

3.9 The Atlantic Side of the Virginia Eastern Shore

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Species and habitats in the tidal marshes of the Atlantic Coast side of the Virginia Eastern shore are potentially at risk because of sea level rise. This region contains the largest stretch of natural coastline along the U.S. Atlantic Coast, almost all of which is owned by either TNC or the federal government. The region includes extensive back-barrier lagoonal marshes and areas of estuarine beach behind a chain of barrier islands. Fringing salt marshes occur on the mainland side of the lagoons.

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 Section 3.1, Overview) (see Map 3.7). 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.

Back-Barrier Salt Marshes

Salt marsh adaptation to sea level rise. Salt marshes occupy thousands of acres in eastern Accomack and Northampton counties.⁴⁸⁵ Marsh accretion experts believe that most of these marshes are keeping pace with current rates of sea level rise, but may be unable to continue to do so if the rate of sea level rise increases by another 2 mm/yr (see Section 2.1). Some local field measurements indicate that accretion rates may be insufficient to keep pace even with current rates of sea level rise. Accretion rates as

low as 0.9 mm/yr (Phillips Creek Marsh) and as high as 2.1 mm/yr (Chimney Pole Marsh) have been reported,⁴⁸⁶ and the average relative sea level rise along the Eastern Shore is estimated as 2.8–4.2 mm/yr.⁴⁸⁷

The dominant accretion processes in eastern Accomack and Northampton counties are storm sedimentation and overwash from the beaches of the barrier islands. A panel of accretion experts recently suggested that if the rate of sea level rise increases by 2 mm/yr, the survival of marshes in this area will depend on the future frequency of storms supplying sediments (see Section 2.1). Other scientists have suggested that the ability of the marshes of the Eastern Shore to keep pace may be constrained by the generally low sediment supply provided by the small watersheds of the area.^{488,489} In 2004, annual losses of 0.2 and 0.67 percent were reported for Curlew Bay and Gull Marsh, respectively, mostly as a result of perimeter erosion to open water.⁴⁹⁰ However, in Mockhorn Wildlife Refuge in southern Northampton County, where elevations are lower, sediments have accumulated in shallow waters, and low marsh is encroaching on adjacent tidal flats.^{491,492}

⁴⁸⁶Kastler, J.A., and P.L. Wiberg, 1996, "Sedimentation and boundary changes of Virginia salt marshes," *Estuarine, Coastal and Shelf Science* 42:683–700, p. 691.

⁴⁸⁷May, M.K., 2002, Pattern and Process of Headward Erosion in Salt Marsh Tidal Creeks, Master's Thesis, Department of Biology, Eastern Carolina University, Greenville, NC, p. 4, reviewing the findings of G.F. Oertel, T.F. Wong, and J.D. Conway, 1989, "Sediment accumulation at a fringe marsh during transgression, Oyster, Virginia," *Estuaries* 12:18–26, and B.P. Hayden, D. Dueser, J.T. Callahan, and H.H. Shugart, 1991, "Long-term research at the Virginia Coast Reserve," *BioScience* 41:310–318.

⁴⁸⁸Christiansen, T., P.L. Wiberg, and T.G. Milligan, 2000, "Flow and sediment transport on a tidal salt marsh surface," *Estuarine, Coastal and Shelf Science* 50:315–331, p. 324.

⁴⁸⁹Reed et al., 2008, Section 2.1.

⁴⁹⁰Erwin et al., 2004, p. 891 (see note 16).

⁴⁹¹Erwin et al., 2006 (see note 58).

⁴⁸⁵Fleming et al., 2006 (see note 67).

Most wetlands are able to keep pace with rising sea level today, become marginal with an acceleration of 2 mm/year, and would be lost with a more substantial acceleration (see Reed et al., Section 2.1). Shore protection is unlikely along much of the mainland opposite the barrier islands and lagoonal marshes. In those unprotected areas, marshes are likely to migrate inland into low-lying areas. Kastler and Wiberg found that from 1938 to 1990 mainland salt marshes on the Eastern Shore increased in area by 8.2 percent, largely as a result of encroachment of salt marsh into upland areas.⁴⁹³

Sea level rise may also contribute to invasion by the common reed (*Phragmites*), which provides lower quality habitat. Higher sea levels cause groundwater discharge to migrate upslope with greater volume. Common reed can invade where this discharge flows over the marsh surface, providing lower salinity habitat.⁴⁹⁴

Impacts on fish and wildlife. Sea level rise is considered a major threat to bird species in this area, which is known as the Virginia Barrier Island/Lagoon Important Bird Area (IBA).⁴⁹⁵ Biologists at the Patuxent Wildlife Research Center suggest that submergence of lagoonal marshes in Virginia would have a major negative effect on marsh-nesting birds such as black rails, seaside sparrows, saltmarsh sharp-tailed sparrows, clapper rails, and Forster's terns.⁴⁹⁶ The USFWS considers black rail and both sparrow species "birds of conservation concern" because populations are already declining in much of their range.⁴⁹⁷ A study of Virginia marshes found that the number of bird species was directly related to marsh size; the minimum marsh size found to support significant marsh

bird communities was 4.1–6.7 ha (10–15 acres).⁴⁹⁸

A diversity of resident and estuarine and marine transient fish species move in and out of marshes with the tides to take advantage of the abundance of decomposing plants in the marsh and refuge from predators.⁴⁹⁹ Marine transients include recreationally and commercially important species, including black drum, striped bass, bluefish, and Atlantic croaker. A study in Virginia showed that nekton abundance and diversity is greater in fringing marsh than along intertidal shorelines that are armored.⁵⁰⁰

Where sea level rise leads to increased flooding of the marsh, some fishes may benefit, at least in the short term, from an increase in tidal creeks and channels, providing greater access to the marsh. More water on the marsh surface may also provide some benefits. For example, in the salt marshes of the Eastern Shore, resident fishes such as common mummichog and spotfin killifish, and invertebrates such as grass shrimp, forage in shallow waters on the marsh surface to take advantage of an underutilized food source and to avoid predators.⁵⁰¹ However, where marshes drown, the loss of marsh primary production will impair the value of the habitat for fish and shellfish. Virginia's highly valued commercial and recreational fishing industry may be harmed if fish and shellfish production declines in these areas.

Sea Level Fen

A globally rare sea level fen community—one of only four in Virginia—is found in the Mutton Hunk Fen Natural Area Preserve fronting

⁴⁹²Erwin et al., 2004, p. 891 (see note 16).

⁴⁹³Kastler and Wiberg, 1996 (see note 486).

⁴⁹⁴Barry Truitt (see note 360).

⁴⁹⁵Watts, B.D., 2006, Synthesizing Information Resources for the Virginia Important Bird Area Program: Phase I, Delmarva Peninsula and Tidewater, Center for Conservation Biology Technical Report Series, CCBTR-06-05, College of William and Mary, Williamsburg, VA, p. 6.

⁴⁹⁶Erwin et al., 2004, p. 901 (see note 16).

⁴⁹⁷USFWS, 2002, Birds of Conservation Concern 2002, Division of Migratory Bird Management, Arlington, VA, Table 30. Available at:

<http://www.fws.gov/migratorybirds/reports/reports.html>.

⁴⁹⁸Watts, 1993 (see note 61).

⁴⁹⁹See general discussions in Boesch and Turner, 1984 (see note 318); and Kneib, 1997 (see note 17).

⁵⁰⁰Carroll, R.A., 2002, Nekton utilization of intertidal fringing salt marsh and revetment hardened shorelines, M.S. Thesis, School of Marine Sciences, College of William and Mary, Williamsburg, VA.

⁵⁰¹Yozzo, D.J., A. Mannino, and D.E. Smith. 1994. "Mid-summer abundance of resident sub-adult marsh nekton at the Virginia Coast Reserve," *Virginia Journal of Science* 45:21–30, as cited by Layman, C.A., 2000, "Fish assemblage structure of the shallow ocean surf zone on the Eastern Shore of Virginia Barrier Islands," *Estuarine, Coastal, and Shelf Science* 51:201.

Gargathy Bay in eastern Accomack County.⁵⁰² This extremely rare type of coastal wetland grows only under the unusual circumstances where there is a natural seep from a nearby slope providing nutrient-poor groundwater to support its unique vegetation, and where there is protection from nutrient-rich tidal flow (see Section 3.1 for more description of sea level fens). The Division of Natural Heritage within the Virginia Department of Conservation and Recreation believes that chronic sea level rise with intrusions of tidal flooding and salinity poses “a serious threat to the long-term viability” of sea level fens.⁵⁰³ If rising seas reach the Mutton Hunk Fen Natural Area, the influx of nutrient-rich waters may destroy the populations of the rare plant species at this site, including the carnivorous sundew, and bladderwort.⁵⁰⁴ On the other hand, sea level rise could cause groundwater discharge to increase in volume at some locations, which would benefit fens.⁵⁰⁵

Back-Barrier Beaches

The beaches on the mainland behind the barrier island complex of the Eastern Shore are small strips of beach that are relatively stable because they are protected from high energy wave action. Where beaches erode in front of shoreline protection structures and are not replenished, the many invertebrates that burrow in the sand and species that spawn on beaches will lose critical habitat. Rare species that have sometimes been observed on these beaches include the northern diamondback terrapin and the northeastern tiger beetle.⁵⁰⁶

⁵⁰²Fact sheet by Virginia Department of Conservation and Preservation on the Mutton Hunk Fen Natural Area Preserve. Accessed December 5, 2007 at: http://www.dcr.virginia.gov/natural_heritage/natural_area_preserves/muttonhunk.shtml.

⁵⁰³Virginia Department of Conservation and Recreation, 2001, The Natural Communities of Virginia, Ecological Classification of Ecological Community Groups, First Approximation, Division of Natural Heritage Natural Heritage Technical Report 01-1, p. 48.

⁵⁰⁴Mutton Hunk Fen Natural Area Preserve Fact Sheet (see note 502).

⁵⁰⁵The authors would like to thank reviewer Barry Truitt for pointing this out (see note 360).

⁵⁰⁶See information on these species and their status in Virginia, provided in Chapter 3: Refuge and Resource Descriptions (specifically pages 3-20 and 3-32) of USFWS, 2004, Eastern Shore of Virginia and Fisherman Island Nation Wildlife Refuges

Tidal Flats

CCSP submissions by the USGS will address the likelihood that sea level rise will reduce the area of tidal flats in areas with naturally low sediment supplies like the Eastern Shore. Loss of tidal flats would eliminate a rich invertebrate food source for migrating birds such as whimbrels, dowitchers, dunlins, black-bellied plovers, and semipalmated sandpipers.⁵⁰⁷

Shallow Waters and Submerged Aquatic Vegetation (SAV)

Natural eelgrass beds occur in a number of areas along the sea side of the Eastern Shore, and are most abundant in Chincoteague Bay. There are also some successful eelgrass restoration projects in South Bay, Cobb Bay, Hog Island Bay, and Spider Crab Bay.⁵⁰⁸ The potential effects of sea level rise on eelgrass beds have not been studied directly. However, Short and Neckles estimate that, in general, a 50 cm increase in water depth as a result of sea level rise could reduce the available light in coastal areas by 50 percent, resulting in a 30–40 percent reduction in SAV growth.⁵⁰⁹ Where this may occur in the nearshore waters of eastern Northampton and Accomack counties would depend on current local conditions such as water depth, the maximum depth of eelgrass growth, and water clarity. A local expert with The Nature Conservancy suggests that because eelgrass is at the southern limit of its range in the Coastal

Comprehensive Conservation Plan, Northeast Regional Office, Hadley, MA, available at:

http://library.fws.gov/CCPs/eastshoreVA_index.htm.

⁵⁰⁷The Nature Conservancy project profile for the Virginia Coast Reserve, 2006, available by searching on “field guides” at <http://www.nature.org/wherewework>. See also Watts, B.D., and B.R. Truitt, 2000, “Abundance of shorebirds along the Virginia barrier islands during spring migration,” *Raven* 71:33–39.

⁵⁰⁸Information provided in July 12, 2006, email to E. Strange of Stratus Consulting from Scott Lerberg of the Virginia Seaside Heritage Program. Orth, R. J., M. L. Luckenbach, S. R. Marion, K. A. Moore, and D. J. Wilcox, in press, “Recovery of the seagrass *Zostera marina* (eelgrass) in the Delmarva Coastal Bays, USA,” *Aquatic Botany*.

⁵⁰⁹Short and Neckles, 1999 (see note 91).

Bays, global warming may be a greater factor in its persistence than light reduction.⁵¹⁰

Loss of eelgrass beds could harm local populations of birds, fish, and shellfish. Various waterbirds feed on eelgrass beds, including brant, canvas back, and American black duck.⁵¹¹ Virginia's commercial and recreational fisheries include many estuarine and marine species that rely on eelgrass for nursery habitat.⁵¹² A number of highly valued shellfish species are also found here, including bay scallop, hard clam, and blue crab.

Marsh and Bay Islands

Several bird species of concern in Virginia and elsewhere along the Atlantic Coast, including gull-billed terns, common terns, black skimmers, and American oystercatchers, nest on shellpiles on marsh islands.⁵¹³ The advantage of this is that the shellpiles are generally free of mammalian predators. However, marsh islands are also subject to tidal flooding, which is known to reduce the reproductive success of island-nesting birds.⁵¹⁴ Therefore, as islands experience more erosion and flooding as a result of sea level rise, local populations of island-nesting birds may decline.

Island shrinking is already apparent along the Eastern Shore. From 1949 to 1990, Chimney Pole marsh showed a 10 percent loss to open water.⁵¹⁵ Chimney Pole marsh is directly inside Quinby Inlet and subjected to high energy wave action during storms. As early as the mid-1990s, gull-billed tern nests on Chimney Pole Island were only a foot above the June high water mark, indicating its vulnerability to even relatively low increases in rates of sea level rise.⁵¹⁶

Coastal Habitat for Migrating Neotropical Songbirds

Because of their importance for migrating neotropical songbirds such as indigo buntings and ruby-throated hummingbirds, the coastal areas of southern Northampton County are a designated Important Bird Area (IBA).⁵¹⁷ Not only are these birds valued for their beauty but they also serve important functions of dispersing seeds and controlling insect pests. It is estimated that a pair of warblers can consume thousands of insects as they raise a brood.⁵¹⁸

Chesapeake Bay is a significant physical barrier that acts as a bottleneck for migrating birds, funneling southbound migrants to lower Northampton County, where they concentrate within the tree canopy and thick understory vegetation found within the lower 9.66 km (6 miles) of the peninsula within 188.82 m (200 yards) of the shoreline. Loss of this understory vegetation as a result of rising seas would eliminate this critical stopover area for neotropical migrants, many of which have shown consistent population declines since the early 1970s.⁵¹⁹

⁵¹⁰Barry Truitt (see note 360).

⁵¹¹Perry and Deller, 1996 (see note 100).

⁵¹²Wyda et al., 2002 (see note 95).

⁵¹³Rounds et al., 2004 (see note 78).

⁵¹⁴Eyler et al., 1999 (see note 78).

⁵¹⁵Kastler and Wiberg, 1996 (see note 486).

⁵¹⁶Erwin, R.M., J.G. Haig, D.B. Stotts, B. Truitt, and C.R. Carlson, 1995, Will the tide tern? Rising sea levels, invasive species, agricultural pesticides, and nesting gull-billed terns. Available at:

<http://www.vcrlter.virginia.edu/davedocs/VCRASC95/erwin.html>

⁵¹⁷Watts, 2006, p. 5 (see note 495).

⁵¹⁸Mabey, S., B. Watts, and L. McKay, n.d., Migratory Birds of the Lower Delmarva: A Habitat Management Guide for Landowners, The Center for Conservation Biology, College of William and Mary, Williamsburg, VA, p. 7.

⁵¹⁹Mabey et al., p. 10 (see note 518).