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Text used from website for EIS below (copy and paste below):

# Chesapeake Bay National Estuarine Research Reserve, Maryland

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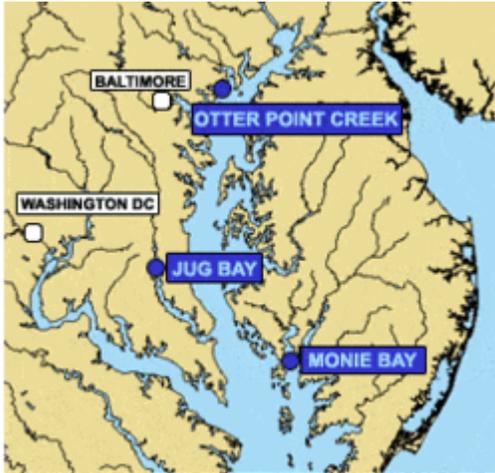
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## Introduction



 Chesapeake Bay, Maryland, boundary map. (Source: [NOAA](#))

The Chesapeake Bay is the largest [estuary](#) in the United States and is roughly divided between the states of Maryland and Virginia. In the Maryland portion there are some 6,945 miles of shoreline, encompassing a wide variety of habitats from salt marshes to riverine systems to tidal, freshwater marshes.

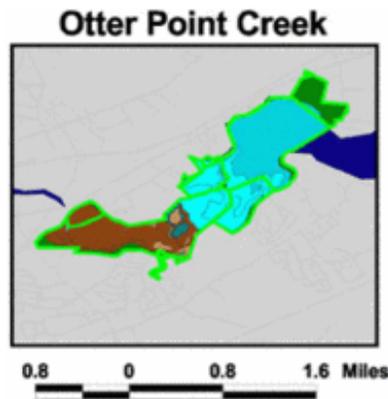
The multi-component Chesapeake Bay National Estuarine Research Reserve in Maryland reflects this diversity of habitat, [geography](#), population and culture. Each component is unique, but the goals of research, [monitoring](#), education and stewardship remain consistent throughout. Components (sites) are located at Otter Point Creek in Harford County, Jug Bay in Anne Arundel and Prince Georges Counties and Monie Bay in Somerset County.

A component is a part of the whole. In the Maryland Reserve there are three "components" which are listed above. Each component represents a different habitat found within the Maryland portion of the Chesapeake Bay.

The Maryland Reserve is one of 27 within the [National Estuarine Research Reserve System](#) (NERRS), forming a partnership between coastal states and the National Oceanic and Atmospheric Administration to protect valuable estuarine habitats.

A cooperative management approach is used involving the Maryland Department of Natural Resources and the National Oceanic and Atmospheric Administration, which promotes long-term research, education and stewardship.

## Otter Point Creek



 Otter Point boundary map. (Source: [NERRS](#))

The Otter Point Creek Component is located in Harford County, east of the intersection of U.S. Route 40 and Maryland Route 24, and north of Edgewood. The creek flows into the Bush River, which drains into the Chesapeake Bay.

One of the last remaining freshwater tidal marshes in the upper Chesapeake Bay is found in the Otter Point Creek component. Its 672 acres of open water, tidal marshes, forested wetlands and upland hardwood forests are surrounded by highways, homes and commercial development. Yet, the woods, creeks and marshes are filled with plants and animals.

### ***Flora***

The vegetation in Otter Point Creek is quite diverse. The shallow water in front of the marsh proper consists of rooted aquatics, such as water milfoil and wild celery, while broad leafed vegetation, such as arrow-aram, spatterdock, and pickerel weed, predominate in the regularly flooded portions of the marsh. The upper regions of the marsh consist mainly of cattail with large stands of sweet flag. Other species grow throughout the marsh, such as wild rice, golden club, jewelweed, river bulrush and smartweed.

### ***Fauna***

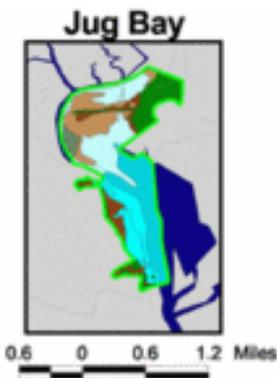


 Otter. (Source: [NOAA](#))

Mammals that frequent the site include muskrats, raccoons, river otters, beavers and an occasional white-tailed deer. A variety of birds also rely upon the marsh in some respect. Species most commonly found include herons, great white and snowy egrets, mallard and black ducks, Virginia rails, red-winged blackbird, marsh wren and spotted sandpiper. Other important birds seen in the area include the American bittern and the upland sandpiper.

The Otter Point Creek component includes valuable spawning area for several species of anadromous and semi-anadromous fish. Other species include banded killfish, mummichog, tidewater silverside, bay anchovy, tessellated darter and spottail shiner. The catadromous American eel may also be found in the area. Snapping turtles and painted turtles inhabit the marsh with blue crabs and various other invertebrates, including radiiferous protozoans and the larval forms of larger organisms.

## Jug Bay



 Jug Bay boundary map. (Source: [NERRS](#))

Quietly secluded and only 20 miles from Washington D.C., the Jug Bay component of the Maryland Reserve is a 722-acre tidal [estuary](#) of the Patuxent River. The broad, shallow waters of Jug Bay support a profusion of freshwater plants and animals surrounded by forested wetlands, upland woods, and fields. Wild rice once dominated these marshes, but has been on the decline. A major research focus has been on the restoration of this emergent plant as well as submerged aquatic vegetation restoration.

There are two partners at this component: Jug Bay Wetlands Sanctuary on the east side of the river and Patuxent River Park on the west side.

## Flora

Jug Bay is a tidal wetland complex surrounded by upland forest and scattered [farm fields](#). Plant life in the area includes hardwood forest species, such as Spanish oak, hickory, sweet gum, American beech, tuliptree and other poplars, red maple and sassafras and related understory vegetation.

Non-tidal wetland species include cardinal flower, red turtlehead and skunk cabbage. Tidal wetland species include wild rice, pickerel weed, spatterdock, rose mallow and *phragmites*. The dominant plant species is wild rice. This along with other seed-bearing plants such as water millet and smartweed, is food for as many as 25,000 waterfowl during winter months.

## ***Fauna***



 Osprey. (Source: [NOAA](#))

Jug Bay is located within the Atlantic Flyway and is a haven for more than 200 species of birds. It is a very important site for waterfowl during the non-breeding season. Twenty-two species of wintering waterfowl use the area, including large flocks of tundra swans, Canada geese and green-winged teal. The wild rice provides a major migratory staging area for Sora rails. Wood ducks also nest in the area. The peregrine falcon has been sighted at Jug Bay. Bald eagles are common in winter and at least one pair nests within a mile of the sanctuary. Many species of migratory songbirds also pass through the area. Other birds of interest include pied-billed grebe, sharp-shinned hawk, northern sawwhet owl, yellow-bellied sapsucker, Swainson's thrush, loggerhead shrike, marsh wren, golden crowned kinglet, red-breasted nuthatch, mourning warbler and dark-eyed junco.

## ***Endangered Species***

Endangered species in the area include several plants, like the smooth tick trefoil, downy bushclover, threadlaid naiad, downy milk pea and a rynchosia. The threatened red turtlehead is also found in the site. Highly rare species for the state include *Desmodium viridiflorum* and anglepod. Other important species at the Jug Bay component include the large flowering partridge pea and the awned mountain mint. Birds of threatened, endangered or rare status include the American bald eagle and the peregrine falcon.

## ***Tidal Range and River Flow***

The component experiences semi-diurnal tides with a two-foot (0.6-meter) tidal fluctuation.

The Patuxent River, Two Run Branch, Pindell Branch, Black Walnut Creek, Swan Point Creek and Deep Creek all flow into Jug Bay. During the low-flow periods of the summer months, increased water temperatures and excessive nutrient levels result in frequent algal blooms in the area.

## **Soil Types**

The predominant soils in the core area of the Jug Bay component are classified as tidal marsh. Soil materials range from sand to [clay](#) and in some areas are mucky or peaty. There are numerous soil types in the upland portion of Jug Bay in Anne Arundel County. Bibb silt loam soils, usually level areas occurring on flood plain, are poorly drained, silty and floury when dry. Evesboro and Galestown loamy sands are made up of sandy Evesboro soils, Galestown soils or both.

In Prince George's County, soils classified as swamp lie inland of the tidal marsh areas and at the mouth of Black Walnut Creek. These areas, covered by fresh water a large part of the time, may contain a mixture of sand, silt, [clay](#), gravel, mud, muck or [peat](#). Fringing upland areas included in the reserve component are primarily Collington fine sandy loam. Surrounding are areas primarily soils in the Donlonton series, which consists of moderately well-drained, nearly level to gently sloping soils on uplands. These developed in old deposits of greenish clay containing greensand.

## **Geology**



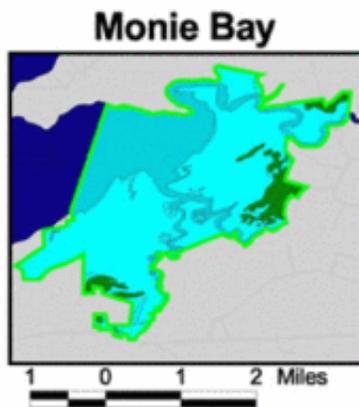
 Jug Bay marsh. (Source: [NOAA](#))

Jug Bay lies in the Atlantic Coastal Plain. The geology of the area consists of a wedge-shaped mass of unconsolidated sedimentary deposits of the Quaternary, Tertiary and Cretaceous ages which overlie older crystalline rocks of the Precambrian or Early Paleozoic ages. The unconsolidated deposits are stratified layers of sand, gravel, silt and [clay](#). In the region of Jug Bay, crystalline rocks have not been penetrated by drilling and little information is available regarding their character. The surface deposits are Quaternary river terrace and lowland estuarine deposits of sand, gravel and silt. Possible underlying formations in the Jug Bay area might be the Calvert and the Nanjemoy formations. These formations may be over Aquia Greensand and Monmouth formations, which are placed over Raritan and Magothy formations. These formations are over the Patapsco and Arundel formations, which are over the Patuxent Formation.

## ***Cultural History***

Artifacts found in the Jug Bay component indicate the presence of Native Americans in the immediate area as early as the early Archaic Period (7,500-6,500 B.C.). At the time of the first white settlements, Jug Bay was a part of the Piscataway Indians' hunting and gathering range. Bristol Landing, just north of Jug Bay, was an important tobacco shipping point during the 1800s and early 1900s. Trains transported tobacco through Jug Bay on the Chesapeake Beach Railroad during these years. The railroad bed remains on site as an historical point of interest. According to the Maryland Historical Trust, there are five known archaeological sites within or adjacent to the Jug Bay Component. It is possible that additional sites are present.

## **Monie Bay**



 Monie Bay boundary map. (Source: [NERRS](#))

Woven by tidal creeks, the brackish waters of Monie Bay support a wealth of wetland vegetation. Dense beds of widgeon grass thrive in the creeks and shallow bay. Salt marsh cordgrass dominates the low marsh, while big cordgrass, saltmeadow hay, and black needlerush grow in the higher areas.

The 3,426-acre Monie Bay component is part of the Deal Island Wildlife Management Area which attracts thousands of waterfowl along with bald eagles, osprey and northern harriers. Special boxes are set out for barn owls and peregrine falcons in an effort to increase their numbers.

Research is a high priority at this site due to its pristine condition. Of particular interest are studies assessing nutrient loadings from various land-use practices and the measuring of nutrient uptake by marsh communities.

## ***Flora***

Overall, the salt marsh vegetation is characteristic of East Coast mid-salinity regimes. Low marsh zones are dominated by smooth cordgrass, while high marsh areas feature salt cordgrass and big cordgrass, salt and three square grass, needlerush and marsh elder. Some areas of higher

ground, such as St. Peter's Marsh, form islands of pine trees within the marsh. Dense beds of widgeon grass, a type of submerged aquatic vegetation, have been reported in Little Monie Creek.

Upland vegetation within the component consists principally of loblolly pine, which dominates the canopy, while wax myrtle and greenbrier occupy the shrub layer. Poison ivy covers many of the trees and grasses dominate the herbaceous zone. These areas are wet and sometimes act as buffers between previously logged areas and marshes at the component boundaries.

## ***Fauna***

Fish species occurring in the numerous tidal creeks adjacent to the component include mummichog, white perch, spot and menhaden. Common invertebrates include fiddler and blue crabs, American oysters, marsh periwinkles and common grass shrimp. Reptiles, amphibians, insects and mammals common to the region also frequent the Otter Point Creek component.

The site also supports an abundance of resident and migratory bird populations, including bald eagles, osprey and numerous hawk species. Waterfowl species include Canada geese, mallards, black ducks and green-winged teals. Birds of interest spotted in the component include the hooded merganser, the sora rail, the American bittern, the pied-billed grebe, the marsh hawk, the sedge wren, the least tern, the common gallinule and the least bittern.

## ***Endangered Species***

Many rare birds have been seen in or near the Monie Bay site. The bald eagle and peregrine falcon, both sometimes residents of the component, are on the U.S. Fish and Wildlife Service's endangered species list.

## ***Tidal Range and River Flow***



 Monie Bay. (Source: [NOAA](#))

Tides in Monie Bay are semi-diurnal and have a mean range of one foot (0.3 meter). The average water levels are generally lower in the winter due to north and northwest [winds](#) that increase the egress from Chesapeake Bay. On the other hand, water levels tend to be higher in the spring and summer when southerly winds reverse the process.

Little Monie Creek, Monie Creek and Little Creek flow into Monie Bay.

## ***Geology***

The Monie Bay component lies in surface deposits of the Quaternary Age, which are composed of grey to buff colored sands with interbedded [clays](#) and shell beds. These are part of a sequence of intercalated alluvial sands and marsh beds on the eastern side of the Delmarva Peninsula. The western side of the peninsula has been described as a broad lowland in which surface altitudes can range from 0-25 feet above sea level, though most are less than ten feet. This lowland is extensively dissected and contains bay flats and broad valley bottoms. Narrow estuaries such as Monie Bay are bordered by tidal marsh deposits of the Holocene Age, which extend east from the Chesapeake Bay and Tangier Sound across this [coastal](#) lowland into the central Delmarva Peninsula. At Monie Bay, Holocene Marsh Deposits overlap the lowland Quaternary Deposits.

## ***Soil Types***

Most of the soils at Monie Bay are classified as tidal marsh soils, containing material ranging from sand to [clay](#), and may be [peaty](#) to mucky and highly sulfurous. Most of the upland portions of the site are in the Othello soil series, typically flat areas just above sea level. This series is generally composed of poorly drained, gray, silty soils over a mottled, silty clay loam subsoil. These soils are strongly acidic.

## ***Cultural History***

Artifacts indicate the presence of Native Americans in the Monie Bay area 13,000 years ago. During the early historical period, Monie Indians occupied this region. Colonial settlement began about 1665 with the movement of Quaker groups from the eastern shore of Virginia across the state line to Maryland seeking refuge from Virginia laws which prohibited their religious practices. The Monie "Hundred" or District was settled by both Quakers and members of the Church of England. By 1696, the Monie Bay District is estimated to have had a population of 900.

The plantation economy of Somerset County centered on tobacco in the early 18th century but diversified later in the century. The first half of the 19th century was prosperous for the county, but the Civil War time period was hard on the [agricultural](#) and minor industrial economy. Outmigration, agricultural competition and the breakdown of the slave labor system led to economic failure for many wealthy families.

Crisfield was connected to the railroad system in 1866; during the 1800s and 1890s, the shellfish industry boomed in this town. Shipbuilding was the most significant supportive industry during the 19th and 20th centuries. Princess Anne sustained its economy through the 19th century as a merchant town and county seat. Deal Island was the site of major water-oriented communities full of small businesses and watermen.

## Cultural History

Artifact dating indicates that bands of territorial semi-nomadic people lived in Maryland in the beginning of the Paleoindian Period (11,000-7,500 B.C.). Through the Archaic Period (7,500-1000 B.C.), the people became more sedentary. Populations climbed as food sources increased with the formation of the Chesapeake Bay and general warming of the climate. During the Woodland Period (1000 B.C.-A.D. 1600), people became even more sedentary and living groups changed from temporary habitats to permanent villages.

European settlement marked the beginning of dramatic changes for the Bay area. The first Europeans settled on the Bay at Jamestown, Virginia, in 1607. In 1634, the first white settlers in Maryland founded St. Mary's City. Tobacco imported from the West Indies flourished in the rich soil of the Bay area and the hope of profit and new life attracted hordes of Europeans. With the creation of the Baltimore and Ohio Railroad in 1828, grain was transported to the Bay from the Midwest. Shipping, ship building and canning became major industries for the area.

## Research



Research divers. (Source: [NERRS](#))

Research, investigation and exploration drive the Maryland Reserve. A variety of research projects are on going at the three components.

**Submerged Aquatic Vegetation (SAV):** Methods to improve SAV restoration are being tested, especially [species diversity](#).

**Turtles:** Research on various species of turtles is being conducted at the Jug Bay Wetlands Sanctuary. One study fits female box turtles with transmitters to track their movements. These studies show that box turtles utilize wetlands, something not previously documented.

**Wild Rice:** Optimal restoration techniques are being identified at Jug Bay to restore and protect wild rice. The recent loss of wild rice is probably attributed to an increase in the resident Canada goose population. Ways to increase seed production and methods to prevent grazing by geese are proving successful and the wild rice is returning.

The reserve supports Graduate Research Fellows from NOAA. Also, several projects funded through the Cooperative Institute for Coastal Estuarine Environmental Technology have been conducted in the reserve.

## Monitoring

**System-Wide Monitoring Program:** The System-Wide Monitoring Program (SWMP) measures changes in estuarine waters to understand how human activities and natural events can affect [coastal](#) resources. It provides valuable data on the short-term variability and long-term changes in estuaries to researchers, natural resource managers, land managers and other coastal decision-makers.

Parameters measured using YSI 6600 continuous dataloggers are [temperature](#), salinity, dissolved oxygen, turbidity, water level and [pH](#). Sampling for nutrients and chlorophyll were scheduled to be added in 2003.

**Tidal and Non-tidal Water Quality Monitoring:** Volunteers, interns and Chesapeake Bay-Maryland Reserve staff conduct spatially intensive, discrete, water quality [monitoring](#) at various tidal sites throughout the reserve, which complements our SWMP effort. Monitoring is currently done at both the Jug Bay and Otter Point Creek components with plans to expand the effort to Monie Bay.

Additionally, a non-tidal water quality monitoring program is being piloted at Otter Point Creek. Pending the results of this effort, additional non-tidal sampling will be developed for the Jug Bay and Monie Bay reserve components as needed.

**Habitat Monitoring:** Reserve staff are focusing habitat [monitoring](#) efforts on critical habitats such as submerged aquatic vegetation (SAV). Annual groundtruthing of SAV beds, to include species composition, percent cover and distribution, is being done throughout the components.

An effort at Otter Point Creek to track the invasion and colonization of the non-native SAV species *Hydrilla verticillata* and *Myriophyllum spicatum* is underway. Researchers at Jug Bay have been tracking the loss and recovery of an emergent aquatic vegetation (EAV) species, *Zizania aquatica*, which was declining due to grazing by resident Canada geese.

Sediment [monitoring](#) is also being done to track rates of [accretion and depletion](#) and to track changes in sediment nutrient concentrations over time.

## Further Reading

- [Chesapeake Bay Reserve's local web site](#)
- [NERRS: Chesapeake Bay Reserve](#)

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