for fish will be lost, as will nesting habitat for marsh obligate birds.<sup>669</sup>

At the southern tip of Kent County is the Eastern Neck National Wildlife Refuge (CBIM location 47). Currently, the greatest rates of erosion in the county are found here, on the western shore of the neck and the southeastern tip on the Chester River.<sup>670</sup> Because of its status as a national wildlife refuge, some shoreline protections are being introduced, with the goal of preserving shoreline habitats for the many migratory and residential birds as well as turtles, invertebrates, and the Delmarva fox squirrel (*Sciurus niger cinereus*), federally listed as endangered. In many marsh locations, stands of *Phragmites australis* are the only areas retaining sediment.<sup>671</sup> Practices of removing invasive *P. australis* stands and revegetating with native, noninvasive species have been curtailed in some areas of the refuge, in recognition of the desirable role that *P. australis* plays in retaining soil.<sup>672</sup> Higher levels of substrate accumulation, both below ground and above ground, have been documented in stands of *P. australis* relative to *Spartina* spp.<sup>673</sup> At Eastern Neck, local managers have observed *P. australis* migrating upland into forested areas as inundation at marsh edges increases, although widespread marsh migration of other species has not been observed.<sup>674</sup>

Thousands of waterfowl winter at Eastern Neck, including Canada geese, tundra swans (*Cygnus columbianus*), and a variety of dabbling and diving ducks, such as mallards, buffleheads (*Bucephala albeola*), red-breasted and hooded mergansers (*Mergus serrator*, and *Lophodytes cucullatus*), scaup, and pintails.<sup>675</sup> Migrating and

<sup>667</sup>USFWS, 1980, Atlantic coast ecological inventory: Wilmington, No. 39074-A1-EI-250, USFWS, Washington, D.C. As referenced for the Elk River in the Sealand Limited Site description of NOAA trust resources, available at: [http://response.restoration.noaa.gov/book\\_shelf/207\\_Sealand.pdf](http://response.restoration.noaa.gov/book_shelf/207_Sealand.pdf) (Table 2).

<sup>668</sup>Barry Knisely (see note 647); USFWS, 1993 (see note 166).

<sup>669</sup>Lippson and Lippson, 2006, pp. 201–239 (see note 2).

<sup>670</sup>Maryland Shoreline Changes Online (see note 665).

<sup>671</sup>Written communication, Tom Eagle, Eastern Neck National Wildlife Refuge, to Christina Bosch, Industrial Economics. "Re: Sea level rise report wrap-up - please respond" confirming text citing Tom Eagle in draft report, including this sentence, sent September 11, 2006.

<sup>672</sup>Ibid.

<sup>673</sup>Rooth and Stevenson, 2000, p. 173 (see note 45).

<sup>674</sup>Tom Eagle (see note 671).

<sup>675</sup>January 2005 waterfowl survey results for Eastern Neck National Wildlife Refuge. Accessed online at

residential birds are a primary component of the Eastern Neck ecosystem. Bald eagles nest at Eastern Neck, usually occupying five to seven active nests at the forested riparian edge.<sup>676</sup> Loss of upland to open water will decrease eagle habitat. Historically, Eastern Neck was a site for black duck (*Anas rubripes*) nesting, along with Smith Island, Barren Island, and other locations in the lower Eastern Shore. However, the three-square bulrush marshes (*Scirpus americanus*) on Eastern Neck have been largely inundated, as have the black needle rush marshes (*Juncus roemerianus*) on Smith Island and other locations, a likely cause of reductions in black duck counts.<sup>677</sup> Loss of tidal marsh at Eastern Neck will reduce suitable habitat for resident and migratory shorebirds. The decreasing size of the upland forested areas will also diminish critical habitat for the Delmarva Peninsula fox squirrel, which resides in forests adjacent to marsh.

## Wrapup

Generally, sediment input to upper Chesapeake Bay is expected to maintain shoreline areas at current rates of sea level rise; marshes will be marginal with a 2 mm per year increase in rates, and lost with a 7 mm per year increase. The Eastern Neck National Wildlife Refuge and the Cecil County marshes in the Elk River are the only areas identified in the Upper Bay as likely to be negatively impacted because of sea level rise. Eastern Neck has already lost marsh areas to open water, and continued loss will limit habitat for bald eagles, the Delmarva Peninsula fox squirrel, and marsh birds. Armoring of the shoreline for developments in Cecil County may limit sediment transport and accretion to marsh areas, thus limiting their extent and suitable spawning habitat for some game fish.

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<http://www.fws.gov/northeast/easternneck/> on 8 June 2006.

<sup>676</sup>Tom Eagle (see note 671).

<sup>677</sup>Ibid.