CHAPTER 3

AFFECTED ENVIRONMENT

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3. AFFECTED ENVIRONMENT

3.1 Introduction

3.1.1 SEASHORE CONTEXT

Congress established Assateague Island National Seashore in 1965 as a unit of the national park system (Public Law 89-195). The seashore is located on the Atlantic Coast of the Delmarva Peninsula, encompassing within its authorized boundary Assateague Island and the adjoining waters of the Atlantic Ocean on the east and the estuarine waters of Sinepuxent and Chincoteague Bays on the west, extending up to one-half mile from the island.

Almost all of the land on the island is in public ownership. The state of Maryland owns Assateague State Park, which is managed by the MD DNR. The FWS owns and manages the Chincoteague National Wildlife Refuge. The NPS owns and manages the remainder of the island, with the exception of a few small tracts located primarily in Maryland. Submerged lands within the seashore boundary are owned by the states of Maryland and Virginia, with ownership extending to mean high water in Maryland and mean low water in Virginia.

Approximately two-thirds of the seashore is located within Worcester County, Maryland, and approximately one-third is located within Accomack County, Virginia. Nearby major population centers – long popular with vacationers – include the coastal communities of Ocean City, Maryland, and Chincoteague, Virginia.

Assateague Island National Seashore
Seashore Purpose

The purpose of Assateague Island National Seashore is:

- to preserve the outstanding Mid-Atlantic coastal resources of Assateague Island and its adjacent waters and the natural processes upon which they depend
- to provide high quality resource-compatible recreational opportunities

3.1.2 SEASHORE SIGNIFICANCE

Assateague Island National Seashore possesses resources and values that are important within a global, national, regional, and systemwide context and that are important enough to warrant designation as a unit of the national park system. Four statements express the significance of the seashore's resources and values:

- The seashore is one of the largest and last surviving Mid-Atlantic barrier islands possessing a continuum of intact coastal habitats where the full range of natural processes occur with little or no human interference.
- The marine and estuarine waters within the seashore are a protected vestige of the high quality aquatic ecosystems that once occurred throughout the Mid-Atlantic coastal region of the United States.
- The seashore's habitats support a broad array of aquatic and terrestrial species, many of which are rare, uniquely adapted to life at the edge of the sea, and dependent upon natural ecosystem processes undisturbed by humans.
- Amidst the highly developed Mid-Atlantic region, the seashore's coastal resources provide unique opportunities for nature-based recreation, education, solitude, and inspiration.

Assateague Island National Seashore
Use of the Term "Seashore"

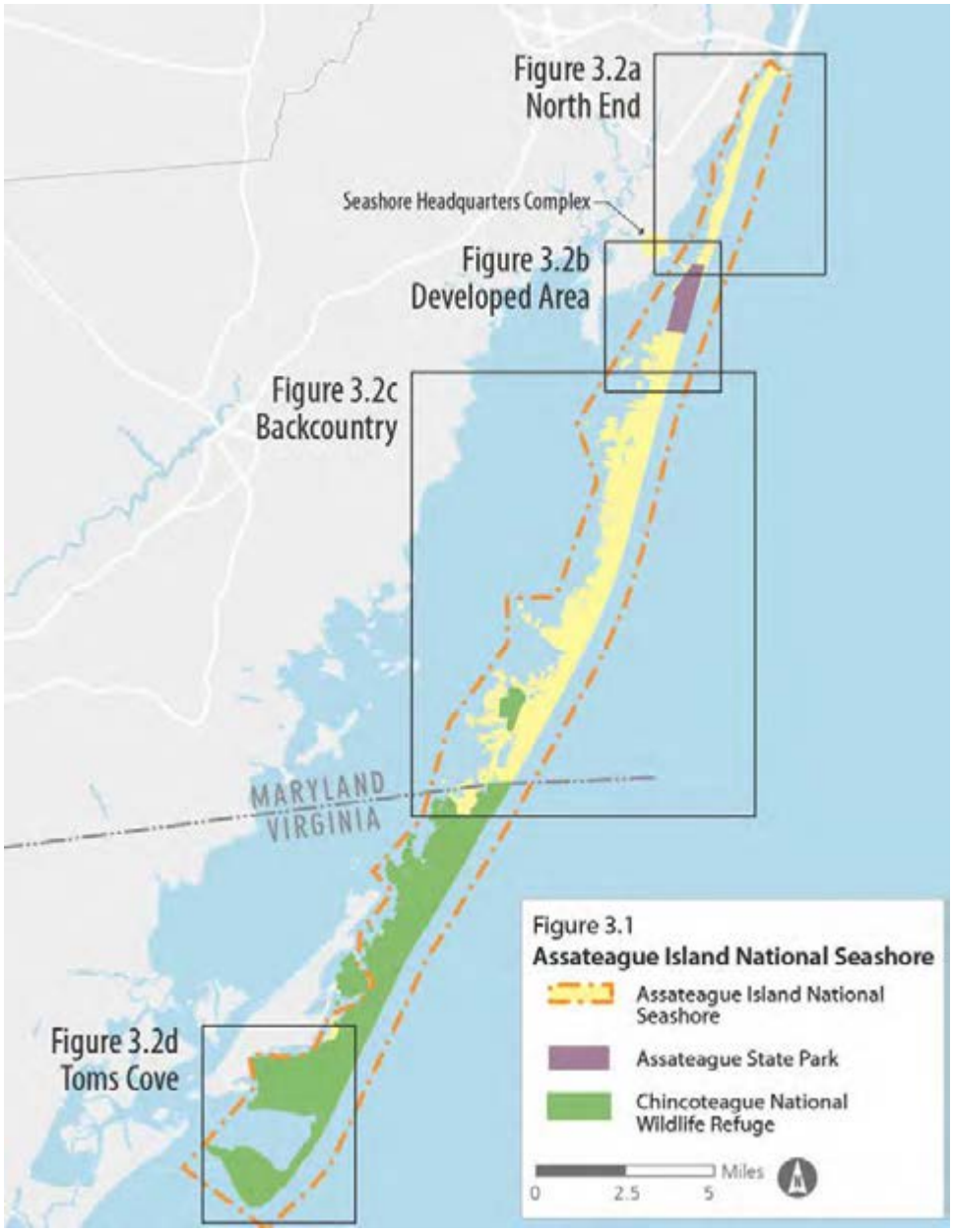
The term "seashore" refers to the following:

- land owned and managed by the NPS within the authorized limits of Assateague Island National Seashore
- waters managed by the NPS within the authorized limits (including waters extending up to one-half mile from the island)

The term "seashore" does not refer to the following:

- land owned by the U.S. Fish and Wildlife Service (FWS) at Chincoteague National Wildlife Refuge
- land owned by the Maryland Department of Natural Resources at Assateague State Park
- submerged lands within one-half mile from the island owned by the states of Maryland and Virginia

The term "Toms Cove Area" refers to the Virginia Assigned Area within Chincoteague National Wildlife Refuge where the NPS currently provides recreation facilities and interpretive programming through a memorandum of understanding (MOU) with the FWS (see section 1.3.2).



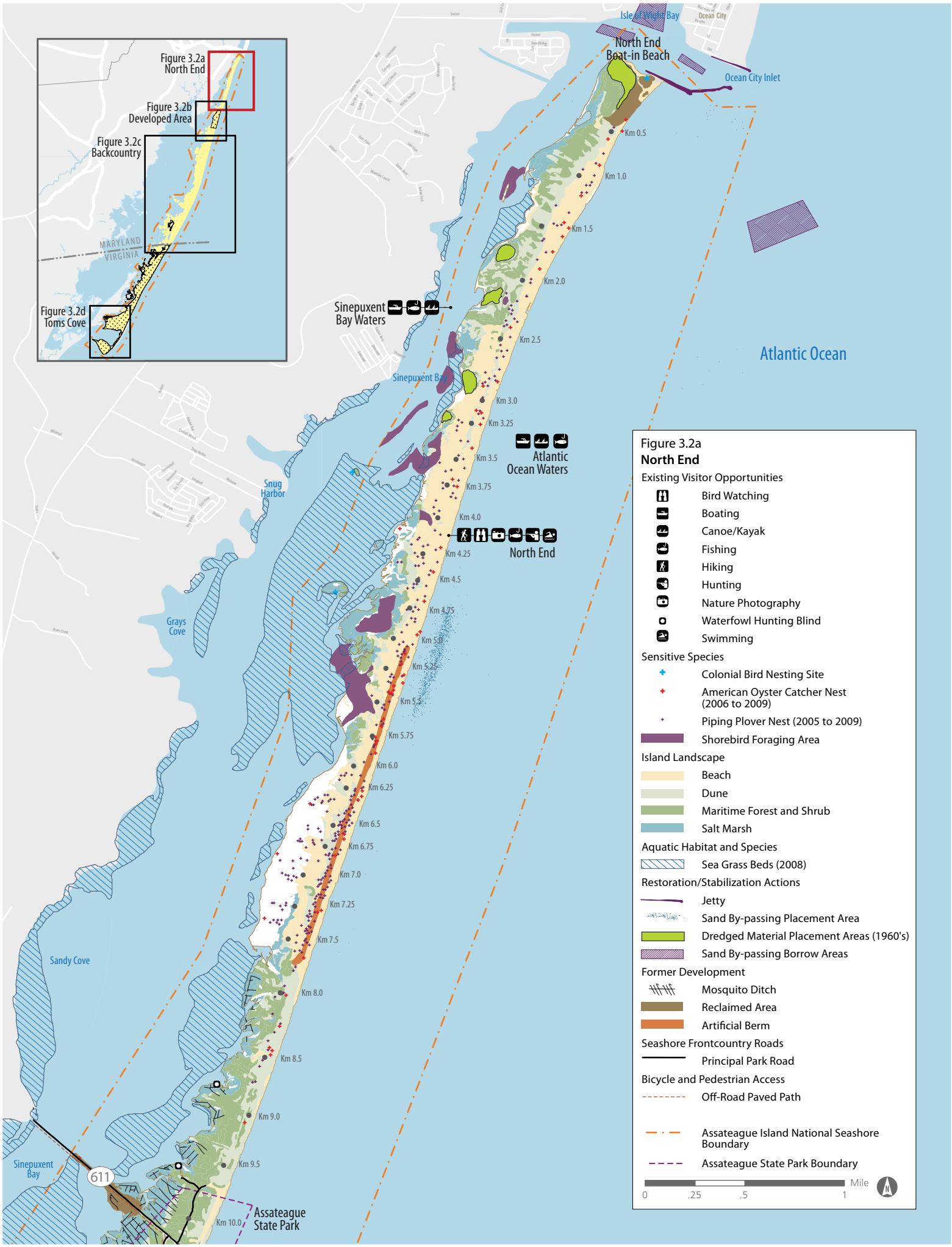


Figure 3.2a
North End
Figure 3.2b
Developed Area
Figure 3.2c
Backcountry
Figure 3.2d
Toms Cove
MARYLAND
VIRGINIA
Isle of Wight Bay
Ocean City
North End
Boat-in Beach
Ocean City Inlet
Atlantic Ocean
Sinepuxent
Bay Waters
Sinepuxent Bay
Atlantic
Ocean Waters
Snug
Harbor
North End
Grays
Cove
Sandy Cove
Sinepuxent
Bay
611
Assateague
State Park
Km 0.5
Km 1.0
Km 1.5
Km 2.0
Km 2.5
Km 3.0
Km 3.25
Km 3.5
Km 3.75
Km 4.0
Km 4.25
Km 4.5
Km 4.75
Km 5.0
Km 5.25
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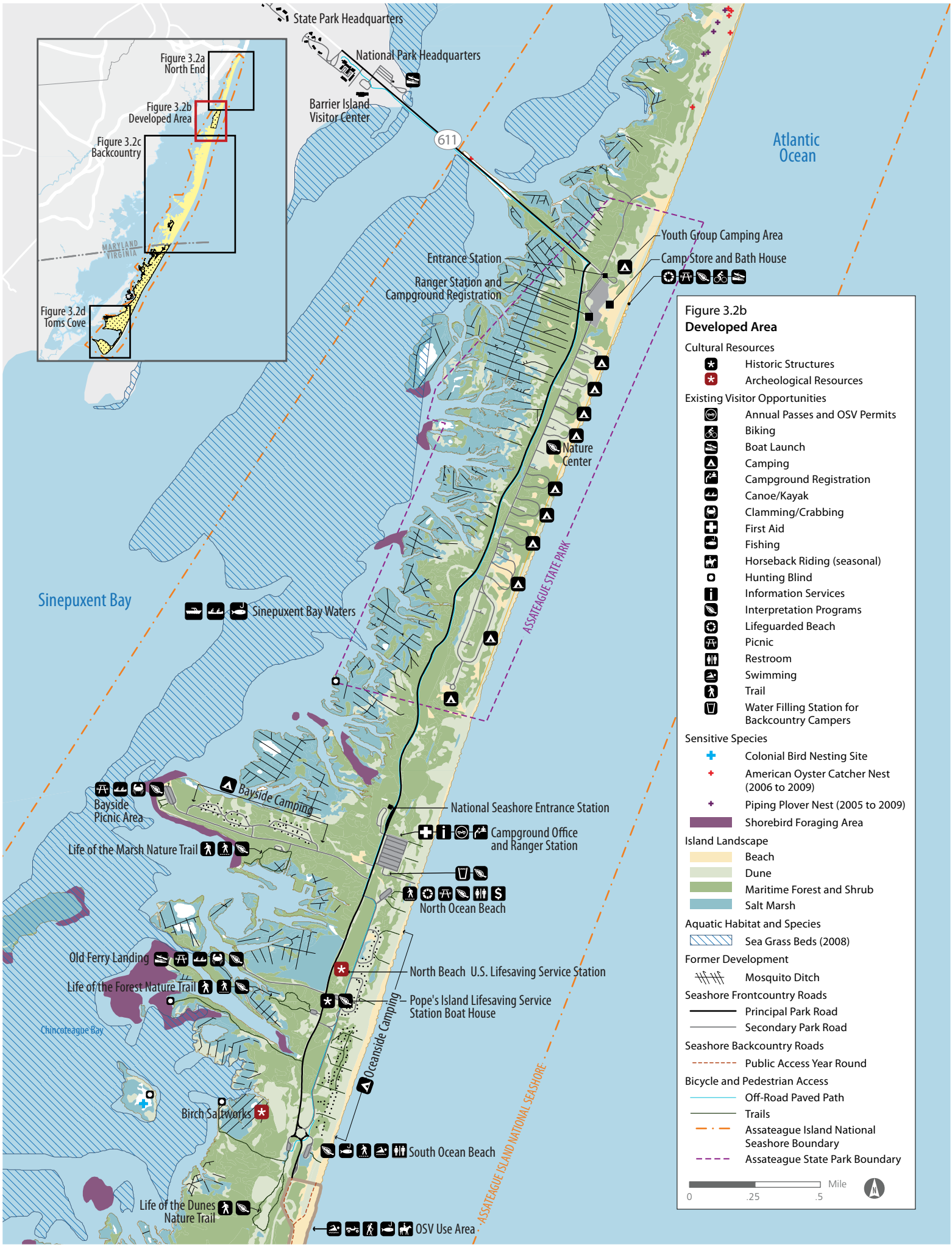
Km 5.75
Km 6.0
Km 6.25
Km 6.5
Km 6.75
Km 7.0
Km 7.25
Km 7.5
Km 8.0
Km 8.5
Km 9.0
Km 9.5
Km 10.0
Figure 3.2a
North End
Existing Visitor Opportunities
Bird Watching
Boating
Canoe/Kayak
Fishing
Hiking
Hunting
Nature Photography
Waterfowl Hunting Blind
Swimming
Sensitive Species
Colonial Bird Nesting Site
American Oyster Catcher Nest
(2006 to 2009)
Piping Plover Nest (2005 to 2009)
Shorebird Foraging Area
Island Landscape
Beach
Dune
Maritime Forest and Shrub
Salt Marsh
Aquatic Habitat and Species
Sea Grass Beds (2008)
Restoration/Stabilization Actions
Jetty
Sand By-passing Placement Area
Dredged Material Placement Areas (1960's)
Sand By-passing Borrow Areas
Former Development
Mosquito Ditch
Reclaimed Area
Artificial Berm
Seashore Frontcountry Roads
Principal Park Road
Bicycle and Pedestrian Access
Off-Road Paved Path
Assateague Island National Seashore
Boundary
Assateague State Park Boundary
Mile
0
.25
.5
1


State Park Headquarters
National Park Headquarters
Barrier Island Visitor Center
611
Atlantic Ocean
Figure 3.2a North End
Figure 3.2b Developed Area
Figure 3.2c Backcountry
Figure 3.2d Toms Cove
MARYLAND
VIRGINIA
Youth Group Camping Area
Camp Store and Bath House
Entrance Station
Ranger Station and Campground Registration
Nature Center
ASSATEAGUE STATE PARK
Sinepuxent Bay
Sinepuxent Bay Waters
Bayside Camping
Bayside Picnic Area
Life of the Marsh Nature Trail
National Seashore Entrance Station
Campground Office and Ranger Station
North Ocean Beach
Old Ferry Landing
Life of the Forest Nature Trail
North Beach U.S. Lifesaving Service Station
Pope's Island Lifesaving Service Station Boat House
Chincoteague Bay
Oceanside Camping
Birch Saltworks
South Ocean Beach
Life of the Dunes Nature Trail
OSV Use Area
ASSATEAGUE ISLAND NATIONAL SEASHORE
Figure 3.2b
Developed Area
Cultural Resources
Historic Structures
Archeological Resources
Existing Visitor Opportunities
Annual Passes and OSV Permits
Biking
Boat Launch
Camping
Campground Registration
Canoe/Kayak
Clamming/Crabbing
First Aid
Fishing
Horseback Riding (seasonal)
Hunting Blind
Information Services
Interpretation Programs
Lifeguarded Beach
Picnic
Restroom
Swimming
Trail
Water Filling Station for Backcountry Campers
Sensitive Species
Colonial Bird Nesting Site
American Oyster Catcher Nest (2006 to 2009)
Piping Plover Nest (2005 to 2009)
Shorebird Foraging Area
Island Landscape
Beach
Dune
Maritime Forest and Shrub
Salt Marsh
Aquatic Habitat and Species
Sea Grass Beds (2008)
Former Development
Mosquito Ditch
Seashore Frontcountry Roads
Principal Park Road
Secondary Park Road
Seashore Backcountry Roads
Public Access Year Round
Bicycle and Pedestrian Access
Off-Road Paved Path
Trails
Assateague Island National Seashore Boundary
Assateague State Park Boundary
Mile
0
.25
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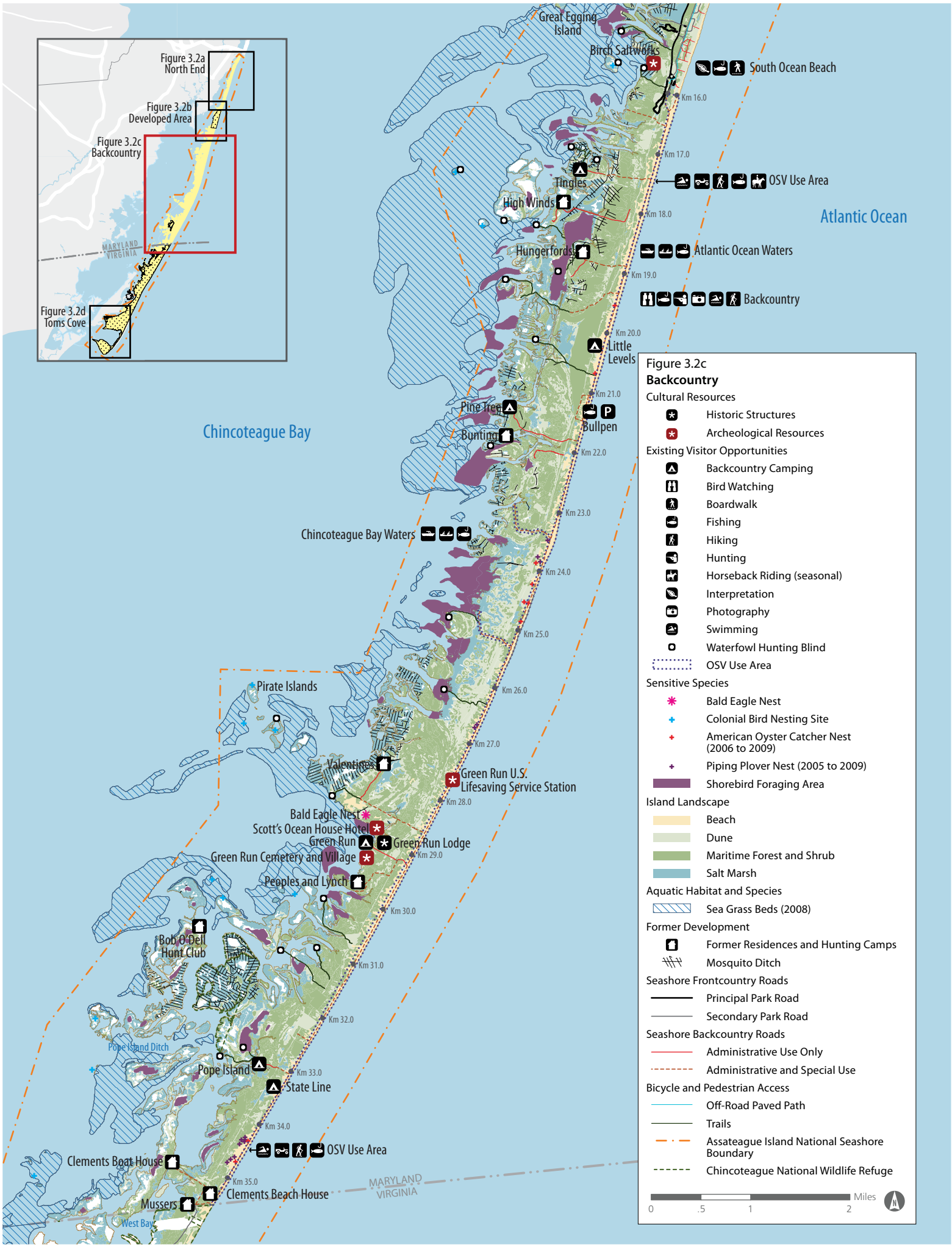
Figure 3.2a
North End
Figure 3.2b
Developed Area
Figure 3.2c
Backcountry
Figure 3.2d
Toms Cove
MARYLAND
VIRGINIA
Great Egging Island
Birch Saltworks
South Ocean Beach
Km 16.0
Km 17.0
Tingles
OSV Use Area
High Winds
Km 18.0
Atlantic Ocean
Hungerfords
Atlantic Ocean Waters
Km 19.0
Backcountry
Km 20.0
Little Levels
Km 21.0
Pine Tree
Bullpen
Bunting
Km 22.0
Chincoteague Bay
Km 23.0
Chincoteague Bay Waters
Km 24.0
Km 25.0
Pirate Islands
Km 26.0
Km 27.0
Valentines
Green Run U.S. Lifesaving Service Station
Km 28.0
Bald Eagle Nest
Scott's Ocean House Hotel
Green Run
Green Run Lodge
Green Run Cemetery and Village
Km 29.0
Peoples and Lynch
Km 30.0
Bob O'Dell Hunt Club
Km 31.0
Km 32.0
Pope Island Ditch
Pope Island
Km 33.0
State Line
Km 34.0
OSV Use Area
Clements Boat House
Km 35.0
Clements Beach House
Mussers
West Bay
MARYLAND
VIRGINIA
Figure 3.2c
Backcountry
Cultural Resources
Historic Structures
Archeological Resources
Existing Visitor Opportunities
Backcountry Camping
Bird Watching
Boardwalk
Fishing
Hiking
Hunting
Horseback Riding (seasonal)
Interpretation
Photography
Swimming
Waterfowl Hunting Blind
OSV Use Area
Sensitive Species
Bald Eagle Nest
Colonial Bird Nesting Site
American Oyster Catcher Nest (2006 to 2009)
Piping Plover Nest (2005 to 2009)
Shorebird Foraging Area
Island Landscape
Beach
Dune
Maritime Forest and Shrub
Salt Marsh
Aquatic Habitat and Species
Sea Grass Beds (2008)
Former Development
Former Residences and Hunting Camps
Mosquito Ditch
Seashore Frontcountry Roads
Principal Park Road
Secondary Park Road
Seashore Backcountry Roads
Administrative Use Only
Administrative and Special Use
Bicycle and Pedestrian Access
Off-Road Paved Path
Trails
Assateague Island National Seashore Boundary
Chincoteague National Wildlife Refuge
Miles
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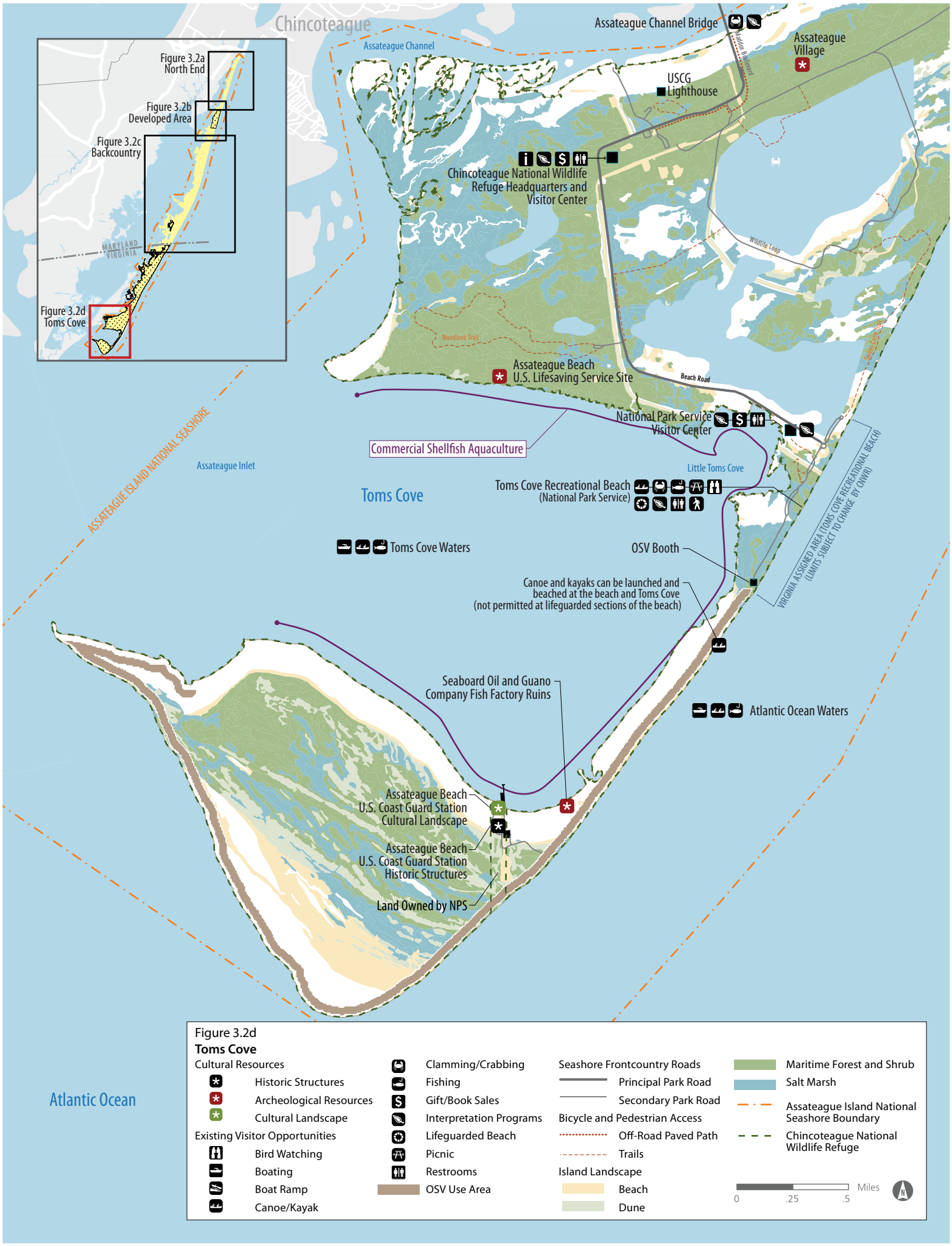
Chincoteague
Assateague Channel
Assateague Channel Bridge
Assateague Village
USCG Lighthouse
Chincoteague National Wildlife Refuge Headquarters and Visitor Center
Wildlife Loop
Woodland Trail
Assateague Beach U.S. Lifesaving Service Site
Beach Road
National Park Service Visitor Center
Commercial Shellfish Aquaculture
Assateague Inlet
ASSATEAGUE ISLAND NATIONAL SEASHORE
Toms Cove
Little Toms Cove
Toms Cove Recreational Beach (National Park Service)
Toms Cove Waters
OSV Booth
VIRGINIA ASSIGNED AREA (TOMS COVE RECREATIONAL BEACH) (LIMITS SUBJECT TO CHANGE BY CNWR)
Canoe and kayaks can be launched and beached at the beach and Toms Cove (not permitted at lifeguarded sections of the beach)
Seaboard Oil and Guano Company Fish Factory Ruins
Atlantic Ocean Waters
Assateague Beach U.S. Coast Guard Station Cultural Landscape
Assateague Beach U.S. Coast Guard Station Historic Structures
Land Owned by NPS
Atlantic Ocean
Figure 3.2a North End
Figure 3.2b Developed Area
Figure 3.2c Backcountry
Figure 3.2d Toms Cove
MARYLAND
VIRGINIA
Figure 3.2d
Toms Cove
Cultural Resources
Historic Structures
Archeological Resources
Cultural Landscape
Existing Visitor Opportunities
Bird Watching
Boating
Boat Ramp
Canoe/Kayak
Clamming/Crabbing
Fishing
Gift/Book Sales
Interpretation Programs
Lifeguarded Beach
Picnic
Restrooms
OSV Use Area
Seashore Frontcountry Roads
Principal Park Road
Secondary Park Road
Bicycle and Pedestrian Access
Off-Road Paved Path
Trails
Island Landscape
Beach
Dune
Maritime Forest and Shrub
Salt Marsh
Assateague Island National Seashore Boundary
Chincoteague National Wildlife Refuge
Miles
0
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N

3.2 Climate Change/Sea Level Rise

The seashore is a highly dynamic place that is constantly changing as currents and storms reshape the landform and its habitats. Most global climate change scenarios indicate that barrier islands such as Assateague will become much more dynamic as a result of accelerating rates of sea level rise, and more intense and possibly more frequent storms. While the pace and magnitude of climate change/sea level rise remains uncertain, it is clear that any plan for the future of the seashore must consider the management challenges associated with an increasingly dynamic island landform.

In 2009, the NPS selected Assateague Island as a case study for exploring climate change scenarios. Researchers identified resource impacts (a range of possible sectors that climate change will likely affect) and climate drivers (the main climatic drivers, such as temperature, precipitation, sea level rise, and drought that are likely to change and hence affect the seashore in the future), and participated in a workshop to explore future scenarios for the seashore. The findings, presented in *Using Scenarios to Explore Climate Change Project Report* (Monitor Group Global Business Network 2009) contributed to the scoping phase of the GMP planning process, providing information regarding how climate change could impact the seashore.

The seashore's natural environment is expected to become less stable under most climate change projections. Driven by increasing rates of sea level rise, and more intense and possibly more frequent storms, the island will experience an increased likelihood for erosion, overwash, inlet breaching, shoreline retreat, and island narrowing. If the highest rates of projected sea level rise occur, the island could exceed stability thresholds, resulting in rapid migration landward, segmentation, and possibly disintegration.

Accelerated landscape dynamics will drive changes in the biotic and abiotic factors influencing the distribution and abundance of existing island habitats. Habitat diversity is expected to decrease, with a trend toward plant species and communities able to tolerate greater and more frequent disturbance from stressors, such as sediment movement and salt water inundation. Community types requiring more stable conditions, such as the island's maritime forests, are likely to decline. Although systems are expected to simplify with a concurrent loss of overall biodiversity, some species will likely benefit, such as shorebirds and other beach-dwelling plants and wildlife.

Anticipated changes in ambient temperature and precipitation patterns will exacerbate the stresses from a more dynamic physical landscape. Although projections regarding overall precipitation are mixed, most suggest that seasonal patterns of rainfall will change, that rainfall will occur in more intense events, and that summer droughts will become more frequent and long lived. Potential impacts to the surficial aquifer from saltwater inundation and a loss of land mass will affect the island's freshwater systems, particularly during summer months. This will likely alter freshwater habitats, threatening a suite of dependent wildlife such as amphibians and waterfowl, as well as the seashore's horses.

Assateague's saltmarsh is also at significant risk from the effects of climate change. Increased rates of sea level rise coupled with a more dynamic landform has the potential to overwhelm the ability of intertidal marshes to maintain surface elevations and keep pace with rising seas. Significant loss of saltmarsh will decrease primary productivity and reduce habitat availability for both terrestrial and aquatic species; some of which are important to regional commercial fisheries.

Rising temperatures and summer drought are also expected to worsen conditions in the estuary formed by Assateague Island by stimulating algal production and increasing anoxia. Estuarine resources already stressed by excess nutrient loading from land uses and development in the mainland watershed are particularly vulnerable. Temperature sensitive aquatic grass species such as *Zostera marina* are likely to decline; a loss that could stimulate wholesale ecological change.

From a visitor use perspective, the more dynamic barrier island landform expected under most climate change projections will challenge the NPS's ability to provide recreational access and opportunities in traditional ways. Rapid rates of shore retreat and storm driven overwash will make fixed location of infrastructure, such as roads, parking lots, and visitor use facilities, increasingly more difficult and costly to maintain. NPS will need new ways of providing sustainable access and infrastructure to protect visitor use opportunities in the face of climate change.

3.3 Natural Coastal Processes

Assateague Island National Seashore
Fundamental Resources – Natural Coastal Processes

Natural processes including the action of tides, wind, waves, currents, storms, and sea level rise, influence and shape the barrier island and adjacent aquatic habitats.

Assateague Island is one of many low lying, floodprone, and highly dynamic barrier islands along the east coast. What is today Assateague Island was originally part of Fenwick "Island." Although referred to as an island, Fenwick is actually a barrier spit attached to the Delaware-Maryland-Virginia (Delmarva) Peninsula. In 1933 a hurricane washed over Fenwick Island forming an inlet (now known as Ocean City Inlet) and creating Assateague Island as a distinct barrier island encompassing the southern 37 miles of what was Fenwick Island. Since that time, stabilization with jetties and routine dredging by the USACE has maintained and enlarged the Ocean City Inlet to provide water access between the Maryland coastal bays and the Atlantic Ocean.

Assateague Island National Seashore
Fundamental Resources – Natural Coastal Environment

The natural coastal environment of the seashore exemplifies the meeting place of land and sea along the Mid-Atlantic coast, and includes miles of broad sandy beaches, an intricate mosaic of natural and scenic landscape features, and qualities of wilderness character.

The Delmarva Peninsula began forming during the Pliocene and early Pleistocene (up to about 1.5 million years ago) as the ancestral Potomac River and Delaware River deposited deltas and outwash plains that would become the peninsula's core (Schupp 2006). Glaciers deposited sediments into major river systems to form a broad coastal plain, and sea level lowering allowed cutting of river valleys and creation of Delaware Bay and Chesapeake Bay. About 18,000 years ago after the last glacial period of the Pleistocene epoch, sea level began to rise, sea water covered the coastal plain, and barrier islands migrated shoreward. Glacial meltwater continued to carry large volumes of sediment to the sea. About 3,500 years ago sea level rise began to stabilize, and waves shaped sediments along the margins of the evolving shoreline and connected barrier features known today.

Table 3.1. Assateague Island National Seashore – Climate Change Projections[1]

	General Change Expected	Range of Change Expected and Reference Period	Size of Expected Change Compared to Recent Changes	Synoptic Signs	Confidence
temperature	increased temperature, but not uniform	1.0 to 1.9°C (1.8 to 3.5°F) increase by 2040	moderate to large	trend to milder winters with lengthening periods of above freezing temperatures	virtually certain that temperature will increase; projections for rate and magnitude of change vary, but forecasts consistently call for an ecologically significant rise in temperature
precipitation	probable decreased total annual precipitation	1 to 6% increase in cold half by 2040; 3 to 7% decrease in warm half by 2040	small to moderate; most changes within the bounds of the observed record	wetter springs and autumns are a signal of more active mid-latitude cyclones	low confidence – model trend is toward drier during the warm season, but this runs contrary to the decadal shift toward more precipitation
sea level	increased sea level	3.5 to 9 inches (80 to 220 mm) by 2040	large	when coincident with lunar phase, nor'easters and hurricanes will enhance floods; increased flushing into coastal bays	very conservative – moderate degree of confidence though it may take some alignment of storms, tides and winds to have a large scale effect
drought	modest increased drought frequency during the warm season	rainfall deficits during the growing season may approach 10 to 25%; more frequent dry spells by 2040	small to moderate	greatest impacts during summer; some effects on Delmarva crops; likely to lower flows into estuaries (increased toxin concentrations)	modest level of confidence – will be largely influenced by regional and sectional droughts which are driven by thermal anomalies on the continent and adjacent oceans
snow cover	increased snow-free days; decreased snow accumulations	up to >50% reduction in average annual snowfall by 2040	moderate	shift in winter storm tracks away from coastal development	high level of confidence – it matches current trend (note that 'odd' extreme snowfalls are likely)
length of growing season	increased length of growing season	likely to be two or more weeks longer by 2040	moderate to large	more large scale stagnant high pressure systems during spring and fall	high degree of confidence – synoptic patterns will also allow the occasional late/early freezes
extreme events: temperature	warm events increased; cold events decreased	record minimums less likely in winter by 2040; record maximums more likely in winter by 2040	moderate	increased frequency of thaws in winter as seen by emergence of subtropical high	moderate to high degree of confidence – it continues existing trend (greatest increase in summer heat occurs later in the period)
extreme events: precipitation	possible decreased frequency of heavy rain; countered by increased intensity of precipitation	uncertain	moderate	potential for more intense spring and autumn floods due to active storm tracks	model forecasts show the least skill in precipitation forecasts, though repetitive storms are a common way for excessive precipitation
extreme events: cold season storms	increased intensity of cold season extreme events	uncertain	moderate to large	increased frequency of transition season storms (nor'easters)	low to moderate confidence
extreme events: warm season storms	increased intensity of warm season events; possible decreased frequency of warm season storms	uncertain	moderate	increased strength of tropical storms; possibility of two storm strikes in short time scale	low confidence

[1] *Table Adapted from A1B Scenarios (Meehl et al in Solomon et al 2007 and Christensen et al in Solomon et al 2007)*

Features such as Fenwick and Assateague spits developed from continued shaping of sediments washed out from the Delaware River basin through forces such as coastal currents, waves, and tidal action. Because Assateague and Fenwick are in an area where tidal change is relatively small (up to six feet, considered "micro-tidal"), other forces such as currents, sea level rise, and wave energy during storms generally shape barrier features.

Today, Assateague Island extends 58 km (37 miles) along the coasts of Maryland and Virginia, ranging in width from 300 m to 1200 m (Schupp 2006). Elevations are generally around 2 m, although dunes may be as high as 10 m. The north end is bounded by the Ocean City Inlet which has an associated flood tidal delta and a large ebb tidal delta that extends both north and south of the inlet, curving to form a 300 m wide attachment bar that currently meets the shoreline between 650 and 950 m south of the inlet (Schupp et al 2006). Winter storms and high wave energy create a low, flat beach with sand stored in a nearshore sand bar, although waves and wind can create a steep scarp at the dune face further inland. Summer beach profiles are steeper (Shupp et al 2006).

Ocean waves and storms constantly reshape barrier islands through erosion and accretion. Waves strike the shore at an angle creating a longshore current that travels parallel to the shore. Longshore currents carry sediment along the shore in a process called littoral drift and deposit it where wave energy is lower. At Assateague, the longshore current moves sediment from north to south in the winter, generally following the direction of the area's largest waves from the northeast. On average 200,000 to 300,000 yd^3 of sediment per year are moved along the coast through longshore transport. This sediment movement and deposition stretches out barrier

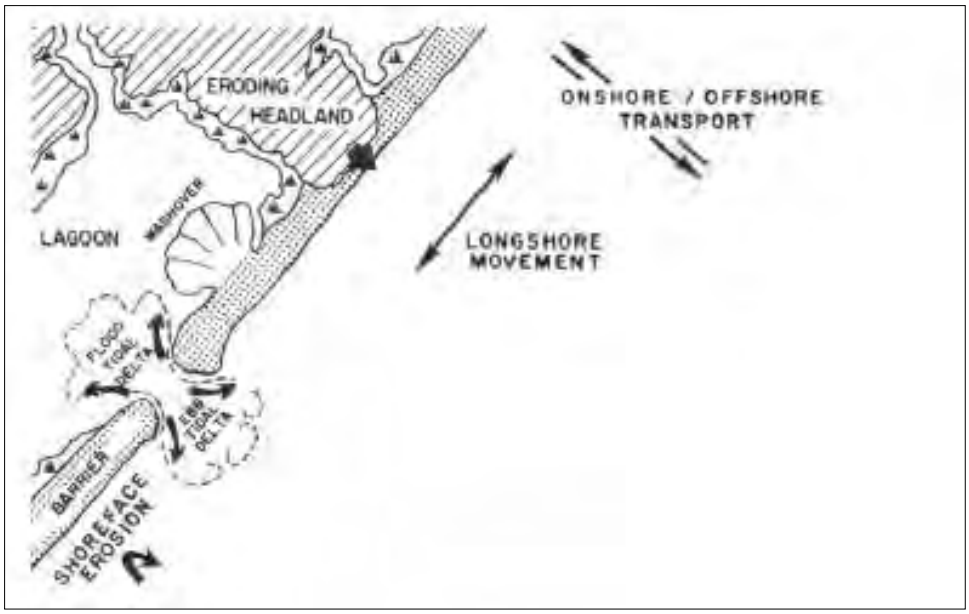


Figure 3.3 General barrier Island geomorphic processes, including current, sediment transport, overwash, and inlet flood tidal formation

features, which become elongated and even curved by accreting sand on the downdrift end (USACE 2009). In the summer waves from the southeast drive sand transport less vigorously northward. As a result the net annual longshore transport is estimated to be between 115,000 and 214,000 m² per year toward the south (Underwood et al 2005 as cited in Schupp et al 2006).

In addition to currents, waves moving perpendicular to the shore help shape the island. When waves are particularly strong they can erode sand from the beach and dunes and carry it across the island. This process of "overwash" deposits sand in the island interior or carries it across the island and deposits it in the bay, keeping the island rolling over itself toward the west, essentially moving away or "retreating" from wave activity. Overwash helps maintain the land base of the island as well as its height in the face of rising sea level. It increases during sea level rise and helps the island resist flooding and erosion associated with sea level rise and more frequent or severe storms that would otherwise erode, flood, and eventually submerge it (USACE 2009).

Barrier islands are also subject to the formation of new inlets, which can form during high energy storm events (e.g. hurricanes or nor'easters). When an inlet opens, sediment is transported by currents and tidal action into the bay or lagoon that separates Assateague Island from the mainland. This creates a flood tidal delta. On the island, saltmarshes vegetated primarily by salt tolerant grasses such as cordgrass (genus *Spartina*) fringe the bays. Over time, continued longshore transport of sediments closes the inlet and the flood tidal delta often evolves into substrate suitable for the development of new saltmarsh. New vegetation grows and dies, its decay adding to the bayside land area, moving the shoreline closer to the mainland and creating needed elevation to withstand increasing sea levels (USACE 2009).

Figure 3.4 Accelerated erosion caused by jetties, groins, and other efforts to stabilize the Ocean City Inlet (particularly at the northern end Assateague Island) (photo taken in September 2004)

The dynamics of shoreline accretion or erosion change from winter to summer. In the winter more forceful waves and wind remove sand from the beaches. The eroded sand is deposited in offshore sand bars and returns to the beaches with gentler summer waves. Because there are more days of low energy waves than high-energy waves, accretion balances erosion (USACE 2009).

The environments on Assateague Island include the nearshore (subaqueous zone), beach (foreshore and backshore), dune, grasslands and shrub/scrub thickets, freshwater ponds, and forest. Where the island is narrow or lower in elevation and subject to persistent overwash, barrier flats, sparse vegetation, and wetlands replace the forested areas. The beach and dune habitats are particularly important to the island's geomorphology because they provide protection from wave attack and absorb wave energy (NOAA Coastal Services Center as cited in USACE 2009).

Human development including jetties and groins can substantially alter the coastal dynamics of the barrier island. In the future, beaches along the east coast are expected to become increasingly vulnerable to storms in part because of the "hardening" of the coastline, a term that refers to the addition of jetties, groins and other stabilizing structures which dramatically stop or slow littoral transport down-current of the structure (Munger et 2010). Following the August 1933 storm that separated Assateague Island from the Fenwick barrier spit, stabilization efforts to keep the inlet permanently open began. USACE built jetties both north and south of the inlet. This caused a dramatic effect on down-current sediment supply to Assateague Island. The jetty-caused sediment deficit has resulted in unnaturally accelerated rates of shoreline erosion along northern Assateague Island.

The U. S. Geological Survey (USGS) has rated the northern 13 km of the island as having "very high vulnerability" to erosion and loss, thought to be caused primarily by the interruption in longshore sediment transport created by the jetties (Rosati et al 1996, as cited in Schupp et al 2006). The lack of sand has removed the buffering ability of the beach, with resulting low elevation, frequent over washing, and high rates of shoreline erosion (Pendleton et al 2004 as cited in Schupp et al 2006). Along this stretch, the shoreline erosion rate more than doubled since the inlet was created, from a pre-inlet rate of -1.5 m per year to a post inlet rate of -3.7 m per year, translating to an estimated loss of sediment volume on the order of 220,000 m^3 per year (Schupp et al 2006). The USACE has predicted that without mitigation the north end of the island will destabilize and eventually breach during storms in the near future.

To maintain both the inlet and the geologic integrity of northern Assateague, local and national government agencies have created a comprehensive two-phase restoration plan (as described in Schupp et al 2006). The first phase placed 1.4 million m^3 of sand just seaward of the mean high water line in September 2002 in an area extending from 2 to 12.5 km south of the inlet. The second phase is longer-term (25 years) and is intended to restore sand transport to northern Assateague Island at the historic, pre-inlet rate. Since January 2004, the USACE had dredged approximately 72,000 m^3 of sand

twice yearly from the ebb and flood tidal deltas and deposited it just seaward of the surf zone off the island's north end. The "bypassed" sand re-enters the longshore transport system and nourishes the down-current beaches, thereby helping to reduce the rate of current shoreline erosion on the beaches of Assateague Island. An assessment following the first two years of the bypass project concluded that, overall, the project has been effective in delivering sand to the surf zone and shoreline of north end of the island.

3.4 Water Resources

3.4.1 NEARSHORE OCEAN WATERS

Assateague Island National Seashore
Fundamental Resources – High Quality Waters

High quality water resources within the seashore's boundary define and sustain the coastal ecosystem and include fresh ground water and surface water systems, and extensive estuarine and marine waters.

Along the length of Assateague Island, 14 percent of the land area is beach and intertidal habitat on the Atlantic coast. This is the least studied habitat of lands and waters managed by the seashore and there is less knowledge of habitats, geomorphic processes, or water quality conditions. However, the NPS does sample ocean water quality several times during the summer, particularly to assess whether EPA water quality standards for the presence of human fecal material (presence of enterococci bacteria as an indicator). High levels of bacteria, which can indicate the presence of pathogens from animal or human waste, are responsible for the overwhelming majority of beach closures and advisories in the nation. Causes can include inadequate or overloaded sewage treatment plants, polluted stormwater runoff, or faulty septic systems. From 2009 to 2011 only one exceedance of EPA standards was recorded at the seashore. This occurred at Toms Cove North on September 7, 2010, following Hurricane Earl which had passed through the area a few days previously.

3.4.2 COASTAL BAYS

- **Chincoteague Bay,**

Assateague Island National Seashore
Fundamental Resources – Related Resources

The waters and mainland watershed of Chincoteague and Sinepuxent Bays and Atlantic Ocean extend far beyond park boundaries. The integrity of many fundamental resources is affected by activities that occur outside of the park, but within the watershed.

Chincoteague Bay is the largest and most southern of the two seashore bays partially within the seashore boundary. It has a surface area of 363 km^2 (including 189 km2 in Maryland and 174.5 km^2 in Virginia) and a water volume of 231m^3. Most of the bay is shallow, with an average depth of 1.22 m. Major sources of sedimentation to the bay are storm overwash events and shore and wind erosion from Assateague Island, with streams providing relatively little contribution. River input to all Maryland coastal bays is low and groundwater is a more important source of freshwater. Flushing (replacing all water through freshwater exchange and ocean exchange) rate for Chincoteague Bay is slow, on the order of 63 days; contaminants that enter the bay tend to stay in the bay and can have a disproportionate effect on water quality and aquatic life compared to larger, deeper bays such as the Chesapeake Bay.

- **Sinepuxent Bay**

Sinepuxent Bay has a surface area of 24.1 km^2 and an average depth of only 0.67 m. Sinepuxent Bay volume is 16.5 million m^3. While the flushing rate is unknown, it is likely quicker than Chincoteague Bay owing to its proximity to the Ocean City Inlet.

- **Newport Bay**

Newport Bay, not part of the seashore, is connected to and influences Chincoteague Bay. It is small and shallow, with a combined volume of 19.4 million m^3, average depth of 1.22 m and surface area of 15.9 km^2.

- **Coastal Bay Water Quality**

The *2004 State of the Bays Technical Report* (Wazniak et al 2004) provides an overview of water quality conditions for each of the bays. Results of monitoring vary from bay to bay, with Newport Bay failing to meet nitrogen and phosphorus standards needed for the protection of seagrass, a critical component of the aquatic ecosystem. While monitoring generally indicated water quality in Sinepuxent Bay met the nitrogen standard, three of five stations actually exceeded the phosphorus standard. In Chincoteague Bay four northern mainstem stations did not meet nitrogen standards, but 13 stations on the eastern side of the bay behind the seashore did. Enrichment with phosphorus was more widespread; all four sites that did not meet the nitrogen standard also failed to meet that for phosphorus. Of the 17 stations where sampling data were summarized, four met the phosphorus standard; these were located on the eastern shore of the bay. Public Landing, Johnson Bay and a site north of Chincoteague Island had the highest phosphorus concentrations (Wazniak et al 2004).

Chlorophyll testing, which measures the density of phytoplankton in the bays, has also been completed. If chlorophyll levels are lower (than 15 µg/L), seagrass receives more light and is better able to grow. Test results have shown that most of Newport Bay and Sinepuxent Bay had chlorophyll levels that were greater than the threshold for seagrass growth, although all of those tested in Chincoteague Bay were at or lower than the density needed to grow seagrass. The area in Chincoteague Bay covered by seagrass more than tripled between 1987 and 2001, but has since leveled off (Harris et al 2005). This leveling off and the observation of large patches of former seagrass beds showing a complete loss of plants and dead rhizomes suggest phosphorus and nitrogen enrichment, dissolved oxygen, and other unknown factors may be also playing a part in seagrass changes in the bay and appear to indicate ecosystem level changes may be ongoing.

A water quality index developed by Wazniak and Carruthers (2004) that synthesized several factors including nutrient loading, chlorophyll concentration, and dissolved oxygen applied to Sinepuxent, Newport, and Chincoteague Bays, found Sinepuxent had overall good water quality with only slightly reduced quality in the north from failure to meet phosphorus standards. Water quality in Newport Bay was generally poor, with

most sites in degraded or very degraded conditions. Water quality in certain areas of northern Chincoteague Bay was poor due to nitrogen and phosphorus levels, particularly in John's Bay and the Public Landing area (Fertig et al 2006). All sites passed chlorophyll and dissolved oxygen thresholds and some sites had good to excellent water quality.

A later study (Wazniak et al 2007) offered a different viewpoint on water quality in the bays by analyzing nutrient concentration data using a non-linear statistical test. Overall the authors found that while traditional linear trend analysis would indicate water quality conditions were improving, non-linear trend tools found the majority of sampling stations in Chincoteague and Sinepuxent Bays have experienced worsening conditions recently. Rather than a simple linear decrease in pollutants, they indicated a "U" shaped trend where nutrients began to increase during the period 1995 to 2000. Although seagrass coverage did increase from 1995 to 1999, it decreased in 2000 and leveled off from that point on; the authors suggest this leveling off may indicate the point where increasing nutrients and chlorophyll began to affect seagrass abundance. They warn that efforts to protect from increasing pollutants are needed and that seagrass abundance may decline without them. Sources of particular concern include inputs from large animal operations near streams including historic organic nitrogen fertilizers, phosphate-rich poultry manure, and sewage.

Sediments in the bays do not contain high levels of contaminants and concentrations of most metals are within background levels. Most organic contaminants are at trace levels or below detection limits (Wells et al 2004).

A recent seashore-specific study of water quality in the bays, sampling of benthic sediments, and collection and analysis of oyster tissue studies concluded that there are no organic compounds that would be at levels high enough to adversely affect seashore benthic communities or wildlife (NPS 2010a). However, given that agricultural practices, including poultry production, continue in the watersheds that feed the Maryland Coastal Bays the authors indicate monitoring should continue. Poultry farming, use of pesticides, and other activities have produced higher levels of several heavy metals such as chromium and arsenic, silver, and mercury, as well as harmful organics that are potential concerns for some aquatic wildlife, such as filter feeding organisms like shellfish or predators that bioaccumulate metals and other pollutants through the food chain.

Three industrial and four wastewater treatment facilities (including the seashore's facility on the mainland) discharge 8,000 gallons per day on average into the coastal bays. These and other identifiable point sources account for only an estimated 5 percent of the pollutant load (Boynton et al 1993 as cited in Wazniak et al 2004). Analysis of nitrogen and phosphorus data from 2001 to 2003 indicates that non-point sources contribute the majority of pollutants entering the bay system. (Wazniak et al 2004). Nonpoint sources include fertilizer, animal waste, atmospheric deposition, septic systems, and natural sources such as wetland, marsh, and forest vegetation. Nitrogen in

the groundwater contributes a substantial load of nitrogen to the coastal bays, which could be on the order of 123,400 kg/year, or nearly one-quarter of the direct discharge into the bays (LaMotte et al 2007). The seashore's wastewater treatment facility discharges approximately 120 kg of total nitrogen per year into Sinepuxent Bay (NPS 2003a).

Assateague water quality and hydrology is also affected by the presence 48,000 meters of ditches originally created to drain the marsh of standing water and reduce the potential for mosquito breeding (see figures 3.2a, 3.2b, and 3.2c). An estimated 90 percent of these ditches remain unfilled today. Although they proved ineffective in controlling mosquitoes (NPS 2011d), they did increase the drainage capacity of the marsh, which in turn reduced the duration of inundation by overwash, rainwater, or particularly of tidal flooding. Instead, water and sediment were trapped in the series of linear channels, where other studies indicate it may become stagnant and accumulate both inorganic and organic nutrients and coliform bacteria (Koch and Gobler 2009 as cited in NPS 2011d). Sediment deposition on the marshes is likely reduced as a result of the channels, affecting an important process required to withstand the effects of sea level rise. Rather than depositing sand in the marsh, it accumulates in the ditches (LeMay 2007). One study (Adamowicz and Roman, 2005 as cited in LeMay 2007) found that ditches cause the marsh to drain differently than those without them, as marsh areas with only creeks (even a high number of creeks) maintain a much higher area of standing water, including water in ponds. Marshes that have been restored at the seashore are currently draining in a more natural manner, with sheet flow occurring at the high tide cycle and similar to other restoration projects (Roman and Burdick 2012).

3.4.3 WETLANDS

The seashore includes approximately 4,700 acres of wetlands, including seasonal pools that are wet only in the spring (vernal pools).

Estuarine fringe and coastal loblolly pine forests lie west of the bay dunes in depressions intersecting the groundwater table. Estuarine fringe is considered a palustrine wetland (or inland wetland of standing water) and is characterized by a closed to partially open canopy with an understory of vines that can cover the lower branches of trees. The coastal loblolly pine forest includes scattered deciduous trees and some shrubs.

A common invader particularly of freshwater maritime shrub wetlands indicative of human disturbance is *Phragmites australis*, also called the common reed or red grass, a species that can tolerate a large range of salinities from fresh to brackish. Dense stands of *Phragmites* can overwhelm native plant communities, grow in colonies of tall leafy plants often to the exclusion of other vascular plants. It is considered an invasive species. Although *Phragmites australis* rhizomes have been found in saltmarsh sediments of the Mid-Atlantic dating to 3000 years and older, the invasive version creating problems throughout the region is believed to have been introduced from Europe during the 19th century.

On the bayside of the seashore vegetation is associated with fresh, brackish, or saltmarsh. Soils of deep muck form and vegetation occurs either in standing water or where groundwater is close to the surface.

Brackish tidal marsh dominated by narrow-leaved cattail (*Typha angustifolia*) and rose mallow (*Hibiscus moscheutos*) occurs where salinity is 0.5 to 18 ppt usually at the edge of non-tidal intermittently flooded wetlands. This community is not widespread at the seashore.

The much more common higher elevation marsh at the seashore, or high saltmarsh, is irregularly flooded by the brackish waters of Chincoteague or Sinepuxent Bays. High marsh covers extensive areas of the bayside of the seashore. Saltmeadow cordgrass (*Spartina patens*) covers 75 to 100 percent of the ground where it occurs. The substrate is peat overlying sand.

On the border between high saltmarsh and adjacent upland is salt scrub, characterized by dense shrubs and a shallow layer of peak overlying sand or loam.

Low saltmarsh which is lower in elevation than high saltmarsh occurs on the bayside between mean sea level and mean high water level on peat soils ranging widely in depth. Brackish water from the bays irregularly to regularly floods this estuarine community. Saltmarsh cordgrass (*Spartina alterniflora*) and *Ascophyllus nodosum* are the dominant species of this moderate salinity zone. Saltmeadow cordgrass (*Spartina patens*) alone often covers 50 to 80 percent of low saltmarsh.

Within high and low saltmarsh, salt panne, a community of low growing forbs, develops in shallow depressions where drainage is poor and water evaporates forming salt pannes. Species include saltwort (*Salicornia spp*.), saltwater cordgrass (*Carcocornia perennis*), and saltmarsh cordgrass (*Spartina alternifolia*). At the seashore the low forb vegetative community takes shape as large sparsely vegetated circular flats or depressions within the low saltmarsh community. Vegetation is sparse except for a dense blue-green algae mat that develops late in the summer. Needle brush marsh which is dominated by species of reeds (*Juncus spp*.) occurs on sandy substrates within both high and low saltmarshes of the bayside.

- **Current conditions**

Inland wetland habitats of the seashore were recently assessed by NPS biologists as being in “fair condition” (NPS 2011d). Impacts to inland wetlands include the effects of invasive plants such as *Phragmites australis*, horse grazing, trampling, and addition of nitrogen and sulfate from air sources outside the seashore and accompanying decreases (e.g. acidification) in pH. Saltmarsh habitat is characterized by the seashore in its *Natural Resource Condition Assessment Report* (NPS 2011d) as “degraded”. This is a result of forces with cumulative effects including grazing and trampling by horses, existing mosquito ditches, erosion of bayside shoreline resulting in the loss of habitat,

nutrient addition, and barriers to natural overwash such as man-made dunes and berms (NPS 2011d).

On the western side of the seashore low and high saltmarsh dominate. Saltmarsh is subject to seasonal changes in salinity as well as daily changes in water levels resulting from the ebb and flow of tidal action twice a day. Some species are irregularly flooded during very high tidal cycles and some are continuously inundated. The network of mosquito ditches created during the 1930s and 1940s has altered the natural hydrology of the low saltmarsh by increasing the amplitude and timing of tidal flooding. Sampling at the seashore during 2008 recorded twenty-seven vegetation species at nine saltmarsh sites (NPS 2010g). No species were listed as rare, threatened, endangered, or exotic or invasive by state or federal agencies. Saltmarsh cordgrass (*Spartina alterniflora*), saltmeadow cordgrass (*Spartina patens*), and spikegrass (*Distichlis spicata*) were the most prevalent species found during this sampling effort.

About 1,600 acres of inland freshwater wetlands occur at the seashore. These are palustrine wetlands found in low swales of the dune systems that are associated with a shallow groundwater table often with intermittent pools of standing freshwater with no source of inflowing water (such as a stream or river). They are characterized as estuarine fringe or coastal loblolly pine forests, sand bog, shrub bog, inland red maple swamp, and maritime shrubland.

The seashore's wetland systems provide important habitat for several species of wildlife, including nurseries for fish, nesting, feeding habitat for waterfowl, and habitat for insects, amphibians, and aquatic reptiles. Saltmarshes provide biomass which supports the estuarine food web as a base for both herbivores and detritovores who feed on decayed vegetative material drifting to the bottom. Freshwater pools or ponds, while intermittent across the island, are an important source of water for plants and animals.

Although much of the wetland system is in good condition, horse grazing has affected low saltmarsh plants particularly, as these are among the preferred species for horses. High marsh species, including spikegrass (*Distichlis spicata*) and saltmeadow cordgrass (*Spartina patens)* are more prevalent in low saltmarsh than under more natural conditions (e.g. without horse grazing). While high marsh plants take advantage of the available low marsh habitat, they are also susceptible to damage from inundation. Over time high marsh plants in what is traditionally lower marsh habitat can die off during high water periods and leave open mud flats or pools, habitats that do not have the same high value to wildlife. This is exacerbated by changing sea level, which is expected to continue to rise and inundate both low and high saltmarsh more frequently in the coming years.

3.4.4 PONDS

Assateague Island has hundreds of natural ponds, which are fed and drained by groundwater seepage and which range in salinity from fresh to near ocean salinity.

Many of the ponds were formed when an erosional process, usually associated with an overwash event cut down through the surface sediment to a base below the water table. The character of individual ponds varies dramatically depending upon the position on the island and the thickness and dynamics of the fresh groundwater lens (Krantz 2009). Salt spray, overwash and surface flow of seawater, inflow of saline groundwater from up-gradient and flooding from the bayside are the four mechanisms responsible for fluctuating salinity levels in the ponds (Hall 2005). Ponds near the center of the seashore that are higher and more protected from overwash from the ocean are most likely to be freshwater; the higher elevation physically protects them and creates higher hydraulic head within the freshwater lens preventing subsurface encroachment of brackish groundwater. Ponds are the only source of freshwater on the island.

3.4.5 FLOODPLAINS

Assateague Island is entirely within the 100-year floodplain, as shown on Federal Emergency Management Agency Flood Insurance Rate Maps (FEMA 2009 and 1992). The Federal Emergency Management Agency defines geographic areas as flood zones according to varying levels of flood risk. Each zone reflects the severity or type of flooding in the area. On Assateague Island, "V zones" occur adjacent to the ocean shore and some areas of Chincoteague Bay; these are areas of 100-year coastal flood with velocity (wave action) where base flood elevations and flood hazard range from 12 to 13 feet in the beach and dune areas along the ocean and 9 feet in some bay shore areas in Chincoteague Bay. "A zones" occur along the length of the island behind the dunes; these are areas of 100-year coastal flood that are not subject to wave action where base flood elevations are generally 8 to 9 feet.

The mainland area in the MD 611 corridor is generally within an "A zone" where the base flood elevation is 8 feet. Exceptions are two "B Zones"; these are either areas located between the limits of the 100-year flood and 500-year flood or areas subject to 100-year flooding with average depths less than one foot, and include the seashore headquarters complex site and the MD 611 right-of-way approach to the Verrazano Bridge.

3.4.6 SURFACE AQUIFER AND FRESH GROUNDWATER SYSTEM

The seashore has a spatially complex surface aquifer and fresh groundwater system. The water table is the top of the surficial (unconfined) aquifer that generally follows the topography of the island surface and its elevation above sea level in part controls the depth of the fresh groundwater lens beneath the island (Krantz 2009). Consequently, geomorphology related to storm processes is linked to the distribution of fresh groundwater on the island, which in turn is a primary control on plant communities (Krantz 2009).

The spatial distribution and dynamics of fresh and brackish groundwater beneath the island are strongly affected by the frequency and magnitude of the input of saltwater

onto the island surface from the ocean side and high water flooding from the bayside of the island (Krantz 2009). Both the ocean and bayside of the island have highly dynamic brackish zones in the aquifer produced by surface inundation of saltwater and deeper density-driven groundwater flow (Krantz 2009).

Six primary hydrogeomorphic units have been defined on the seashore that exhibit consistent characteristics with respect to geomorphology and hydrologic characteristics (Krantz 2009):

- The island core or the central part of Assateague Island is higher elevation and is where maritime forest generally occurs. The central part of the core has the most stable, deepest fresh groundwater lens at the seashore, reaching 7 to 8 m down and is the most consistently fresh.
- Overwash zones occur on the ocean side of the island. Overwashing seawater typically flows through low areas among the dunes, often creating channels, and ponds in swales, where the saltwater infiltrates the surficial aquifer. Groundwater is brackish nearly year-round, and highly dynamic with the episodic input of full-salinity seawater.
- Tidal marshes are one of the most extensive features on the bayside of the barrier island. Groundwater is typically brackish to fully saline, although fresher groundwater recharge from the island interior may flow shallowly beneath the marsh in discrete sand beds overlain by low-permeability saltmarsh peat and mud.
- Former inlets occur throughout the seashore. At many sites, the tidal channels of the former inlet are prominent features cutting across the island and extending as deep channels into the back-barrier lagoon. Former inlets typically have predominantly saline to brackish groundwater because they are preferential pathways for both storm overwash and subsequent groundwater flow due to coarse permeable channel fill.
- Washarounds are slightly higher elevation features in otherwise low-lying former inlets or areas of extensive overwash. The center of washarounds may have a permanent, moderately deep (3-4 m) fresh groundwater lens.
- Hundreds of ponds have formed by channelized overwash flow during storms that cut below the depth of the water table. All ponds are fed by groundwater seepage

Assateague Island National Seashore
Fundamental Resources – Barrier Island Habitats and Species

The unique environmental conditions found on Assateague Island are reflected in the dynamic continuum of habitats stretching from ocean to bay, including beaches, dunes, grass and shrublands, freshwater wetlands, maritime forests, and saltmarshes. The diverse landscape provides habitat for a multitude of specialized plant and animal species, many of which are rare, threatened, or endangered. Abundant and diverse populations of migratory birds - such as raptors, shorebirds, waterfowl, and neo-tropical migrants – use the seashore seasonally for breeding, overwintering, and as stopover habitat while moving along the coastal route of the Atlantic Flyway.

3.5 Vegetation

Vegetation at the seashore consists of forest, shrublands, marshlands, grasslands and sparsely vegetated herbaceous communities. Forests and tidal marshes generally occur on the more stable western or bayside of the island. A mosaic of fresh and brackish marshes, shrublands, and grasslands characterize the central portion of the island while grasslands associated with sand dunes dominate the more dynamic eastern margin. (See section 3.4.3 for additional discussion of marshlands.)

Environmental conditions, including elevation, the height of the groundwater table, susceptibility to overwash, and vulnerability to wind and salt spray help in determining where different vegetative communities exist at the seashore. Soil types which range from sand to loam and mucky peat are also a determinant of vegetative community as well as a result of the plants that have grown here. Vegetative communities at the seashore are described briefly below, and location, dominant species and rarity ranking are shown in table 3.2.

Plants living on the beach and foredunes must be able to withstand harsh conditions, including blowing winds, shifting sand, salt spray and soil composed of low nutrient and low moisture sand. According to The Nature Conservancy (TNC 1995) classification, this beach community is sparsely vegetated and occurs on unconsolidated sands of the beach and foredunes out of reach of regular tides, although it is frequently inundated during spring or storm tides.

Moving west, vegetation changes to a dune grass ecosystem dominated by American beach grass (*Ammophila breviligulata*), a species that is able to live and propagate despite shifting sands and which grows additional rhizomes and stems when buried by sand, and is the plant species primarily responsible for dune growth and stabilization.

Table 3.2 Habitats and Vegetative Communities

Habitat	Vegetative community	Dominant Plant Species	Rank
beach and intertidal	beach	sea rocket (*Cakile edentula spp. edentula*), saltwork (*Salsola caroliniana*)	G4, G5
dunes and grassland	dune grass	American beach grass (*Ammophila breviligulata*)	G3, G4
	maritime dry grassland	saltmeadow cordgrass (*Spartina patens*), three square (*Scirpus pengens*)	G2, G3
	Hudsonia dune	beach heath (*Hudsonia tomentosa*) and beachgrass (*Panicum amarum*), loblolly pine (*Pinus taeda*)	G2, G3
forest and shrubland	maritime forest	wax myrtle (*Myrica cerifera*), black cherry (*Prunus serotina*), greenbrier (*Smilax rotundifollio*)	G2, G3
	maritime shrubland	wax myrtle (*Myrica cerifera*) and bayberry (*Myrica spp)*, buttonwood (*Diodia teres*)	G2, G3
	estuarine fringe	loblolly pine (*Pinus taeda*), wax myrtle (*Myrica cerifera*), vines, *Phragmites australis* in wet areas of fringe	
saltmarsh	high saltmarsh	saltmeadow cordgrass (*Spartina patens*), spikegrass (*Districhlis spicata*)	
	low saltmarsh	saltwater cordgrass (*Spartina alterniflora*), brown alga (*Ascophyllus nodosum*)	G5

Key to Ranks
G2 – imperiled G3 – vulnerable G4 – apparently secure G5 – secure

Source: TNC 1995

At the seashore the dune grass community also grows in meadows behind the foredune and is able to tolerate wind, salt spray, and occasional storm tidal surges. About half (40 to 60%) of the sand substrate in dune grass communities is devoid of vegetation and is open unstable sand.

Another grassland community that can grow close to the ocean at the seashore is maritime dry grassland, an open short grassland common in overwash areas. Maritime dry grassland also occupies space behind foredunes that are "blown out" during storm events.

Maritime shrubland, a patchy community of low-growing plants dominated by wax myrtle (*Myrica cerifera*), bayberry (*Myrica spp*), and buttonweed (*Diodia teres*) also grows on the unstable sands of foredunes beyond the reach of tides. Generally intolerant of salt, overwash or storm surges kill species in this community. It occurs throughout the seashore wherever afforded protection from salt water intrusion.

Behind the linear foredune or primary dune are secondary dunes, which are larger, more well-established, and varied in size and shape. Here the Hudsonia dune community occupies upland dunes. The Hudsonia dune community is locally abundant, generally occurring in the backdunes toward the west side of the seashore.

In the swales of the low lying interdunes, groundwater fluctuates and flooding can occur during rainstorms either directly or from overflow by the coastal bays. Several different vegetative communities identified by The Nature Conservancy (TNC 1995) occur here, including the maritime shrub, freshwater marsh, and shrub bog communities. The water table is shallow and several wetland herbaceous species grow here as well, creating mucky deep and wet soils over time. Freshwater plant communities such as marshes can form early in the spring growing season in standing water in dune swales, and last until the end of spring when water dries up. As freshwater marshes, shrub bog communities grow in seasonally flooded swales of dunes.

Maritime forest, which is also called the sunken forest, grows in lower elevation areas (not wet areas) of dune systems or behind them. The dunes shield this community from strong wind and salt spray allowing the growth of shrubs and vines. Dense vines grow on the crest of dunes or over older stems of shrubs in the central portion of the seashore in this community.

Another important vegetative community is the seagrass meadow which provides nursery and adult habitat for a number of aquatic species including waterbirds, fish and shellfish. The dominant seagrass in these coastal bays is eelgrass (*Zostera marina*) (NPS 2011d). (See section 3.4.2 for additional discussion of seagrass in the coastal bays.)

3.5.1 PLANT SPECIES OF SPECIAL CONCERN

At the seashore the NPS management actions protect several rare, threatened, or endangered plants of concern to the state of Maryland that are not subject to the Endangered Species Act or its thresholds (table 3.3). Several of these state species of

concern occur in habitat similar to that required by seabeach amaranth (*Amaranthus pumilus*). Therefore if seabeach amaranth (*Amaranthus pumilus*) and its habitat are successfully managed the state listed species will similarly benefit. Most state listed plants species at the seashore are not targeted by specific management actions except for seabeach amaranth (*Amaranthus pumilus*). However the NPS does perform periodic presence and absence monitoring (NPS undated).

3.6 Wildlife

3.6.1 MARINE WILDLIFE

Assateague Island National Seashore
Fundamental Resources – Aquatic Habitat and Species

From open ocean to protected estuary, the seashore includes a diverse array of aquatic habitats including abundant sea grass beds, expansive saltmarshes, and a mosaic of sandy shallows and intertidal flats. These protected habitats support a rich marine life, ranging from small sedentary plants and invertebrates to large ocean-going marine mammals.

Information on the seashore's marine resources is taken from two regional sources (US DOI BOEMRE 2006; US DOI BOEMRE 2012) and some very early data from benthic surveys off the seashore. Most of the information is not site specific, but rather applies to the offshore region of the Mid-Atlantic Bight (MAB), including the continental shelf off Maryland and Virginia (the MAB includes the Georges Bank north of Cape Code to Cape Hatteras off North Carolina and east to the Gulf Stream) (US DOI BOEMRE 2012). The biological resources that occur here are unique largely because of the meeting of relatively warm weather and cool weather regimes. This region of the inner shelf is inhabited by a large variety of species with varying temporal and spatial patterns. Nowhere else in the Atlantic does such a wide variety of cold-temperature, warm-temperature, and estuarine species co-exist. Seasonal changes in water temperature are primarily responsible for species composition and distribution, but sediment type, water depth, and hydrodynamics are also important (US DOI BOEMRE 2006).

Plankton are small, floating or weakly swimming photosynthetic organisms, classified as either algae or cyanobacteria. Plankton are an important food source in marine and estuarine ecosystems. Nutrients supplied from coastal runoff and vertical mixing in the water column support a relatively high abundance of phytoplankton out to about 20 m (65 ft) depth in the ocean (USACE 1997). Peaks in phytoplankton populations vary annually, with peak abundances occurring in spring and from late summer to late fall. Zooplankton includes those species that spend their entire lives as plankton as well as the eggs and larvae of many fish and invertebrates. Phytoplankton and zooplankton are abundant off the coast of Assateague Island (US DOI BOEMRE 2006); for example, phytoplankton has been estimated to have the highest productivity along the east coast (Sherman et al 1996 as cited in US DOI BOEMRE 2006).

Marine benthic (bottom dwelling) resources in federal waters offshore of the seashore are composed of moderate densities of arthropods (such as crabs), annelid worms, mollusks (such as clams and mussels), and echinoderms (such as starfish) (Wigley et al 1981 as cited in US DOI BOEMRE 2006). Many of the benthic organisms located off the seashore have wide-ranging distributions within the entire MAB region. Common coastal macro invertebrates include lobed moon snail (*Polinices duplicates)*, whelks *Buccinidae*), starfish (*Asteroidea*), surfclams (*Spisula solidissima*), and horseshoe crabs

Table 3.3 Plant Species of Special Concern (Maryland)

Scientific Name	Common Name	Rank
Amaranthus pumilus	seabeach amaranth	SH
Ammannia latifolia	Koehne's toothcup	S2
Aristida tuberculosa	Nuttall seabeach three-awn grass	S1
Borrichia frutescens	DC sea ox-eye	SH
Carex silicea	Olney seabeach sedge	S1
Centella erecta	Fern coinleaf	S3
Eleocharis albida	Torrey white spike-rush	S1
Eleocharis rostellata	Torrey beaked spike-rush	S3/S4
Fimbristylis caroliniana	Carolina fimbry	S1
Fuirena pumila	Torrey smooth fuirena	S1
Galium hispidulum	coast bedstraw	S1
Gymnopogon brevifolius	broad-leaved beardgrass	S1/SU
Honkenya peploides	seabeach sandwort	S1
Leptochloa fascicularis	Gray long-awned diplachne	SU
Persea palustris	red bay	S2
Polygonum glaucum	seaside knotweed	S1
Prunus maritima	beach plum	S1
Sacciolepis striata	American cupscale	S1
Scleria verticillata	whorled nut-rush	S1
Sesuvium maritimum	sea-purslane	S1
Spiranthes praecox	grass-leaved lady's-tresses	S1

Key to Ranks

S1 – extremely rare; usually 5 or fewer populations or occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation

S2 – very rare; usually between 6 and 20 populations or occurrences; or with many individuals in fewer occurrences; often susceptible to becoming extirpated

S3 – rare to uncommon; usually between 20 and 100 populations or occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances

S4 – common; usually >100 populations or occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats

SH – historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently

SU – status uncertain, often because of low search effort or cryptic nature of the element

(*Limulus polyphemus*) (USACE 1997). Recent work by Cutter and Diaz (2000 as cited in US DOI BOEMRE 2006) in the MAB reported over 160 taxa of benthic organisms from 72 samples. The most abundant species were annelid worms, followed by mollusks and crustaceans. Species densities ranged from 90 to 70,000 organisms/m² and biomass varied from 0.03 to 2,000 g wet/m². These results are similar to those reported by Scott and Burton (2005) who surveyed several sites closer to shore than those reported by Cutter and Diaz (2000) (both as cited in US DOI BOEMRE 2006). Very recent and preliminary data from benthic surveys in NPS managed waters (MDGS 2012) found bottom sediments were dominated by very fine to fine sand, with areas of coarse sand and gravel and linear fields of mud and poorly sorted sand in the inner troughs between shore-attached shoals. Video from this survey found a large and vibrant community of tube worms on the bottom area fringing the mud.

Nektonic resources (stronger swimmers) in the ocean off Assateague are composed of fish, sea turtles, marine mammals, and large mobile invertebrates (squid). Most of the fish and squid, and all the sea turtles and marine mammals are seasonal migrants through the area (Musick et al 1986 as cited in US DOI BOEMRE 2006). Resident species include few fish; several macrobenthic invertebrates are common throughout the year. Over 300 species of fish are known in the MAB and many of them occur off the seashore on a seasonal basis (Sherman et al 1996 as cited in US DOI BOEMRE 2006). Several recent inshore studies (Slacum et al 2005 and Scott et al 2005 as cited in US DOI BOEMRE 2006) list over 60 fish, 16 invertebrates, and several squid species in the area. The highest diversity occurred during the summer and the lowest diversity occurred during the winter (Scott et al 2005 as cited in US DOI BOEMRE 2006).

3.6.2 COASTAL BAY AND TERRESTRIAL INVERTEBRATES

The estuarine environment formed by Assateague Island is home to a diverse array of invertebrates, including mollusks, crustaceans, annelid worms, arthropods, sponges, corals, bryozoans, nematodes, and tunicates. A benthic invertebrate survey in the 1990s (Prezant et al 2002 as cited in NPS 2008a) found 298 species. Freshwater invertebrates also inhabit the streams flowing into the coastal bays east of the seashore, with dominant taxa including clams, isopods, midges, and blackflies (Boward et al 2004). A 1997 to 2001 sampling effort for these streams found 70 genera of benthic macroinvertebrates. For streams and ditches supplying freshwater to Chincoteague Bay, the benthic biotic index indicated fair conditions in two streams (Paradise Branch and Riley Creek). These streams accounted for 8 percent of those sampled for Chincoteague. All others were rated poor (21%) or very poor (71%). Authors Boward and Schenk concluded the impacts to these freshwater benthic invertebrates were likely from physical changes made to streams to create ditches, as ditches have less habitat diversity and lower flows that minimally altered streams.

Another population of freshwater invertebrates exists in the permanent and seasonal freshwater pools and ponds at the seashore. This group includes dragonflies and damselflies. Although they traditionally occupy freshwater wet habitats, they were also

found in a variety of upland habitats near water and in or near the beach and saltmarsh. A survey conducted between 2005 and 2007 found 27 species of dragonflies and damselflies at the seashore; nearly all were tied to fresh or slightly brackish water (Orr 2008). The highest density was found in deeper freshwater ponds that occurred at the transition between grasslands and forest or brush edges. Although woodlands do have stable deep ponds, they are heavily shaded and accumulate pine needles which change water quality and restrict insect diversity. Abundance was also tied to rainfall, as well as the amount of light reaching the pond. Where water and sunlight were both abundant, the number of individuals was highest. Only one species of dragonfly, the seaside dragonlet, has adapted to breed in the saltmarsh.

Overall, Orr found the dynamic nature of freshwater ponds at the seashore was critical in supporting or inhibiting populations of arthropods. The most stable habitat was the saltmarsh, with dune and grassland ponds less stable. Overwash from strong storm events can either greatly reduce or even remove arthropod populations associated with more ephemeral freshwater ponds. When this occurs the resulting vacuum is filled by long-distance fliers such as dragonflies. The reintroduction of less mobile species can take months or even years and occurs primarily from foot or car traffic.

The survey of saltmarshes found that although only a relatively limited number of species of arthropods live at the seashore, densities of those species could be quite high, especially in June and July. Most appeared to be feeding on algae mats and decaying vegetation. Water boatmen, which are predatory insects, occurred in open pannes in the saltmarsh with densities on the order of 25,000 per square meter. Other species such as katydids, saltmarsh ground crickets, plant hoppers, ladybugs, wolf spiders, and marsh and fiddler crabs were found in the lower and/or upper saltmarsh habitats (Orr 2008).

Orr (2006 as cited in NPS 2008a) also surveyed the upland habitats of the seashore. Species of grasshoppers, katydids, and crickets were found in a variety of habitats, including grasslands, woodlands, brush, and open sandy areas. Leaf beetles have also been found in abundance associated with a variety of plant hosts, including grasses, woody shrubs, hardwood trees, and vines. Forty-four species of orthoptera (grasshoppers, crickets), and 50 species of leaf beetles were recorded in Orr's study. Thirty-nine species of butterflies and skippers were found in many of the island's habitats. The seashore is also host to 58 species of bees, as well as a number of moths and wasps. Of note, wild honey bees, which used to be abundant at the seashore and mainland, have been declining since the 1980s due to the introduction of tracheal and virola mites in North America; only a single individual was noted in Orr's survey.

Orr classified the groups of insects and other arthropods (crabs, spiders, etc.) into three categories – long-term resident species, mainland species, and vagrants. The long-term resident species are barrier island specialists that are able to inhabit the dynamic island habitats including the beaches and saltmarsh. Mainland species find temporary suitable habitat at the seashore to maintain their populations for a few years or a few decades,

but generally do not persist beyond that time. Vagrants tend to be migrants from the north or south or from the mainland that do not establish a viable population at the seashore. Most of the arthropod species at the seashore are mainland species. Although these species are able to exist at the seashore in the absence of severe weather or overwash conditions they are unlikely to survive larger, 100-year storms, while barrier island arthropod specialists will likely survive intact (Orr 2008).

Aquatic invertebrates in the coastal bays east of the seashore include commercially important shellfish populations, such as mussels, oysters, and clams. Mollusks are an important group of animals in an estuarine ecosystem. They help in cycling organic matter from the water column to the bottom, can have a pronounced impact on the structure of an ecosystem (by reworking the sediment, grazing, securing existing substrate, building new substrate such as oyster reefs, etc.), and are both directly harvestable and serve as an important food source for crabs, fish, and waterfowl.

Between 1993 and 1996 the MD DNR collected 50,000 individuals composed of 63 mollusk species in its coastal bays (Tarnowski 2004). Generally, the survey found that the community of mollusks differed widely with geography and was influenced by the type of sediment, interaction with other biological communities including availability and type of structures, and natural events. Mollusks also showed variability with season and year. As noted above, streams and ditches entering the bays are of lower habitat quality for the most part; this study also found species abundance was lower in these tributaries than in the open bays.

Hard clams flourished after the Ocean City Inlet opened in 1933. Prior to the inlet, salinity in the upper Chincoteague Bay was too low to support this species. The highest densities of hard clams in the area occur in Sinepuxent and Chincoteague Bays, with the highest concentration of these occurring on the east side of the bay adjacent to the seashore. Although recruitment of juveniles to the population appears to be low, the population level in Chincoteague was relatively stable from 1993 to 2003. Hard clam harvest is mostly from hydraulic escalator dredge, however seashore commercial hard clam harvest may be limited by recruitment and management constraints since 2001 (Tarnowski 2002).

The Eastern oyster has been cultured in the bay since before the Civil War. Oysters help to build reefs in an otherwise soft-bottom environment. Reefs provide protection larvae and juveniles for oysters and other aquatic species. The opening of the Ocean City Inlet and subsequent increases in predators, competition, and disease are considered the primary reasons oysters are relatively rare in Chincoteague Bay (Tarnowski 2004).

Developed during the 1850s to meet increasing demands, commercial aquaculture is still important in the Virginia portion of Chincoteague Bay (Chambers and Sullivan 2012). Commercial aquaculture initially consisted of oysters but now includes both oysters and hard clams. Currently, there are approximately 41 lease holders with about 1,233 acres leased within seashore waters. The largest single lease holder encompasses

380 acres. At this time, there are no aquaculture leases located in the Maryland portion of seashore waters, and Maryland has passed a regulation that prohibits such leases in seashore waters. However, a new five-acre lease area has recently been proposed immediately adjacent but outside of the seashore boundary in Chincoteague Bay just south of the Pirate Islands.

Bay scallops are not harvested commercially anywhere in the Coastal Bays. Scallops were caught in about 4 percent of the hard clam survey stations in the MD DNR study (Tarnowski 2004), primarily in northern Chincoteague and Sinepuxent Bay. Although the increased salinity related to the opening of the Ocean City Inlet benefitted scallops, an eelgrass wasting disease that occurred at the same time removed most of its habitat. MD DNR planted over one million bay scallops in 1997 and 1998, and in 2002 for the first time live scallops were recorded north of the Ocean City Inlet. Wild scallops of unknown origin have also recently appeared in Chincoteague Bay in the vicinity of the Maryland/Virginia state line (NPS 2008a). Despite the reintroduction and generally improving habitat conditions, scallop populations remain very low.

Crabs, and in particular the blue crab – the most commercially valuable species harvested in coastal bays – and the horseshoe crab, are monitored in the bays. The abundance of blue crabs taken from the Maryland coastal bays fluctuates; on average, between 0.5 and 1.5 million pounds of blue crab were commercially harvested from the bays between 1990 and 2002. Crab pots accounted for 98 percent of the harvest from Maryland Bays 1991-2001 (Maryland DNR. 2001). An examination of crabs caught during this period indicates no decline in average size, possibly suggesting a minimal increase in fishing pressure during this period. A substantial number of larval blue crabs are thought to remain in Chincoteague Bay, as circulation in the bay is relatively slow and larvae are not moved out to sea as they are in the Chesapeake Bay. Mature female crabs overwinter in the deepest parts of the bays. Since 1992 Hematodinium sp., a parasitic dinoflagellate, has caused substantial late season mortality in the coastal bays' blue crab population. Invasive crabs such as the green and Pacific shore crab may also threaten blue crabs.

The horseshoe crab (*Limulus polyphemus*) is an endemic species found on the east coast of the United States, with the center of abundance between New Jersey and Virginia. It is characterized by high fecundity, and can spawn multiple times per season or even per tide in the spring during new and full moon periods starting the end of April and lasting into June, laying 3500 to 4000 eggs in a cluster. Sandy beaches and nearshore shallow water mud and sand flats are important spawning and nursery habitats for the horseshoe crab. The horseshoe crab is considered a key part of the maritime food web; spawning coincides with the spring migration of shorebirds whose success or failure is dependent upon finding sufficient energy (food) to complete migration and then to breed. Horseshoe crab eggs that wash up on beach after a spawning cycle are known to supply some or the entire energy requirement to complete migration (US FWS 2014). Rufa red knot (*Calidris canutus rufa*), a bird species proposed to be listed as threatened under the Endangered Species Act, uses Chincoteague NWR beaches during spring and

fall migration, with peak spring numbers occurring in the last half of May and peak fall numbers occurring in August (Smith et al 2008); the severe decrease in horseshoe crab eggs in Delaware Bay is a suspected cause in the 68 to 80 percent decline of the species since the 1980s (Cohen et al 2009). Horseshoe crabs are not harvested for human consumption, but are important in the biomedical industry and as bait to catch American eel and whelk. In the first part of the 20th century, horseshoe crabs were used for fertilizer and animal feed (Doctor et al 2004). Regionally the horseshoe crab is probably most affected by the lingering effects of overharvesting during the 1990s and habitat lost from coastal development (Botton et al 1994 as cited in Doctor et al 2004). Horseshoe crabs are arachnids (not crustaceans), managed by the NPS as wildlife that is fished.

Commercial horseshoe crab harvest is regulated by the states of Virginia and Maryland with annual catch quotas, permits, and closures and guided by an interstate fishery management plan (ASMFC 1998, Maryland DNR 2014, Virginia MRC 2015). Maryland prohibits harvest of female horseshoe crabs, male horseshoe crabs during winter and spring, and horseshoe crabs within one mile of shore from June to mid-July (MD DNR 2014). Virginia prohibits the harvest, except biomedical catch-and-release harvest, within 1000 feet of mean low water from May 1 through June 7 (Virginia MRC 2015).

Currently, horseshoe crabs are commercially harvested for use as American eel, conch (or whelk), baitfish, and catfish bait as well as for the biomedical industry (Doctor and Wazniak 2004, ASMFC 1998). The horseshoe crab harvest is unique in that crabs can be easily harvested during their spawning season and caught with minimal financial expense. The commercial horseshoe crab fishery within the seashore has focused on the beaches and coastal waters at the southern end of the island in the vicinity of Toms Cove in Virginia. The protected bayside beaches provide suitable spawning habitat for horseshoe crabs and attract large numbers of horseshoe crabs to both the island and surrounding waters during the spawning season.

Horseshoe crabs are arachnids (arthropods), not crustaceans; therefore, they are wildlife and their harvest is prohibited in national parks (36 CFR 2.2). The seashore, now 50 years old, has never enforced this provision, which came into being after the designation of the seashore.

3.6.3 FISH

- **Finfishing**

Commercial fishing activity and harvest are known to occur within the seashore; however, the specific locations of commercial fishing activities and amounts of harvests within the seashore boundary, as well as gears used, are not currently documented.

Many of the region's valuable commercial finfish are dependent on estuaries for food or nursery habitat. These include summer flounder (*Paralichthys dentatus*), bluefish (*Girella cyanea*), weak fish (*Cynoscion regalis*), spot (*Leiostomus xanthurus*), Atlantic

croaker (*Micropogonias undulates*), American eel (*Anguilla rostrata*), and striped bass (*Morone saxatilis*), as well as smaller forage species such as Atlantic menhaden (*Brevoortia tyrannus*), Atlantic silverside (*Menidia menidia*), and bay anchovy (*Anchoa mitchili*). Finfish harvesters utilize trawl and gill nets and eel pots (Forsell 1999; Virginia MRC. 2014; Maryland DNR 2014). In 2002 commercial landings for these and all species of finfish at Ocean City totaled 12 million pounds worth $8 million; most of this catch was taken from the Atlantic rather than the coastal bays. Trend data indicate a slow downward movement since the mid-1980s. This is primarily a result of the decreased abundance of forage species, including bay anchovy (*Anchoa mitchili*), Atlantic menhaden (*Brevoortia tyrannus*), spot (*Leiostomus xanthurus*), and Atlantic silverside (*Menidia menidia*) (Casey et al 2004).

In addition to commercial catch, recreational fishing and low oxygen events affect finfish populations. Sportfishing in both the bays and in the ocean is an important economic contributor in Maryland. In 2003, over 700,000 people fished seven million days in Maryland waters (Casey et al 2004). Kills from low oxygen have been a particular problem for the smaller forage species noted above, as these are the most susceptible species to low oxygen levels (NPCA 2007). Since 1984, 49 confirmed or probable fish kill events resulted in approximately 3.3 million mortalities; most of these events occurred in dead end canals along developed shorelines outside the seashore's boundaries. The majority of these events occurred in summer months when decaying algal blooms and higher temperatures lower available oxygen. The average number of fish kill events reported in the 1980s and 1990s was 1.5 per year. This increased to seven per year from 2000 to 2004 (Luckett et al 2004).

Summer flounder (*Paralichthys dentatus*) have recently recovered from overfishing and a population collapse in 1989 and are rising in abundance in the waters off Assateague Island (Casey et al 2004). While flounder numbers are recovering they are still below what is considered optimum (NPCA 2007). Declining populations of forage fish eaten by flounder may be partially at fault.

- **Saltmarsh Fish**

As part of its long term monitoring program in 2008 the NPS collected fish and other nektonic species from select marsh pools, tidal creeks, and bay shoreline habitats less than one meter deep (NPS 2011d). Seventeen species were collected, including 15 species of nekton, one species of crab, and one species of shrimp. Four species of fish account for 94 percent of fish collected – sheepshead minnow (*Cyprinodon variegatus*), common mummichog (*Fundulus heteroclitus*), rainwater killifish (*Lucania parva*), and inland silverside (*Menidia beryllina*). Of these, the sheepshead minnow (*Cyprinodon variegatus*) accounted for the great majority.

- **Essential Fish Habitat**

The 1996 Magnuson-Stevens Act required agencies and others to cooperate to protect, conserve, and enhance essential habitats for federally managed marine and anadromous fish species. Essential fish habitats are those water and substrate areas needed for fish to spawn, breed, feed, and grow to maturity. Species for which essential fish habitat exists either offshore of the seashore or in Chincoteague Bay include red hake (*Urophycis chusss*), winter flounder (*Pseudopleuronectes americanus*), window pane flounder (*Scophthalmus aquosus*), bluefish (*Girella cyanea*), king and Spanish mackerel (*Scomberomorus cavalla*), cobia (*Rachycentron canadum*), summer flounder (*Paralichthys dentatus*), scup (*Stenotomus chrysops*), black sea bass (*Centropristis striata)*, spiny dogfish (*Squalus acanthias*), and several species of sharks that migrate through the area (such as sand tiger shark (*Carcharias taurus*), blue shark (*Prionace glauca*), sandbar shark (*Carcharhinus milberti*), and scalloped hammerhead shark (*Sphyrna lewini*)) (NOAA 2012a). Adults of most of these species also use marine or brackish waters in essential fish habitat either in Chincoteague Bay or the Atlantic coast and several require estuaries or other specific habitat for laying eggs, larvae, and juveniles. Those species that require a sandy substrate for stages of their lifecycle where essential fish habitat exists off the coast of the seashore (black sea bass (*Centropristis striata*), possibly adult spawning winter flounder (*Pseudopleuronectes americanus*) are susceptible to effects when sand nourishment occurs to protect beaches.

3.6.4 AMPHIBIANS AND REPTILES

The seashore and surrounding waters provide habitat for 19 species of reptiles and 7 species of amphibians (Mitchell 1994 and Brotherton 2005 as cited in NPS 2008a). Several of these species are found only on the Virginia side of Assateague Island where artificially created water impoundments have increased habitat diversity for those that are water dependent.

Eleven species of turtles have been documented at the seashore. Four of these are marine, one is an upland species, and the remaining are dependent on the saltmarsh, bay, or freshwater habitats. These latter species include eastern mud turtle (*Kinosternon subrubrum subrubrum*), snapping turtle (*Chelydra serpentina serpentine*), spotted turtle (*Clemmys guttata*), eastern painted turtle (*Chrysemys picta picta*), and northern red-bellied cooter (*Pseudemys rubriventris*). The northern diamondback terrapin (*Malaclemys terrapin*) is an estuarine-dependent species and is fairly abundant at the seashore although there may be considerable mortality associated with by-catch from commercial crabbing.

Five species of sea turtles occur in the MAB area, of which the loggerhead (*Caretta caretta*) and Kemp's Ridley (*Lepidochelys kempii*) are the most abundant. The Atlantic leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), and hawksbill (*Eretmochelys imbricata*) turtles also occur, but are far less abundant. Most of these

turtles overwinter south of Cape Hatteras and migrate into or through the area in early spring or summer. Four of these species have been documented in waters offshore of Assateague (hawksbill turtles (*Eretmochelys imbricata*) have not been sighted). All of these species are federally listed as threatened or endangered and are discussed in section 3.7. Atlantic Loggerhead turtles (*Caretta caretta*) occasionally nest at the seashore (primarily at the southern end), and single event nests of leatherback (*Dermochelys coriacea*) and green sea turtles (*Chelonia mydas*) have been documented. Most observations are from strandings, 90 percent of which involve loggerheads (*Caretta caretta*) (NPS 2008a).

The seashore is also host to six species of frogs and toads, which is low compared to the 23 amphibian species on the neighboring mainland. The most abundant amphibian at the seashore is the Fowler's toad (*Anaxyrus fowleri*) which is dependent – as other amphibians – on the seashore's ponds and wetlands for reproduction.

Seven species of snakes occur at the seashore. All are non-venomous (NSP 2008a). One species, the northern water snake (*Nerodia sipedon sipedon*), is primarily aquatic and closely tied to saltmarshes or ponds. Others are found in a variety of upland habitats including shrub, beaches, grasslands, forests, and open areas.

Only one lizard species has been documented at the seashore, the northern fence lizard (*Sceloporus undulatus hyacinthinus*).

Of the species of reptiles and amphibians recently observed within the Maryland portion of the seashore, eleven are considered stable and five have experienced decline. Several of the declining species were already uncommon or rare. Brotherton attributes their decline to intolerance to the harsh and dynamic barrier island environment and the seashore's relative isolation from source populations (Brotherton 2005 as cited in NPS 2008a).

3.6.5 BIRDS

The seashore affords important habitat for a variety of birds. It lies on the Atlantic Flyway and provides one of the longest stretches of undeveloped and high quality habitat between Forsythe National Wildlife Refuge in New Jersey and Pea Island National Wildlife Refuge in North Carolina. The seashore offers nesting habitat for both resident and seasonal species, stopover habitat for long distance migrants, and wintering habitat for northern species. Intertidal sand and mud flats at the seashore are prime feeding areas for shorebirds because of horseshoe crab eggs and other high quality invertebrate and small fish food sources (US FWS 1993). The waters surrounding the island support large numbers of wintering waterfowl and seabirds. Bird species occurring in significant numbers at the seashore (in Maryland) include the largest ground-nesting colony of least tern (*Sterna antillarum*) in Maryland, black skimmers (*Rynchops niger*) (state endangered), and peregrine falcons (*Falco peregrinus*). Migrant shorebirds congregate along the ocean beach in numbers significant at the state level, the most abundant species being sanderling (*Calidris alba*), dunlin (*Calidris alpina*), and

ruddy turnstone (*Arenaria interpres*). The saltmarshes support significant populations of two Audubon watchlist species – saltmarsh sharp-tailed sparrow (*Ammodramus caudacutus*) and seaside sparrow (*Ammodramus maritimus*). Because of this high diversity and relative abundance, and because the seashore is also home to 60+ pairs of the federally threatened piping plover (*Charadrius melodus*) that nest on its beaches (representing 2% of this species' global population), it is designated by the National Audubon Society as a globally important bird area and is a component of the Western Hemisphere Shorebird Reserve Network (table 1.4).

The exact number of species at the seashore varies from year to year, but is well over 300 and has recently been reported as "at least 338", including species of migratory, wintering, resident, or nesting birds (Hoffman, MD DNR as cited in NPS 2008a). Observed species include shorebirds, waterfowl, upland songbird species, and raptors.

Upland birds in shrub and forest habitat include owls, woodpeckers, flycatchers, sparrows, and warblers. Some of the most common nesting passerines (small to medium perching songbirds) include the red-winged blackbird (*Agelaius phoeniceus*), song sparrow (*Melospiza melodia*), yellow-throated warbler (*Dendroica dominica*), fish crow (*Corvus ossifragus*), gray catbird (*Dumetella carolinensis*), pine warbler (*Dendroica pinus*), and Carolina wren (*Thryothorus ludovicianus*).

Raptors including red-tailed hawks (*Buteo jamaicensis*), ospreys, kestrels, merlins, sharp-shinned hawks (*Accipiter striatus*), and the state protected bald eagle (*Haliaeetus leucocephalus*) and northern harrier (*Circus cyaneus*) migrate along the Atlantic Flyway and pause to rest at the seashore during the fall. Peregrine falcons (*Falco peregrinus*), which are not listed but are relatively rare, also use the island to rest during their fall migration from the arctic to the southern hemisphere (Seeger et al 2010). More than 400 peregrines are counted at the seashore during most fall seasons. In 2010 457 peregrine sightings were reported (National Audubon Society 2012). Most of these were tundra peregrines (*Falco peregrines tundrius*), a migratory arctic nesting sub species. Although the population declined from DDT use in the mid-1940s, it rebounded dramatically after the ban of DDT in 1972. Today peregrine falcons (*Falco peregrinus*) have been removed from the federal list of endangered species

Some of the most important habitats for breeding birds at the seashore include the sparsely vegetated upper beaches and overwash flats created and maintained by storm events. These habitats are unique to barrier islands and are used by a variety of rare ground-nesting shorebirds and colonial water birds. Seagrass beds in Chincoteague and Sinepuxent Bay are important foraging habitat for waterfowl including American black duck (*Anas rubripes*), Northern pintail (*Anas acuta*), American wigeon (*Anas americana*), ruddy duck (*Oxyura jamaicensis*), and canvasback (*Aythya valisineria*). Coastal marshes are important for wading birds such as blue herons (*Ardea herodias*) and snowy egrets (*Egretta thula*), and provide nesting habitat for clapper rail (*Rallus longirostris*), black rail (*Laterallus jamaicensis*), least bittern (*Ixobrychus exilis*), Forster's tern (*Sterna forsteri*), and laughing gull (*Larus atricilla*). Beaches and tidal flats provide feeding and resting

habitat for migratory species such as red knot (*Calidris canutus*), piping plovers (*Charadrius melodus*), American oystercatcher (*Haematopus palliatus*), ruddy turnstone (*Arenaria interpres*), sanderling (*Calidris alba*), and sandpipers (*Scolopacidae sp.)* (Glick et al 2008).

Assateague is home to eight colonial nesting seabird colonies, as well as a host of rare, threatened, or endangered bird species. Federally listed species are described in section 3.7. State listed species, which are managed in units of the national park system for protection, are not subject to these thresholds and so are described in section 3.6.7.

Twenty-two species of colonial waterbirds breed in Maryland, including gulls, terns, herons, night herons, egrets, skimmers, pelicans, ibises, and cormorants. The majority of waterbird species nest on or near the ground. Most colonies in the Maryland Coastal Bays are located on either natural or dredge spoil bay islands because of the absence of mammalian predators. Within these islands, nests are located on bare sand or shell and in marsh grasses, *Phragmites austrailis*, shrubs, and small trees. Colonies may be single species or multiple species, such as mixed heronries. Nests are separated by less than one meter in most species and the largest colonies have more than 1500 nesting pairs (MD DNR 2004).

During the period 1985 to 1995, the MD DNR surveyed and reported monitoring results for 21 different colonial nesting sites within or near the seashore. Species observed nesting in these sites included egrets, herons, ibis, pelicans, terns, gulls, and black skimmers *(Rynchops niger*). In 2009, NPS staff visited each of these colonies to update results, including determining the exact location of each colony, whether each continued to be active, and which species were nesting. The NPS biologists also surveyed appropriate habitat to see if any new colonies had established since 1995. Seven of the historic sites showed evidence of nesting during the 2009 breeding season (NPS 2009). Some supported multi-species colonies, while others had as few as two nests. No evidence of breeding was found at ten of the historic sites, three were not within the seashore, and one had been lost to erosion or subsidence. The biologists also found a new and active site. Nesting was confirmed at one or more of the eight sites for Great Black-backed gull (*Larus marinus*), herring gull (*Larus argentatus*), double-crested cormorant (*Phalacrocorax auritus*), glossy ibis (*Plegadis falcinellus*), and great egret (*Casmerodius albus*). Species present but nesting unconfirmed included: black-crowned night heron (*Nycticorax nycticorax*), yellow-crowned night heron (*Nyctanassa violacea*), tricolored heron (*Egretta tricolor*), cattle egret (*Bubulcus ibis*), snowy egret (*Egretta thula*), and brown pelican *(Pelecanus occidentalis*). While great black-backed gull (*Larus marinus*) and great egret (*Casmerodius albus*) numbers have increased in recent years, herring gull (*Larus argentatus*) breeding populations and glossy (*Plegadis falcinellus*) ibis numbers have decreased in the Chesapeake Bay region (Erwin et al 2010). Of the wading birds, both black-crowned night heron (*Nycticorax nycticorax*) and yellow-crowned night heron (*Nyctanassa violacea*)numbers have increased and the rest have declined (ibid).

3.6.6 MAMMALS

Upward of 20 marine mammals, including pinnipeds and cetaceans, may occur in the seashore's ocean waters on a seasonal basis (Waring et al 2002 as cited in US DOI BOEMRE 2006). The offshore area is adjacent to areas on the mid-shelf, where marine mammals that prefer fish and squid are known to concentrate (Kenney et al 1986 as cited in US DOI BOEMRE 2006). During the summer bottlenose dolphins (*Tursiops truncatus*) occur in high concentrations; the harbor porpoise (*Phocoena phocoena*) dominates during the winter (Kenney et al 1986 as cited in US DOI BOEMRE 2006). During the fall dolphins migrate south following schools of migratory fish. At the peak of the migration season, a near continuous column of dolphins can be seen from the beaches of Assateague (NPS 2008a). Harbor seals (*Phoca vitulina*) are also common in winter. Several whales are transient seasonally through the area, including North Atlantic right whales (*Eubalaena glacialis*), which are common during migrations to and from calving grounds in the south Atlantic. A number of immature Great Atlantic right whales (*Eubalaena glacialis*) also winter along the local coastline and can sometimes be seen from the beach (US DOI BOEMRE 2006). Juvenile humpback whales (*Megaptera novaeangliae*) are also known to overwinter here, and short-finned pilot whales (*Globicephala macrorhynchus*) are common during summer months (US DOI BOEMRE 2006). Documented marine mammals offshore of the seashore include six species of baleen whales, 16 species of toothed whales (includes dolphins), the West India manatee (*Trichechus manatus*), and four species of seals (NPCA 2007).

Upland mammals include common muskrat (*Ondatra zibethicus*), North American river otter (*Lutra canadensis*), common opossum (*Didelphis marsupialis*), eastern cottontail (*Sylvilagus floridanus*), eastern gray squirrel (*Sciurus carolinensis*), meadow vole (*Microtus pennsylvanicus*), least shrew (*Cryptotis parva*), and several species of mice and rats. Rodents such as the meadow jumping mouse (*Zapus hudsonius*) and meadow vole (*Microtus pennsylvanicus*) live in grassy areas bordering saltmarsh and freshwater wetlands. North American river otter (*Lutra Canadensis*) and common muskrat (*Ondatra zibethicus*) use the seashore's marsh habitats and adjacent waterways.

Three species of bats – eastern red bat (*Lasiurus borealis*), big brown bat (*Eptesicus fuscus*), and Seminole bat (*Lasiurus seminolus*) – were found inside the seashore in a series of mist net surveys conducted in 2005 and 2006. Acoustical monitoring indicated three additional species – silver haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), and eastern pipistrelle (*Pipistrellus subflavus*). Most of those captured in nets were eastern red bats (*Lasiurus borealis*). Activity was highest in forests and near freshwater pools. The low diversity of bat species was attributed to the relatively low diversity of forest roosting habitat at the seashore. However, many of the captured eastern red bats (*Lasiurus borealis*) were reproductive females and juveniles, indicating that the island has maternity roosts.

Meso-predators include red fox (*Vulpes vulpes*), common opossum (*Didelphis marsupialis*), and raccoon (*Procyon lotor*). Foxes are one of the most influential

predators of ground-nesting birds such as tern, skimmers, and plovers. The NPS protects piping plover (*Charadrius melodus*) nests from predation, including periodically controlling the north end the fox population. Opossum (*Didelphis marsupialis*) are primarily carrion eaters. Raccoons (*Procyon lotor*) are opportunistic feeders that consume a wide range of food sources such as bird eggs and aquatic invertebrates.

Three large mammals live at the seashore: the native white-tailed deer (*Odocoileus virginianus*), non-native sika deer (*Cervus nippon*), and feral horses (*Equus caballus*). Historical documents refer to the presence of horses on Assateague Island since the late 1600s. Early residents of the region used the island to graze horses and other livestock, with periodic roundups or "pennings" held to determine ownership and to count and sell stock. Although the familiar legends of ponies escaping from a wrecked Spanish ship persist, they appear to have little basis in fact (NPS 2008a). When the seashore was established in 1965, most of the horses were confined to the Chincoteague National Wildlife Refuge (CNWR) in Virginia by a fence on the northern reaches of the refuge. The exception was a small, free-ranging herd belonging to a Maryland landowner who had purchased horses at the annual Chincoteague penning event in 1961. In 1968, the NPS acquired legal ownership of those horses and their offspring. The horses are considered a "desirable feral" species by the NPS, although they do have impacts on marsh and beach habitat and wildlife, and are genetically the product of a limited gene pool. In an effort to reduce the population size, in 1994 the NPS began a contraception program involving most of the Maryland herd's breeding age females. Since the program began the herd size has declined from 170 horses to 93 horses (in 2015). The NPS has completed an environmental assessment of herd management alternatives; the preferred alternative proposes to reduce the Maryland herd to between 80 and 100 horses in order to maintain genetic diversity and to not adversely affect island vegetation (NPS 2008a).

Sika deer (*Cervus nippon*) which are a small species of elk native to Asia, were introduced in the 1920s and have since become well-established throughout the seashore. Populations estimates of sika deer (*Cervus nippon*) in the Maryland portion of the island in 2006 were 342, about three times that of the native white-tailed deer (*Odocoileus virginianus*) (116) (NPS 2008a). Both species of deer are managed through an annual hunting program.

3.6.7 WILDLIFE SPECIES OF SPECIAL CONCERN

Table 3.4 shows species of concern in the state of Maryland. The first three species listed are also threatened or endangered on the federal list and are discussed in section 3.7 below.

Two species of invertebrates, the white tiger beetle (*Cicindela dorsalis media*)and the little white tiger beetle (*Cicindela lepida*), are listed as S1 (highly state endangered). The white tiger beetle (*Cicindela dorsalis media*) is rarer at the seashore and occurs only in the north end and in a small area immediately north of the state line. This species

Table 3.4 Wildlife Species of Special Concern (Maryland)

Scientific Name	Common Name	State Rank	State Status
Caretta caretta	Loggerhead Sea Turtle	S1B, S1N	T
Dermochelys coriacea	Leatherback Sea Turtle	S1	E
Charadrius melodus	Piping Plover	S1	E
Cicindela dorsalis media	White tiger beetle	S1	E
Cicindela lepida	Little white tiger beetle	S1	E
Haematopus paliatus	American oystercatcher	S3B	None
Sternula antillarum	Least tern	S2B	T
Rynchops niger	Black skimmer	S1B	E
Ixotrychus exilis	Least bittern	S2S3B	I
Haliaeetus leucocephalus	Bald eagle	S3B	None
Circus cyaneus	Northern harrier	S2B	None
Cistothorus platensis	Sedge wren	S1B	E
Gelochelidon nilotica	Gull billed tern	S1B	E
Thalasseus maximus	Royal tern	S1B	E
Charadrius wilsonia	Wilson's plover	S1B	E
Nyctanassa violacea	Yellow crowned night heron	S2B	None
Thalasseus sandvicensis	Sandwich tern	S1B	None
Podilymbus podicepts	Pied billed grebe	S2B	None

Key to Codes
S1 – highly state rare, critically imperiled in Maryland
S2 – State rare; imperiled in Maryland because of rarity
S3 – Rare to uncommon
B – Animal is migratory and rank refers only to the breeding status
N – Animal is migratory and rank refers only to non-breeding status
T – state threatened
E – state endangered
I – in need of conservation

forages along the high tide line and lays its eggs in the upper beach and primary dune. The population has ranged from 14 to 698 individuals since surveys began in 1985. It is considered secure globally. The little white tiger beetle (*Cicindela lepida*) occurs on interior dune habitats and prefers areas of dune blowouts and over wash channels. It is more widely distributed at the seashore than the white tiger beetle (*Cicindela dorsalis*

media); the population has ranged from 84 to 892 individuals since surveys began in 1990. However, the global population of the little white tiger beetle (*Cicindela lepida*) is G3/G4 (very rare and local throughout its range) (MD DNR 2010a). The American oystercatcher (*Haematopus palliatus*), is not a listed bird but its numbers have declined in recent years. It is on the National Audubon "watch list" and ranked as S3 (rare to uncommon) by the state. In its monitoring of other shorebirds of concern (least tern (*Sterna antillarum*) and piping plover (*Charadrius melodus*)) the NPS tracks nesting activities, including successful fledging of chicks. This species nests along both ocean and bay shorelines at the seashore. In 2010 and 2011 the NPS scanned nests along the ocean shoreline (NPS 2010b; NPS 2011c). In 2010 26 adult American oystercatchers (*Haematopus palliatus*) were counted on the north end and 11 in the OSV use area on the south end. On the north end 14 nesting pairs attempted 22 nests; of these six hatched and 10 chicks were fledged. The southern nests all failed. In 2011, 23 nesting attempts from 15 nesting pairs of American oystercatchers (*Haematopus palliatus*) occurred on the north end and two on the south end. One of the two southern nests hatched and fledged two chicks, the other failed. A total of 11 chicks were fledged from northern nests.

The 2011 report also noted that five breeding pairs of common terns (*Sterna hirundo*), a species that was severely reduced in the 19th and 20th century from hunting, were counted at km 6.0 and one chick fledged (NPS 2011c). This was the first year since 1997 that common terns successfully hatched nests at the seashore.

Least terns (*Sterna antillarum*) are a state threatened species that nests in open, sandy habitat. Due to fox disturbance they are usually more scattered than the species appears to prefer. While monitoring piping plovers (*Charadrius melodus*), NPS biologists have also surveyed least tern nesting sites. In 2010 298 nests were counted and in 2011 360 nests counted in the north end (from the inlet to km 9.5). In the late winter of both years, the NPS participated in a multi-agency removal of foxes from the north end, which appears to have contributed to nesting attempts and success by least terns (NPS 2010b; NPS 2011c).

The 2011 report on nesting piping plovers (*Charadrius melodus*) also looked for evidence of other nesting seabirds. In addition to finding least tern (*Sterna antillarum*) and common tern (*Sterna hirundo*), and American oystercatcher (*Haematopus palliatus*) NPS biologists found that black skimmer (*Rynchops niger*) (a state endangered species) were also displaying courtship behavior, although no eggs were found. This species historically nested on the beaches of the seashore but has not successfully bred in recent years, largely due to predation pressures of red fox (*Vulpes vulpes*) and disturbance by feral horses (*Equus caballus*) (NPS 2008a).

Maryland tracks bald eagles (*Haliaeetus leucocephalus*) because of the global significance of Maryland occurrences and because they are protected under the Golden and Bald Eagle Protection Act and the Migratory Bird Treaty Act. Bald eagle sightings have increased in recent years (Seegar et al 2010). Bald eagles (*Haliaeetus*

leucocephalus) nested at a single location at the seashore during 2001, 2002, 2006, and 2007, and 2011. There were two active nests in 2012. Up to 30 bald eagles (*Haliaeetus leucocephalus*), including many juveniles, also use the seashore during the winter months.

Northern harrier (*Circus cyaneus*) generally inhabits marshlands or wet meadows and are far more numerous across the northern Great Plains than in the east. Populations have generally declined in the northeast throughout the twentieth century, primarily as a result of habitat destruction and more intensive agricultural use of remaining grasslands (Sauer et al 2011; accessed 02.20.12).

The sedge wren (*Cistothorus platensis*) a small, brown songbird that is classified by the state as endangered, prefers marshes and wetland habitat. The species has been observed in the past at the seashore, but it is unknown whether the bird breeds there. The deteriorated condition of the seashore's saltmarsh habitats might play a role in its limited occurrence.

Gull-billed terns (*Gelochelidon nilotica*) (state endangered) and Wilson's plover (state endangered), also nest on barrier islands, but none of these state listed species have nested at the seashore in recent years. Gull-billed terns (*Gelochelidon nilotica*) last nested at the seashore in the early 1990s in a colony of royal terns (state endangered). The Wilson's plover (*Charadrius wilsonia*), a state endangered species, is an infrequent and rare breeder on open washes/sand flats, beaches, and dredge spoil mounds in Sinepuxent Bay. It has not been observed breeding in Maryland for more than 10 years (MD DNR 2004). It is also limited by human disturbance of nesting habitat.

Surveys of waterbird colonies indicate that 20 species currently inhabit in the coastal bays, including the state endangered royal tern (*Thalasseus maxima*), sandwich tern (*Thalasseus sandvicensis*), and yellow-crowned night heron (*Nyctanassa violacea*), and other species considered rare (MD DNR 2004). The only Maryland breeding colonies for royal tern (*Thalasseus maxima*), sandwich tern (*Thalasseus sandvicensis*), and gull-billed (*Gelochelidon nilotica*) tern are in the Coastal Bays.

A Virginia study of 13 wading birds found that the number of breeding pairs of yellow-crowned night heron (*Nyctanassa violacea*) increased from 55 in 1977 to 476 in 2003 (Williams et al 2007). The number of breeding colonies also increased from 10 in 1977 to 57 in 2003. This occurred despite a decline in the population across Virginia.

Pied billed grebes (*Podilymbus podiceps*) are a wetland species and the only breeding grebe in the Mid-Atlantic/New England region. It is considered a species of high conservation concern in parts of its range, but is secure globally (MD DNR 2010b). Threats include threats to the quality of its breeding habitat such as invasive plants and water pollution in the Coastal Bays. In addition, pied-billed grebes (*Podilymbus podiceps*) appear to be a carrier of West Nile virus; efforts to control mosquitoes could have adverse effects to reproductive success or health (US FWS undated).

3.7 Federally Listed Threatened or Endangered Species

Nine federally listed threatened or endangered plants and animals have been observed within the seashore, including sea turtles (four species), whales (three species), piping plover (*Charadrius melodus*) and seabeach amaranth (*Amaranthus pumilus*) (table 3.5).

Table 3.5 Federally Listed Threatened or Endangered Species

Scientific Name	Common Name	Rank
Charadrius melodus	Piping plover	Threatened
Amaranthus pumilus	Seabeach amaranth	Threatened
Caretta caretta	Atlantic loggerhead sea turtle	Threatened
Chelonia mydas	Green sea turtle	Endangered
Dermochelys coriacea	Leatherback turtle	Endangered
Leidochelys kempi	Kemp's Ridley sea turtle	Endangered
Eubalaenas glacialis	Northern right whale	Endangered
Megaptera novaeangliae	Humpback whale	Endangered
Physeter catodon	Sperm whale	Endangered

3.7.1 PIPING PLOVER (*Charadrius Melodus*)

The piping plover (*Charadrius melodus*) is a small, stocky, sandy-colored shorebird resembling a sandpiper. The Atlantic coast population was listed as threatened under the Endangered Species Act in 1986. The Atlantic coast population of piping plover (*Charadrius melodus*) breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. Piping plovers (*Charadrius melodus*) were common along the Atlantic Coast during much of the 19th century, but nearly disappeared due to excessive hunting for the millinery trade. Following passage of the Migratory Bird Treaty Act in 1918, numbers recovered to a 20th century peak which occurred during the 1940s. The current population decline is attributed to increased development and recreational use of beaches since the end of World War II. The most recent surveys place the Atlantic population at less than 2000 pairs.

The northern 9.5 kilometers of the seashore has supported up to 60+ pairs of breeding piping plovers (*Charadrius melodus*) and is the only nesting site for this species in Maryland. Most nesting takes place in the northern part of the seashore where overwash is more frequent and human disturbance is less common. In the southern end (within the OSV use area) further disintegration of the man-made protective dune – constructed in the 1960s – will improve habitat conditions; if plover nests are seen in this area, the 200m buffer is enforced by closing it to OSV use and predator cages are installed for protection. In 2010, 41 pairs of plovers hatched 149 chicks and 48

survived; the number of chicks fledged per pair was 1.09 (NPS 2010b). In 2011 32 successful nests hatched 107 chicks, of which 45 survived to fledging age, for a productivity of 1.25 chicks fledged per pair (NPS 2010b). The FWS recovery goal is 1.5 chicks/pair, which the seashore population has met in 7 of the 21 breeding seasons from 1986 to 2007 (NPS 2001b; NPS 2008a; NPS 2010b, NPS 2011c).

The nest survival and hatching success rate is low at the Assateague Island National Seashore compared to other areas. Weather, possible effects of the Deepwater Horizon oil spill, visitor and OSV use, predation pressure (primarily from red fox), and less than optimum habitat conditions in parts of the seashore are all considered possible reasons for this low productivity (NPS 2010b). To help improve reproductive success, the NPS has installed predator exclosure cages around individual nests since 1988 and periodically removes select predators from the plover's primary breeding grounds. Other management actions include public use closures to protect breeding birds from visitor use impacts. The population has fluctuated from a low of 14 pairs in 1990 to a high of 66 pairs in 2004 (NPS 2008a); the 2011 population was 36 breeding pairs (C. Zimmerman, pers comm. 07/2012).

Piping plovers (*Charadrius melodus*) breed in the spring, laying eggs in April in a depression in the sand somewhere on the high beach. The nest is sometimes lined with small stones or fragments of shell. The eggs hatch in about 25 days, and the young are soon able to follow their parents in foraging for marine worms, crustaceans, and insects they pluck from the sand. When predators or intruders come close, the young stay motionless on the sand while the parents attempt to attract the attention of the intruders, often by feigning a broken wing. Surviving young are fledged in about 30 days. If nesting is disrupted before the eggs hatch, the plovers will often re-nest, with chicks not fledged until late August. By mid-September, both adult and young plovers will have departed for their wintering areas.

Piping plovers (*Charadrius melodus*) are dependent on early-successional, disturbance habitats for both nesting and foraging. These types of habitats are created and maintained by washover during major storms. Both adults and chicks use the low, moist interior sand flats and bayside habitats to forage. It is important that this species have expanses of sparsely vegetated flat ground, as predators hide in more dense vegetation or block the plover's view of aerial predators, and can be a substantial reasons nests fail. When strong storms do not occur for several years (typical of the seashore since the late 1990s), vegetation grows in and plover habitat decreases. In addition to loss of foraging habitat and increased predation, the increased vegetation can attract more Assateague horses, which can inadvertently impact eggs and nests through trampling.

3.7.2 SEABEACH AMARANTH (*AMARANTHUS PUMILUS*)

Seabeach amaranth (*Amaranthus pumilus*) is a federally threatened species listed in 1993. It is an annual vascular plant that inhabits upper beaches and overwash areas. Without overwash to maintain the open, sparsely vegetated habitat required by seabeach amaranth (*Amaranthus pumilus*), other plants out compete and eliminate it.

Seabeach amaranth (*Amaranthus pumilus*) has been lost over much of its former range on the east coast, primarily from development and stabilization of barrier island beaches. Today the seashore hosts the only population of seabeach amaranth (*Amaranthus pumilus*) in Maryland. It was considered extirpated from the seashore until 1998, when two plants were discovered after 30 years of no observed occurrences. During the next few years, an additional five plants were discovered; some were removed to a greenhouse and used to produce seeds and plant stock for restoration. The NPS planted more than 5,000 amaranth seedlings at restoration sites from 2000 to 2002. By 2001, 800 wild amaranth were growing naturally from seeds and young plants. Research determined that the primary factors limiting amaranth success included herbivory by deer, horses, and insects, as well as weather extremes, habitat conditions, and overwash events. NPS staff found that burying from sand actually stimulated growth. In 2005, NPS managers began a larger scale program to protect amaranth from deer and horse browsing and OSV use through the use of cages, signs, and marking. By 2006 the population was up to 1,500 wild plants, and by 2007 had increased to a record 2,179.

3.7.3 SEA TURTLES

All species of sea turtles in waters of the United States are currently listed as threatened or endangered. The FWS and NOAA National Marine Fisheries jointly manage sea turtles. Four species of marine sea turtles have been documented either within the seashore's waters and/or on its beaches, including the Atlantic loggerhead (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*), and Kemp's Ridley sea turtle (*Leidochelys kempi*). By far most observations at the seashore are of loggerhead strandings, which occur when they are killed by boat collisions or commercial fishing gear, or die from natural causes. Loggerheads also occasionally nest at the seashore; single event nesting by leatherback and green sea turtles have also been documented (NPS 2008a).

- **Atlantic Loggerhead Turtle**

Loggerheads in the waters adjoining the seashore are part of the Northwest Atlantic distinct population segment, which is listed as threatened (NOAA 2012a). Loggerheads nest on ocean beaches, generally preferring high energy, relatively narrow, steeply sloped, coarse-grained beaches. Loggerheads are circumglobal, occurring throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans, and are the most abundant species of sea turtle found in coastal waters of the United States. In the Atlantic Ocean the range of the loggerhead turtle range extends from

Newfoundland to as far south as Argentina. During the summer, nesting occurs primarily in the subtropics. Although the major nesting concentrations in the United States are found from North Carolina through southwest Florida, minimal nesting occurs outside of this range westward to Texas and northward to Maryland. Nesting at the seashore is a relatively unusual occurrence.

Somewhere between 7- to 12-years-old, oceanic juveniles migrate to nearshore coastal zone and continue maturing until adulthood. In addition to providing critically important habitat for juveniles, the nearshore coastal zone also provides crucial foraging habitat, inter-nesting habitat, and migratory habitat for adult loggerheads off the east coast of the United States. The predominate foraging areas for western North Atlantic adult loggerheads are found throughout the relatively shallow continental shelf waters of the United States, Bahamas, Cuba, and the Yucatán Peninsula, Mexico. Adult loggerheads are known to make extensive migrations between foraging areas and nesting beaches, and seasonal migrations of adult loggerheads along the mid- and southeast coasts of the United States have also been documented.

Loggerheads face threats on both nesting beaches and in the marine environment. The greatest cause of decline and the continuing primary threat to loggerhead turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and dredges.

Directed harvest for loggerheads still occurs in many places (for example, the Bahamas, Cuba, and Mexico) and is a serious and continuing threat to loggerhead recovery.

- **Green Sea Turtle**

While breeding populations of green sea turtles off of Florida and Mexico are considered federally endangered, those in the rest of this species' range are listed as threatened under the Endangered Species Act by NOAA National Marine Fisheries (NOAA 2012a). They are classified as globally endangered by the IUCN International Union for the Conservation of Nature (IUCN).

Green turtles are the largest of all the hard-shelled sea turtles. They are globally distributed and generally found in tropical and subtropical waters along continental coasts and islands of more than 140 countries. Nesting occurs in over 80 countries throughout the year (though not throughout the year at each specific location). In Atlantic and Gulf of Mexico waters of the United States green turtles are found in inshore and nearshore waters from Texas to Massachusetts, the Virgin Islands, and Puerto Rico.

They use three different habitats during their life cycle – beaches for nesting, the benthic habitat of coastal areas for feeding, and the open ocean for travel and maturing into adulthood.

While nesting season varies from location to location, in the eastern United States females generally nest in the summer between June and September; peak nesting

occurs in June and July. During the nesting season, females nest at approximately two-week intervals. They lay an average of five nests. In Florida green turtle nests contain an average of 135 eggs, which will incubate for approximately two months before hatching.

Adult females migrate from foraging areas to mainland or island nesting beaches and may travel hundreds or thousands of kilometers each way. After emerging from the nest, hatchlings swim to offshore areas, where they are believed to live for several years, feeding close to the surface on a variety of pelagic plants and animals. Once the juveniles reach a certain age/size range, they leave the pelagic habitat and travel to nearshore foraging grounds. Once they move to these nearshore benthic habitats, adult green turtles are almost exclusively herbivores, feeding on sea grasses and algae.

Analyses of historic and recent abundance information by the Marine Turtle Specialist Group of the IUCN indicates that extensive population declines have occurred in all major ocean basins over approximately the past 100 to 150 years. Analysis of population trends at 32 index nesting sites around the world has found a 48 to 65 percent decline in the number of mature females nesting annually over the past 100 to 150 years.

The principal causes of the decline are harvest of eggs and adults on nesting beaches and harvest of juveniles and adults on feeding grounds. Incidental capture in fishing gear, primarily in gillnets, but also in trawls, traps and pots, longlines, and dredges is a serious ongoing source of mortality that also adversely affects the species' recovery.

- **Leatherback Turtle**

The leatherback is the largest turtle – and the largest living reptile – in the world and is endangered throughout its range. Leatherbacks are commonly known as pelagic (open ocean) animals, but they also forage in coastal waters. They are the most migratory and wide ranging of sea turtle species.

Female leatherbacks lay clutches of approximately 100 eggs on sandy, tropical beaches. Females nest several times during a nesting season, typically at 8- to 12-day intervals. After 60 to 65 days, leatherback hatchlings emerge from the nest. No nesting areas are known to exist on the east coast north of Florida, although migrating leatherbacks have been sighted along the entire continental coast of the United States as far north as the Gulf of Maine and south to Puerto Rico, the U.S. Virgin Islands, and into the Gulf of Mexico.

The Atlantic Ocean population is generally larger than the Pacific Ocean population. While the IUCN notes Pacific nesting populations have declined more than 80 percent, declines on the Atlantic side and in the remainder of the leatherback's range are not as severe, and some population trends are increasing or stable. Nesting on beaches of the United States has been increasing in recent years.

Leatherback turtles face threats on both nesting beaches and in the marine environment. The greatest causes of decline and the continuing primary threats to leatherbacks worldwide are long-term harvest and incidental capture in fishing gear. Harvest of eggs and adults occurs on nesting beaches while juveniles and adults are harvested on feeding grounds. Incidental capture primarily occurs in gillnets, but also in trawls, traps and pots, longlines, and dredges. Together these threats are serious ongoing sources of mortality that adversely affect the species' recovery.

- **Kemp's Ridley Sea Turtle**

Kemp's Ridley sea turtle is endangered throughout its range. It is the smallest of the sea turtles (NOAA 2012a). It breeds en masse off a particular nesting beach near Rancho Nuevo, Mexico, in the state of Tamaulipas each year. Adult females migrate but only as far north as Florida. Male adults remain in the Gulf of Mexico. Newly emerged hatchlings inhabit a much different environment than adult turtles. After emerging from the nest, hatchlings enter the water and must swim quickly to escape near shore predators. Some hatchlings remain in currents within the Gulf of Mexico while others are swept by the Gulf Stream out of the Gulf of Mexico, around Florida, and into the Atlantic Ocean.

Juveniles of many species of sea turtles have been known to associate with floating sargassum seaweed, utilizing the sargassum as an area of refuge, rest, and/or food. This developmental drifting period is hypothesized to last about two years or until the turtle reaches a carapace length of about 8 inches (20 cm). Subsequently, these sub-adult turtles return to nearshore coastal zones of the Gulf of Mexico or northwestern Atlantic Ocean to feed and develop until they reach adulthood.

The nesting population of Ridley's has experienced dramatic declines in the past 60 years, falling from 42,000 in 1947 to 2,000 in 2000. Much of this decline was due to egg collection by the local villagers until nesting beaches were afforded official protection in 1966. Approximately 8,000 nests were observed in 2003 and 2006, suggesting that protection measures are helping. The greatest threats remain incidental capture in fishing gear (primarily in shrimp trawls, but also in gill nets, longlines, traps, and pots), as well as dredges in the Gulf of Mexico and North Atlantic.

3.7.4 WHALES

- **North Atlantic Right Whale**

The Northern right whale is endangered throughout its range (NOAA 2012a). Unlike other baleen whales, right whales are skimmers; they feed by removing prey from the water using baleen while moving with their mouth open through a patch of zooplankton. The primary food sources are zooplankton, including copepods, euphausiids, and cyprids.

Females give birth to their first calf at an average age of 9 to 10 years. In the coastal waters off Georgia and northern Florida, calving occurs from December through March. Although they primarily occur in coastal or shelf waters, movements over deep waters are known. For much of the year, their distribution is strongly correlated to the distribution of their prey. During winter, most right whales occur in lower latitudes and coastal waters where calving occurs. The whereabouts of much of the population during winter remains unknown, although a few juvenile right whales are known to winter at the mouth of the Chesapeake Bay. Right whales are often seen off the coast of the seashore, particularly during their migration to and from calving areas in the southeastern coastal waters to summer feeding and nursery grounds in New England.

It is believed that in the western North Atlantic along the coast of the United States population numbers are about 300 to 400 individuals. Recent analysis of sightings data suggests a slight growth in population size, although the population remains critically endangered.

The most common human causes of serious injury and mortality of western North Atlantic right whales are ship collisions and entanglement in fishing gear. Additional threats include pollutants, climate and ecosystem change, noise, whale watching activities, and natural threats from predators.

- **Humpback Whale**

The humpback whale is endangered throughout its range. Humpback whales are well known for their long pectoral fins, which can be up to 15 feet (4.6 m) in length (NOAA 2012a). While feeding and calving, humpbacks prefer shallow waters. They also stay near the surface of the ocean while migrating, making them particularly susceptible to injury from ship strikes.

During the summer months, humpbacks spend the majority of their time feeding and building up fat stores (blubber) from which they will live during the winter. Humpbacks filter feed on tiny crustaceans (mostly krill), plankton, and small fish, and can consume up to 3,000 pounds (1360 kg) of food per day. In their wintering grounds, humpbacks congregate and engage in mating activities. Gestation lasts for about 11 months. Newborns are 13 to 16 ft (4 to 5 m) long and grow quickly. Weaning occurs between 6 and 10 months after birth.

In the western north Atlantic Ocean, humpback whales feed during spring, summer, and fall over a range that encompasses the east coast of the United States (including the Gulf of Maine), the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland. In winter, whales from the Gulf of Maine mate and calve primarily in the West Indies. Not all whales migrate to the West Indies every winter; significant numbers of animals are found during winter in mid- and high-latitude regions. As immature right whales, humpbacks winter at the mouth of Chesapeake Bay and migrate through ocean waters off Assateague Island.

Humpback whales face a series of threats including entanglement in fishing gear, ship strikes, whale watch harassment, habitat impacts, and harvesting. Despite these threats, international whaling treaties have helped humpbacks to increase in abundance in much of their range. For the North Atlantic, the best available estimate is 11,570 whales.

- **Sperm Whale**

Sperm whales are endangered throughout their range (NOAA 2012a). Sperm whales (*Physeter macrocephalus*) are the largest of the toothed whales. In winter North Atlantic sperm whales are concentrated east and northeast of Cape Hatteras. In spring, the center of distribution shifts northward to east of Delaware, Maryland, and Virginia, and is widespread throughout the central portion of the Mid-Atlantic bight and the southern portion of Georges Bank. In summer, the distribution is similar but also includes the areas east and north of Georges Bank and into the Northeast Channel region, as well as the continental shelf south of New England. In the fall sperm whale occurrence south of New England on the continental shelf is at its highest levels; some whales also occur offshore of the seashore at the edge of the continental shelf in the Mid-Atlantic Ocean

The greatest threat for sperm whales has been whaling. Currently, most countries abide by a moratorium against whaling implemented in 1988, although there is some evidence suggesting illegal hunting of sperm whales in some parts of the world. At present, because of their general offshore distribution, sperm whales are less likely to be impacted by humans, and those impacts that do occur are less likely to be recorded. The best available abundance estimate for sperm whales in the North Atlantic along the coast of the United States is 4,700.

3.8 Historic Structures

3.8.1 ASSATEAGUE BEACH U.S. COAST GUARD STATION

The Assateague Beach U.S. Coast Guard Station was built in 1922. It was located across from the site of the original Assateague Beach Life-Saving Station, one of eight life-saving stations along the Atlantic Coast built between 1874 and 1906 between Cape Henlopen, Delaware, and Cape Charles, Virginia. The U.S. Coast Guard operated the station from 1922 to 1967, when it was decommissioned. After decommissioning the NPS took possession of the site. The NPS currently uses the station for general storage but is seeking to identify appropriate adaptive uses.

The station and its five associated structures are on the seashore's *Final List of Classified Structures* (NPS 1995b) and have been determined eligible for listing on the *National Register of Historic Places*. The complex of buildings is architecturally significant as a representative example of early 20th century U.S. Coast Guard buildings constructed primarily to execute the boat and life rescue service provided along the coastline. As a

Assateague Island National Seashore
Other Important Resources – Cultural Resources

The seashore contains a variety of locally, regionally, and nationally significant cultural resources, ranging from historic structures to archeological objects and sites. These structures and sites, as well as the associated documents and objects, are all that remain from the relatively brief periods when humans occupied Assateague Island. Combined, the seashore's cultural resources tell the story of mankind's inability to establish a permanent foothold on the constantly changing barrier island.

type of building, their simple frame construction takes a vernacular form which reflects some influence of the Colonial Revival style, indicative of their period of design. Originally designed to launch hand-rowed rescue boats directly into the ocean surf, the station evolved to use motorized vessels but eventually became obsolete in the 1960s with the advent of larger and deeper-draft rescue boats. The station is also listed as a Virginia State Historic Landmark. Five structures contribute to the site's significance.

Station House. The station house served as headquarters for Coast Guard operations at Assateague Beach. It is a plainly detailed rectangular structure facing the Atlantic Ocean, which is approximately 150 yards to the south. The structure is in relatively good condition. It represents a fine example of a period Coast Guard station located in a protected area from which crews could perform rescue operations.

Station Boathouse. The boathouse was the hub of Coast Guard operations and provided a dry storage area for boats and space for working on them. It is a hip-roofed rectangular structure, standing on pilings at the edge of Toms Cove to the north of the station house. The structure, which was in fair condition in 2010 at the time of the most recent assessment, is an excellent example of a colonial revival-type boathouse.

Station Garage. The garage was the original boathouse for the station. It is a rectangular hip-roof structure located approximately 100 yards to the south of the station house. The structure which was in good condition in 2010 at the time of the most recent assessment.

Guard Tower. The guard tower was built in 1922 and enlarged from two to three stories in 1938. Before radar, the tower served to direct vessels from dangerous shoals and to keep a look out for vessels in distress. During World War II, the tower was used for 24-hour surveillance. The tower was in good overall condition in 2010 at the time of the most recent assessment.

Wharf and Breakwater. The wharf and breakwater provided access to the boathouse and supported boating operations of the U.S. Coast Guard. The structures have suffered damage from multiple storms, particularly the most seaward portions, and are in poor condition overall.

3.8.2 GREEN RUN LODGE

Waterfowl hunting was and still is a popular form of recreation along the Mid-Atlantic seaboard from the Canadian Maritime Provinces to the Florida Everglades. Starting as subsistence hunting and commercial or "market gunning," waterfowl hunting reached its peak as a recreational sport in 1939 with over 44,000 waterfowl sportsmen and nearly 3,000 waterfowl hunting clubs and privately owned hunting marshes (Eshelman et al 2004). Since the late 1930s, the loss of eelgrass due to blight in the 1920s, the Great Depression, and severe storms along the Mid-Atlantic have contributed to decline of traditional waterfowl hunting and their associated clubs and lodges.

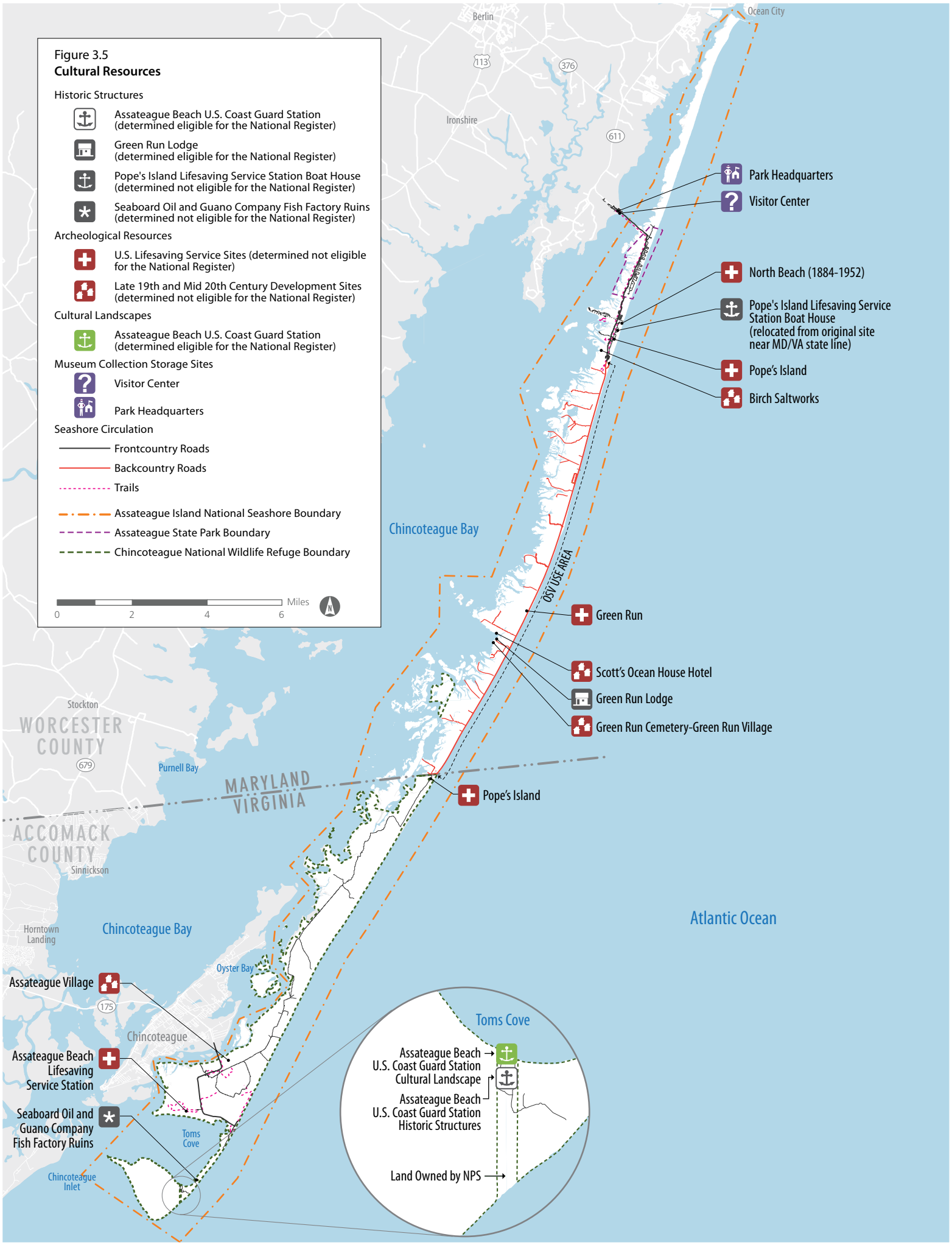


Figure 3.5
Cultural Resources
Historic Structures
Assateague Beach U.S. Coast Guard Station (determined eligible for the National Register)
Green Run Lodge (determined eligible for the National Register)
Pope's Island Lifesaving Service Station Boat House (determined not eligible for the National Register)
Seaboard Oil and Guano Company Fish Factory Ruins (determined not eligible for the National Register)
Archeological Resources
U.S. Lifesaving Service Sites (determined not eligible for the National Register)
Late 19th and Mid 20th Century Development Sites (determined not eligible for the National Register)
Cultural Landscapes
Assateague Beach U.S. Coast Guard Station (determined eligible for the National Register)
Museum Collection Storage Sites
Visitor Center
Park Headquarters
Seashore Circulation
Frontcountry Roads
Backcountry Roads
Trails
Assateague Island National Seashore Boundary
Assateague State Park Boundary
Chincoteague National Wildlife Refuge Boundary
Miles
0
2
4
6
Berlin
Ocean City
Ironshire
113
376
611
Park Headquarters
Visitor Center
North Beach (1884-1952)
Pope's Island Lifesaving Service Station Boat House (relocated from original site near MD/VA state line)
Pope's Island
Birch Saltworks
Chincoteague Bay
OSV USE AREA
Green Run
Scott's Ocean House Hotel
Green Run Lodge
Green Run Cemetery-Green Run Village
Pope's Island
Stockton
WORCESTER COUNTY
679
Purnell Bay
MARYLAND
VIRGINIA
ACCOMACK COUNTY
Sinnickson
Atlantic Ocean
Horntown Landing
Chincoteague Bay
Oyster Bay
Assateague Village
175
Chincoteague
Assateague Beach Lifesaving Service Station
Seaboard Oil and Guano Company Fish Factory Ruins
Toms Cove
Chincoteague Inlet
Toms Cove
Assateague Beach U.S. Coast Guard Station Cultural Landscape
Assateague Beach U.S. Coast Guard Station Historic Structures
Land Owned by NPS

Remnants of several former lodges remain at the seashore. A cultural landscape and architectural survey conducted in 2000 provided a basis for evaluating the eligibility of each lodge property for the *National Register of Historic Places*. To assist in that process, a historic context study was completed that provided information against which each of the properties (and associated landscapes) was evaluated to determine their eligibility (NPS 2004). Based upon these studies the NPS in consultation with the Maryland State Historic Preservation Officer (MD SHPO) determined that Green Run Lodge is the only former lodge on the island that is eligible for listing on the *National Register of Historic Places*.

Green Run Inlet was first hunted from floating shanty boats about 1924. In 1946 a shanty boat was pulled up on land to create Green Run Lodge, the first land-based hunting lodge at Assateague Island, located at a site about one mile north of the present lodge location. The original lodge burned around 1952, after which the surviving structures, a shanty boat, and several other small structures from elsewhere on the island were moved to the present location and connected to form the lodge that remains today. At least one component is believed to be the kitchen of the former Green Run Lifesaving Service Station.

The Green Run Lodge property was used for commercial waterfowl hunting, game hunting, and fishing. It played a significant role in the history of hunting on Assateague and helped popularize the island and Chincoteague Bay as a hunting destination during the mid-20th century. During the 1940s and 50s, Green Run Lodge was the largest waterfowl hunting lodge on the island and a focal point of outside interest. The lodge was described as "one of the finest commercial clubs in the country" and "one of the finest gunning spots in the east." It was considered the largest commercial gunning club in Maryland. After moving the lodge from its original location to its present location in 1954, the property was used as a private hunting membership club. The owners sold the property to the federal government in 1972, retaining rights to continue to operate the club for many years afterward. Throughout its period of occupancy the lodge was used exclusively as a hunting camp and was never adapted for a different use.

The lodge complex includes a clubhouse, two small wood frame sheds, a dock/pier with covered storage, a breakwater, boat docking slips, and a boardwalk along the shore connecting to a decoy shed. The clubhouse is a one- and two-story frame structure, approximately 1,765 square feet in size with seven rooms, including a clubroom, gear room, three bedrooms, full bath, hall and kitchen on the first floor, and one large bedroom on the second floor. The exterior is finished in asphalt siding over clapboard and board and batten; the roof is a combination of asphalt, metal and cedar shingle, reflecting characteristics of the component parts.

Green Run Lodge is significant as a representative example of waterfowl hunting camps associated with historical commercial and recreational hunting on Assateague Island (NPS 2011h). It retains a significant amount of its original fabric, demonstrates distinctive methods of construction and creative use of materials that is typical of island

hunting camps, and epitomizes the relationship of waterfowl hunting camps to the water and marsh habitats frequented by wintering populations of ducks and geese. The landscape surrounding the lodge remains essentially unchanged from its period use and exhibits all of the natural features of barrier island bayside habitat. The view from the lodge is striking and its inherent connection to the adjacent marsh and bay waters is entirely characteristic of the island's former waterfowl hunting camps.

3.8.3 OTHER STRUCTURES FROM THE HISTORIC PERIOD

Three other structures remain from the seashore's historic period: Green Run Cemetery, the Pope Island Boat House, and the remains of the Seaboard Oil and Guano Company Fish Factory. Each structure is on the seashore's *Final List of Classified Structures* (NPS 1995b), but each has been determined ineligible for listing on the *National Register of Historic Places*. The cemetery is a remnant of the former Green Run Lifesaving Service Station and associated village. The Pope Island Boat House was moved to its present location in the North Beach area of the seashore in 1978 after fire destroyed the remainder of the Pope Island Lifesaving Service Station in 1972. Portions of concrete foundations and masonry walls are all that remain of the Seaboard Oil and Guano Company Fish Factory; the remains are currently located in the shallow waters of Toms Cove.

3.9 Cultural Landscapes

3.9.1 ASSATEAGUE BEACH U.S. COAST GUARD STATION CULTURAL LANDSCAPE

The most important cultural landscape at the seashore is associated with the Assateague Beach U.S. Coast Guard Station at Toms Cove (NPS 2004). It is an individual landscape within the seashore. The station landscape remains largely unchanged from the period of U.S. Coast Guard activity and is integral to understanding the history and evolution of the station. Views to and from the station add to the story of the U.S. Coast Guard history by providing a visual of how life may have been for the life-savers working on an isolated barrier island along the Atlantic coast.

In 2004, the station landscape and its features were found to be in fair overall condition and determined eligible for listing on the *National Register of Historic Places*. The Virginia SHPO concurred with the eligibility determination. Features contributing to the significance of the station landscape include all structures (exclusive of the generator house and power poles), vegetation (exclusive of junipers), all external views and vistas, and a few small-scale features.

3.9.2 ASSATEAGUE ISLAND CULTURAL LANDSCAPE

The Assateague Island cultural landscape is a representative Atlantic coast barrier island. The landscape encompasses the full range of natural resources found on the island, in the water, and on the marshes surrounding the island. It exemplifies the continual

changes that occur along a barrier island of the Mid-Atlantic Coast, where extraordinarily dynamic geomorphological processes occur. The action of wind, tides, waves, and currents generate periodic episodes of erosion and deposition which change the configuration of the barrier island within periods ranging from centuries to hours, affecting the cultural land use and altering the cultural landscape in short intervals. The communities that developed on Assateague Island in the 19th to early 20th centuries from the salvage industry, the life-saving stations, the resort industry, and oil and guano operations have succumbed to the environment. Moving sands have inundated the remains of many of these sites, although some remain relatively intact. Human actions, including vandalism, salvage, and looting have also heavily impacted the sites.

3.10 Wilderness

3.10.1 POTENTIAL AND RECOMMENDED WILDERNESS

The Wilderness Act of 1964 (Public Law 88-577) directs the Secretary of the Interior to review road-less areas of 5,000 contiguous acres or more in units of the national park system, and provide the President of the United States with a recommendation as to the suitability of each area for preservation as wilderness.

A study evaluating the suitability of portions of Assateague Island, Maryland, and Virginia for wilderness designation was completed by the NPS and Bureau of Sport Fisheries and Wildlife in 1974. The study concluded that portions of the island retained "primeval character and influence" and that about 6,500 acres of land qualified for wilderness designation. The proposed area included approximately 1,300 acres of US FWS managed lands in Virginia, and approximately 5,200 acres of NPS managed lands in Maryland. The study clarified that "utilization of the shellfish resources would not be affected nor would fishing or the use of navigable waters." Public response to the study's recommendations was mixed but largely positive.

Of the 5,200 acres of NPS managed lands determined suitable, 440 acres were formally recommended to Congress for wilderness designation by President Gerald Ford in 1974. The balance of the NPS managed lands – 4,760 acres – were identified as a "potential wilderness addition", to become eligible for wilderness designation when nonconforming features and uses were eliminated. Congress failed to act on the President's recommendation.

Subsequent attempts to introduce legislation designating an Assateague wilderness were abandoned with the passage of Public Law 94-578. The act amended the seashore's enabling legislation and directed the NPS to prepare a "comprehensive plan for the protection, management, and use of the seashore". The question of wilderness was to be considered as part of the ensuing GMP.

The 1982 GMP identified the presence of retained rights of use and occupancy by 11 former property owners as the most significant impediment to wilderness designation. Other considerations included the incompatibility of OSV use within the wilderness area

and concern that designation would preclude existing methods of access for recreational purposes. The GMP concluded that "when the natural zone is free of retained rights, wilderness designation will be reconsidered." The last of the retained rights of use and occupancy expired in 2002.

3.10.2 CURRENT CONDITIONS

The Maryland portion of the Assateague Island's recommended and potential wilderness lies roughly in the center of the island, stretching from Fox Hills south to the Maryland/Virginia state line. Because of its relatively isolated location, the wilderness area has historically received less intense use than other parts of the island. Contemporary use of the seashore follows a similar pattern and, except for OSV use along the ocean beach, the area experiences relatively limited visitor use.

At the time of the original study, it was estimated that the Maryland portion of the recommended and potential wilderness area encompassed approximately 5,200 acres of land. Recent analysis using 2008 aerial photography and GIS technology has determined that the actual acreage within the wilderness boundary is considerably less than the 1974 estimated approximately 4,000 acres. While some land has likely been lost through erosion of both the ocean and bayside shorelines, it is likely that the original estimate was significantly inflated.

Within the recommended and potential wilderness area, management actions by the NPS since the initial study have improved conditions and reduced impacts to wilderness character. During the 1970s, more than 680 acres of the island were legally available for OSV use, much of which was located in sensitive interior and bayside habitats within the wilderness area. Since then, the extent of the island open to public OSV use has been progressively reduced. At present, public OSV use is limited to the ocean beach below the winter storm berm and to two cross-island bayside access sand trails. The cumulative result has been a four-fold reduction in the wilderness lands affected by OSVs.

Other significant management actions have included removal of more than 15 miles of overhead power lines that served the former retained rights properties, and the abandonment of more than 13 miles of backcountry roads, including the former 'Back Trail'. Many of these closed roads are rapidly revegetating and becoming indistinguishable from adjacent unaffected areas. In both cases, the removal of visual intrusions and incompatible use yielded dramatic improvements in the condition of wilderness lands.

While management actions have improved conditions in many areas, much of the Assateague Island's potential and recommended wilderness continues to be affected by incompatible features and uses. The following describes some of the existing impacts and the approximate acreage affected:

- **Backcountry Roads.** The wilderness area contains approximately 9.3 miles of backcountry roads, including a mix of abandoned roads not yet rehabilitated and roads that remain in intermittent use for administrative purposes. As of 2011, approximately 81 acres of potential wilderness lands were impacted by the presence of roads (acres = land within 35 feet of road centerline as determined by GIS analysis).
- **Oversand Vehicle Use.** Public OSV use is currently permitted within the potential wilderness area in a designated zone that includes the ocean beach below the winter storm berm and two cross-island bayside access sand trails. As of 2011, approximately 256 acres of wilderness lands are impacted by the presence of OSV use (acres = lands in the designated OSV use area plus a 50 foot buffer as determined by GIS analysis).
- **Retained Rights Properties**. Six former retained rights properties occur in the wilderness area. Unnatural features associated with these properties include structures, roads, bridges, docks and boathouses, and semi-permanent duck blinds. As of 2011, approximately 45 acres of potential wilderness lands are impacted by the presence of unnatural features (acres = lands within 300 feet of former retained rights structures or significant infrastructure as determined by GIS analysis).
- **Mosquito Ditches**. Mosquito control programs during the 1940s led to construction of ditches which continue to affect Assateague's bayside marshes. As of 2011, approximately 812 acres of potential wilderness lands are impacted by mosquito ditches (acres = salt marsh habitat influenced by mosquito ditches as determined by GIS analysis).
- **Non-native Invasive Plants**. Several non-native invasive plants occur at levels that have displaced native species and altered natural communities on Assateague Island. As of 2011, approximately 880 acres of potential wilderness lands are impacted by non-native invasive plants (acres = lands where invasive plants exceed 3 percent cover as estimated by sampling and GIS analysis).

In total, approximately 2,074 acres or 51 percent of the land within the Assateague Island's potential wilderness are affected by unnatural conditions or incompatible uses, and currently fail to meet desired conditions.

3.10.3 MANAGEMENT OF VISITOR USE

Most visitor use activities within the recommended and potential wilderness area are compatible with the protection of wilderness character. Contemporary uses include hiking, fishing, swimming, camping, hunting, nature photography, wildlife viewing, and seeing and experiencing natural barrier island conditions. The primary challenge regarding public use is not what visitors are doing but, rather, how they access the wilderness area.

Most visitors to the Assateague Island wilderness gain access via OSVs. The use of OSVs to access remote portions of Assateague Island has been occurring since well before the

seashore's establishment. Concern that wilderness designation would restrict the use of OSVs was the predominant issue during public hearings regarding creation of the Assateague Island Wilderness in the 1970s. Little has changed since then and the use of OSVs remains both the most serious impact to wilderness character and the greatest obstacle to public acceptance of wilderness designation.

Public OSV use is allowed by special use permit in a designated zone along the ocean beach below the winter storm berm and on two cross-island bayside access sand roads. The use of OSVs is regulated under special park regulations found in 36 CFR 7.65(b), which includes provisions for use limits, conditions of use, equipment requirements, and permit requirements. Limited OSV use outside the public OSV use area is also allowed on a seasonal basis to support the public hunting program. Registered deer and waterfowl hunters are allowed to drive into the interior of the island from the public OSV use area at four locations where off-beach, hunter-only parking is provided. In addition, a portion of Valentines Road is available for use by mobility impaired deer hunters, as well as waterfowl hunters accessing blind sites.

3.10.4 MANAGEMENT OF ADMINISTRATIVE ACTIVIITES

NPS management activities within the wilderness area have traditionally been conducted with limited consideration of their effects on wilderness character. Beginning with the closure of the former 'Back Trail' in 1999 and continuing to the present, there has been a concerted effort to reduce the scope of incompatible administrative activities, including the use of motorized vehicles on wilderness lands. In 2010, the NPS developed a guidance document for use and management of the OSV use area and other backcountry roads. The directive formally discontinued all administrative use on some of the existing roads, and limited the types and frequency of use allowed on the remainder. At present, there are two categories of administrative use on existing roads within the wilderness area:

- **Limited Administrative Use** – includes existing sand roads providing access to three backcountry campsites and the Green Run and Valentines retained rights properties. Administrative use is limited to access for campground maintenance, resource and visitor protection patrols, emergency response, hunting management, and certain resource management activities.
- **Restricted Administrative Use** – existing sand roads providing access to the Clements and Peoples & Lynch retained rights properties. Administrative use is limited to access for periodic road maintenance (mowing) and cultural resource management activities.

3.11 Seashore Operations

3.11.1 OPERATIONAL STAFFING AND FUNDING

The seashore is managed by the superintendent and a senior management team consisting of the heads of the seashore's five operational divisions – administration, maintenance, interpretation and education, resource and visitor protection, and resource management. Each division is staffed with a combination of permanent and temporary employees. In FY 2012, the seashore's staff included approximately 41 FTE (full time equivalent) of permanent staff and an additional 36 FTE of temporary staff, primarily summer employees.

The seashore's annual operating revenue comes from various sources, the largest of which is the park's portion of the annual federal appropriation for operation of the national park system (ONPS). In fiscal year 2014, the seashore received $5,255,000 in ONPS funding. Other sources of annual operating funds include revenue from special use permits (e.g. OSV use permits), commercial use permits, reimbursable agreements with other federal agencies (e.g. US FWS), and rental income for the use of government housing. Collectively, these funds are used to conduct the seashore's day-to-day operations. Approximately 70 percent of the annual operating funds support personnel costs associated with the seashore's permanent employees and a portion of the temporary staff. The balance pays for recurring fixed costs such as utilities, vehicle fuel and maintenance, supplies and materials, and recurring management programs such as the north end Restoration and certain long-term resource monitoring activities.

The U.S. Government Accountability Office (GAO), in its report *Major Operational Funding Trends and How Selected Park Units Responded to those Trends for Fiscal Years 2001 through 2005* noted that " ... each unit experienced an increase in daily operations allocations, but most experienced a decline in inflation-adjusted terms." Congress later confirmed the GAO findings, noting in the House Report for Fiscal Year 2007 Appropriations Bill for the NPS that, "Unfortunately, because of inadequate budget requests, the parks have had to absorb $61,000,000 over the last six years in mandatory pay costs. This figure is exclusive of other costs impacts cited by GAO including unfunded retirement and health benefit increases, and mandates for homeland security and information technology security."

The seashore has experienced these same trends. Between 2009 and 2012, the seashore's annual ONPS appropriation has decreased by approximately 3 percent. In addition, inflation in the cost of fixed items such as fuel, utilities, supplies and materials has also impacted the seashore's annual operating budget. As a result of these factors the seashore has not been able to replace staff vacancies that have arisen over the past several years. Of the 50 permanent FTE in the seashore's approved organizational chart, only 41 FTE are currently filled. Vacant positions span the range of expertise needed to manage the seashore and include two park rangers, a heavy equipment operator, a wastewater treatment plant operator, an ecologist, and a coastal geologist. These

vacancies impede the seashore's ability to maintain public use facilities and infrastructure, complete needed resource management and stewardship activities, and provide the full range of visitor services.

The seashore also receives funds from other sources that help support non-recurring and one-time projects. The most important source is the revenue generated from recreational fees collected at the seashore. Approximately 80 percent of the revenue generated by recreational user fees (primarily entrance and camping fees) returns to the seashore for use in funding one-time projects. Fee revenue is used to support capital improvements such as the new campground office and ranger station and other facility enhancements, interpretive exhibits, educational programs, and habitat restoration projects. Fee revenue also supports much of the seasonal staff and other temporary employees hired to provide visitor services during the busy season and to help complete one-time projects. Other sources of funding for one-time actions come from NPS servicewide fund sources including those for cyclic maintenance, repair/rehabilitation, equipment replacement, and resource stewardship. The seashore also benefits from private donations, and non-NPS funding sources such as the US DOT's Federal Lands and Highways Program which helps maintain seashore roads.

3.11.2 OPERATIONS, FACILITIES, AND INFRASTRUCTURE

- **Overview**

Administration. The seashore superintendent and senior management staff direct overall seashore operations from the headquarters complex at the seashore entrance on MD Route 611. The complex includes administrative offices and the Maryland maintenance facility.

Operations Facilities. The Chief of Maintenance manages the seashore's maintenance operations from the headquarters complex. Routine maintenance operations for Maryland are based in the adjoining maintenance facility which includes operations offices, storage buildings, garages, workshops, outdoor storage areas, and the Maryland District's wastewater treatment plant. A smaller facility along Bayberry Drive provides material and supply storage closer to seashore facilities at the beach and campgrounds. The Virginia maintenance facility is located on FWS property on the mainland. Most visitor use facilities (portable restrooms, showers, etc.) at Toms Cove Beach – which are now relocatable – are removed from the island to the mainland maintenance site for winter storage and before storms to prevent loss or damage.

Interpretation and Visitor Services Facilities. The Chief of Interpretation and supporting administrative staff manage the seashore interpretive and visitor services from seashore headquarters. Rangers manage programs at the Assateague Island Visitor Center (where most interpretive staff are based) and the Toms Cove Visitor Center. The two visitor centers are the primary visitor contact facilities and generally

include administrative and storage facilities that support the seashore's interpretive programs.

Visitor and Resource Protection Facilities. The Chief Ranger oversees the visitor and resource protection staff from administrative offices at seashore headquarters. Maryland protection operations in the field are managed from the North Beach Ranger Station. In Virginia the NPS and FWS have an agreement whereby the FWS oversees protection operations in the refuge including the Toms Cove Recreational Beach (where NPS provides recreation opportunities for visitors to the refuge). NPS rangers assigned to Toms Cove report to the FWS chief ranger and are based at the refuge's Herbert H. Bateman Educational and Administrative Center.

Protected Beach Operations. The seashore operates two protected beach operations, one in Maryland and one in Virginia. A Chief Lifeguard oversees this operation and reports to the Chief Ranger. Two lead lifeguards, one for each operation, provide daily supervisory direction to the 6 to 8 lifeguards stationed at each protected beach. Typically, the seashore operates lifeguard protected beaches from Memorial Day through Labor Day.

Marine Protection Operation. A Supervisory Park Ranger oversees the water operations activities and protection for the seashore and reports to the Deputy Chief Ranger. The seashore has several law enforcement equipped vessels for patrol and enforcement of marine laws and regulations. These vessels also conduct search and rescue operations, provide support to the hunting program, and assist federal and state cooperating agencies on a regular basis.

Emergency Preparedness Operations. The visitor and resource protection division responds to an average of over 1000 emergencies annually. In addition to these incidents the seashore prepares every year for significant storms, hurricanes and human caused disasters. The seashore coordinates with other regional emergency service providers and organizations on a regular basis. The Chief Ranger maintains the park's Emergency Operating Plans and related SOP's and directives. Recurring emergencies that require extensive preparedness include:

- lost person/child
- drowning or near drowning
- overdue hunter or hikers
- boating or other marine emergency
- coastal storms and hurricanes

Housing. Affordable housing for seasonal employees is extremely difficult to find in both Maryland and Virginia, making it quite hard to recruit lifeguards, rangers, interpretive staff, and others needed during the busy summer season. In Maryland, NPS housing includes 19 bedrooms in three dorms and two houses. In Virginia the difficulty in finding seasonal housing has been a serious problem since the Assateague Beach U.S. Coast Guard Station was closed as an NPS dormitory; currently Virginia seasonal employees are housed in an FWS bunkhouse.

A recent employee housing needs assessment certified a deficit of 17 seasonal housing units in Maryland and 14 seasonal housing units in Virginia (NPS 2011g).

Water Supply and Wastewater Treatment Facilities. In Maryland water is drawn from wells on the island and pumped throughout the developed area to most visitor use areas. Consumption for drinking and cold water showers is approximately 8,000 gallons per day, reduced from 18,000 gallons per day usage as a result of a recent switch from flush toilets to vault toilets at the North Beach day-use area. In the backcountry no drinking water is available. At Toms Cove Beach in Virginia, wells along the parking area perimeter provide potable water and for cold water showers.

In Maryland vault toilets are available at campgrounds, North Ocean Beach, South Beach, Bayside Picnic Area, and Old Ferry Landing. Portable toilets are available at backcountry campsites. Two dump stations are located in the Maryland developed area campgrounds. Wastewater is hauled by tanker truck to a recently upgraded wastewater treatment facility on the mainland within the headquarters complex. In Virginia, Toms Cove Beach has vault toilets that are pumped and hauled to a treatment facility at Wallops.

Roads and Parking Facilities. (See section 3.11.)

- **Seashore Assets Analysis**

Two considerations inform management decisions regarding operations facilities and infrastructure, referred to as "assets" by seashore managers:

- the asset's relative importance (assessed in relation to the park's purpose and expressed through the its asset priority index (API))
- the asset's condition (assessed at a particular point in time and expressed through its facility condition index (FCI))

The relationship between the two considerations defines the appropriate actions needed to protect each asset. In general, assets fall into one of four categories (table 3.6). NPS policy regarding future public investment is generally: 1) to focus on the highest priority assets that are in the poorest condition (Category 2 assets), and 2) conversely, to avoid further public investment in low priority assets, particularly if they are in poor to serious condition (Category 4 assets).

Figure 3.6 presents a graphic summary of the findings from the analysis of seashore assets. Following are the major findings from the analysis:

Finding 1 Of the seashore's 225 assets (referred to as 'locations' in the scatter plot), 68 percent (154 of 225) are in good condition, requiring only routine preventative maintenance.

Finding 2 Four of the seashore's assets with high APIs (>70) are in poor condition and require rehabilitation; five assets with high APIs are in serious condition.

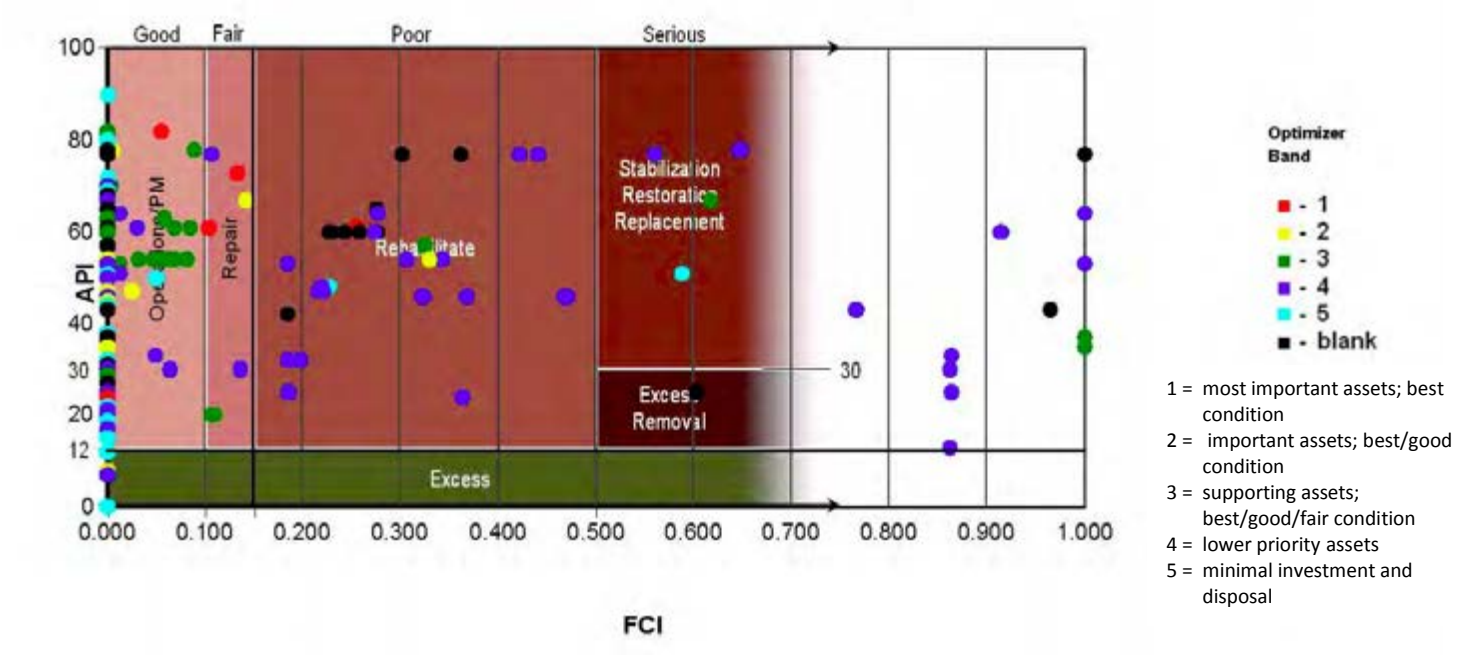
Table 3.6

Assateague Island National Seashore
Generalized Seashore Asset Analysis Categories

	Priority*	Condition
1	high to moderate	good
2	high to moderate	fair to poor
3	fair to poor	serious
4	low	all conditions

** Priority expressed in relation to the seashore's purpose*

Figure 3.6 Park Asset Analysis – Summary of Findings



Finding 3 Of the 32 assets in poor condition and requiring rehabilitation, 84 percent (27 of 32) are roads, parking lots, or hard surfaced trails.

Finding 4 Twelve assets are considered obsolete or excess to the needs of the seashore, or are in such poor condition as to warrant removal

3.11.3 PARTNERSHIPS

- **Volunteers**

Volunteering is an American tradition that the NPS recognizes is vital to the success of its parks. The NPS Volunteers in Parks (VIP) program coordinates voluntary help and services from the public. In 2011, nearly 700 volunteers donated more than 19,500 hours of time, providing an equivalent monetary value of $396,000 (table 3.7). The volunteers contributed their expertise and assistance to a wide variety of seashore programs and activities including visitor center operations, water quality, and threatened or endangered species monitoring, interpretive and educational activities, invasive species control, litter and marine debris clean up, campground operations, horse management, and cultural resource preservation.

Table 3.7

Assateague Island National Seashore
Volunteers in Park Program Participation

	Volunteers	Hours Donated
2011	694	19,557
2010	613	14,549
2009	1016	12,592
2008	1,280	12,432
2007	828	14,676

- **Entities Who Help the NPS Achieve Its Mission at the Seashore**

The seashore has many successful partnerships with organizations, state and local governments, and other federal agencies that help to accomplish the seashore's mission (table 3.8). Through these relationships the seashore has received valuable assistance in the conduct of educational programs, visitor services, emergency services, resource stewardship, scientific and scholarly research, and other activities.

Table 3.8 Entities that Help the NPS Accomplish Its Mission at Assateague Island National Seashore

Entity	Type of Agreement and General Provisions
General	
• **Assateague Island Alliance**	The Assateague Island Alliance is the seashore's friends group and assists the NPS by supporting interpretive, educational and scientific programs, and by helping to assure a balance between resource stewardship and compatible recreational uses of the seashore.
• **Eastern National**	Eastern National provides visitor services for the seashore by operating bookstores in the two NPS visitor centers under a national agreement with the NPS. Sales generated from the bookstores enable Eastern National to make donations to the seashore.
• **National Parks Conservation Association**	NPCA is a non-profit organization whose mission is to protect and enhance America's national parks for present and future generations. From its Virginia and Chesapeake Program Office in Washington, D.C., NPCA works to strengthen the relationship between the seashore, the general public, visitors, and neighboring gateway communities.
Emergency Service Providers	
• **Law Enforcement** – Maryland State Police – Virginia State Police – Local Police Departments – Maryland DNR Natural Resources Police – Virginia DGIF Law Enforcement Division – US Fish and Wildlife Service – Worcester County Sheriff – Accomack County Sheriff	Assateague Island National Seashore is a concurrent jurisdiction park. NPS has enforcement jurisdiction on Federal lands and on navigable waters within the seashore boundary. NPS, MD and VA State Police, MD DNR, VA DGIF, and local police departments have agreements to assist one another when needed. NPS provides law enforcement on federal lands inside the seashore and at its mainland facilities as well as on private land outside the seashore if there is a bona fide emergency situation. In Virginia, the NPS and the FWS have an agreement whereby the FWS oversees protection operations in the refuge including the Toms Cove Recreational Beach where the NPS provides recreation opportunities for refuge visitors; FWS supervises NPS rangers assigned to the Toms Cove area. NPS and FWS have a contract with the town of Chincoteague for radio dispatching services in Virginia. MD DNR Natural Resources Police and VDGIF Law Enforcement Division are responsible for enforcement of the states' wildlife and boating laws.
• **Fire Protection/Emergency Services/Search and Rescue/Hazardous Material Response** – Berlin Fire Company – US Coast Guard – Chincoteague Volunteer Fire Company – Maryland State Police – US Fish and Wildlife Service	NPS and local volunteer and paid professional fire and ambulance companies have mutual aid agreements to provide fire protection, emergency medical services, search and rescue assistance, and hazardous material response at the seashore. MD State Police provide helicopter Med-Evac services. The US Coast Guard has primary responsibility for marine search and rescue operations and marine pollution response. The NPS and state and local public safety agencies assist the Coast Guard in responding to marine emergencies. The NPS and US FWS respond to wild land fires within the seashore with assistance when needed from local fire fighters.
Economic Development and Tourism Organizations	
• **Economic Development** – Berlin Maryland Chamber of Commerce – Ocean City Chamber of Commerce – Worcester County Department of Economic Development – Chincoteague Chamber of Commerce – Eastern Shore of Virginia Chamber of Commerce	The NPS works cooperatively with local economic development organizations to promote initiatives designed to strengthen and advance the general welfare and economic prosperity of the region.

Table 3.8 Entities that Help the NPS Accomplish Its Mission at Assateague Island National Seashore

Entity	Type of Agreement and General Provisions
• **Tourism** – Delmarva Low Impact Tourism Experiences – Eastern Shore Tourism Commission – Ocean City Department of Tourism – Worcester County Department of Tourism	The NPS works cooperatively on many initiatives with local tourism groups. Initiatives focus on attracting visitors to the region, providing information to visitors, and developing visitor support services in gateway communities.
Conservation Organizations	
• **Maryland Coastal Bays Program** – Maryland Coastal Bays Program	The seashore actively supports and benefits from the activities and initiatives of the Maryland Coastal Bays Program (MCBP). The MCBP, a component of the EPA's National Estuary Program, plays a central role in coordinating federal, state and local governments and the public in broad-based efforts to protect and conserve the waters and surrounding watershed of Maryland's coastal bays to enhance their ecological values and sustainable use for both present and future generations.
• **Audubon Society**	The NPS and Audubon Society collaborate in research and conservation programs of mutual interest. The mission of the Audubon Society of Maryland-DC is to restore the natural ecosystems of Maryland focusing on birds, other wildlife, and their habitats for the benefit of humanity and the earth's biological diversity.
• **Assateague Coastal Trust**	The NPS and Assateague Coastal Trust collaborate in conservation and environmental education initiatives of mutual interest. Assateague Coastal Trust's mission is to protect and enhance the natural resources of the Atlantic Coastal Bays watershed through advocacy, conservation, and education.
Federal, State and Local Agencies	
• **US Fish and Wildlife Service**	The NPS and US FWS cooperatively manage the Toms Cove recreational Beach within Chincoteague National Wildlife Refuge under a memorandum of understanding. The two agencies also partner on matters related to the overall management of Assateague Island and the adjacent coastal waters. The NPS also consults with the US FWS in managing and protecting threatened or endangered species as per requirements of the Endangered Species Act.
• **US Army Corps of Engineers**	The NPS and USACE are partners in the north end Restoration Program as governed by an Interagency Agreement. Both agencies contribute funding to support the 25 year program intended to mitigate the impacts of the federal navigation channel at Ocean City Inlet on Assateague's sediment supply.
• **US Department of Agriculture**	The NPS partners with the USDA Plant and Animal Health Inspection Service to manage certain wildlife species on Assateague Island under an Interagency Agreement.
• **Maryland Department of Natural Resources (Maryland Park Service) – Assateague State Park**	The seashore collaborates with ASP on a variety of issues related to visitor use, resource management, and other operational issues where the agencies' interests and management responsibilities for Assateague Island intersect.
• **State Resource Management Agencies** – MD Department of Natural Resources – MD Department of the Environment – VA Department of Conservation and Recreation – VA Department of Game and Inland Fisheries	The NPS works with state conservation agencies on a wide range of issues of mutual concern and responsibility, including wildlife management, monitoring and protection of water quality, threatened or endangered species management, and A cooperative agreement between the NPS and MD DNR facilitates collaboration in scientific research and other management initiatives.

Table 3.8 Entities that Help the NPS Accomplish Its Mission at Assateague Island National Seashore

Entity	Type of Agreement and General Provisions
• **State Transportation Departments**	The Maryland and Virginia Departments of Transportation and the NPS work cooperatively to address vehicular, bicycle, and pedestrian access to the seashore via state roads and bridges.
• **State Historic Preservation Officers**	The Maryland and Virginia State Historic Preservation Officers and the NPS work cooperatively to identify, preserve, and protect the cultural resources representative of the island's heritage that are found in the seashore.
County Governments	
• **County Governments** – Worcester County, MD – Accomack County, VA	The NPS collaborates with county governments on a variety of issues of mutual concern ranging from public health and safety to land use and watershed conservation planning.
Academic Institutions	
• **Academic Institutions** – University of Maryland Horn Point Environmental Laboratory – University of Maryland Eastern Shore – Salisbury University	The NPS collaborates with regional universities in the development of scientific information related to the natural environment of Assateague Island and the adjacent coastal waters. The NPS also works cooperatively with academic institutions to advance learning opportunities for students of all ages through internships, environmental education initiatives, and sponsored research.
Other Organizations	
• **Assateague Mobile Sportfishermen's Association**	AMSA supports the mission of the seashore through a variety of local activities including environmental education, OSV user education, sponsoring beach clean-ups, community outreach, and through donations to the NPS.

3.12 Access and Circulation

The seashore's access and circulation system has evolved over the years in response to the dynamic nature of the coastal environment, the growing numbers of summer visitors, and the need to protect sensitive natural resources. Within Maryland, the NPS has primary management responsibility for managing the transportation system, working in collaboration with the MD DNR and the Maryland State Highway Administration (MD SHA) which owns and manages the MD Route 611 and Verrazano Bridge. Within Virginia, the U.S. Fish and Wildlife Service (FWS) has primary management responsibility for managing the transportation system, working in collaboration with the NPS whose area of jurisdiction includes Toms Cove Recreational Beach, the Former Assateague Beach U.S. Coast Guard Station, and the two Assateague Channel bridges that connect Chincoteague and Assateague Islands.

Recent transportation studies for the Maryland and Virginia portions of the island provide information on the access and circulation infrastructure, transportation needs, and potential management actions and strategies to address transportation needs, including:

- *Assateague Island National Seashore Alternative Transportation Systems Planning Study and Business Plan for Alternative Transportation* (US DOT 2012) (prepared for the NPS through a grant from the Federal Lands Highway Program)
- *Chincoteague National Wildlife Refuge Alternative Transportation Study* (US DOT 2010) (prepared for the US FWS, the NPS, and the town of Chincoteague through a grant from the Federal Transit Administration's Alternative Transportation in Parks and Public Lands Program)

The following text describing the transportation infrastructure, transportation issues and needs, and transportation management actions and strategies for the Maryland and Virginia portions of the seashore using information has been excerpted from the two studies referenced above.

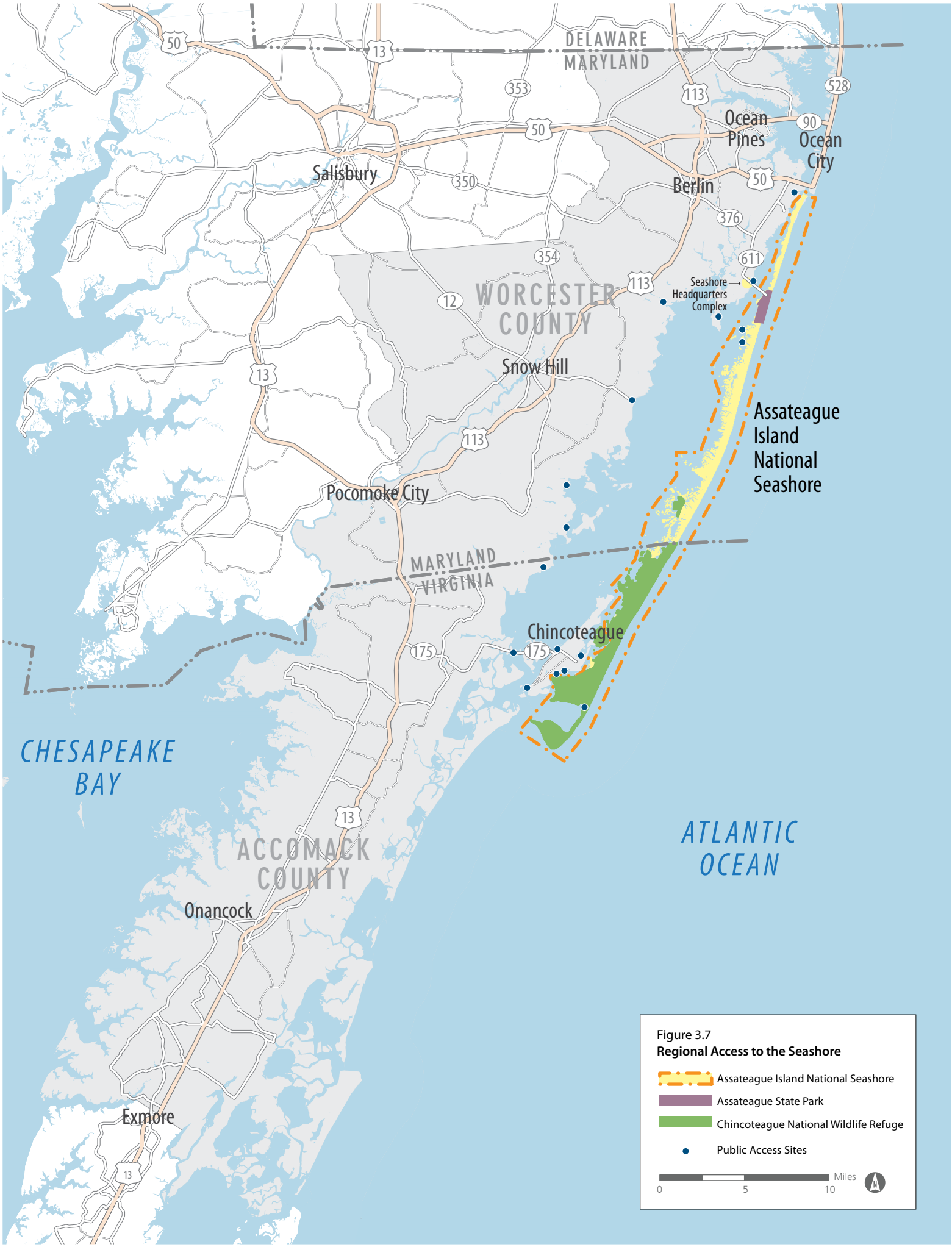
3.12.1 ACCESS AND CIRCULATION IN MARYLAND

- **Access and Circulation Infrastructure (Maryland)**

Vehicular Access. Most visitors to the seashore arrive by private vehicle, although a growing number of senior citizens arrive by motor coach and many school groups also visit by bus (NPS 2002a; Eppley Institute 2007). The primary access route from Washington, D.C. and Baltimore, the two closest major metropolitan areas, is the Chesapeake Bay Bridge along US Route 50 near Annapolis. Other driving options from the north include the Cape May-Lewes Ferry (which connects southern New Jersey to Delaware, north of Ocean City) and DE Route 1/US Route 113 from the north (which connects with Interstate 95 in Wilmington, Delaware. From the south, the only access route to the Virginia and Maryland Eastern Shores is via the Chesapeake Bay Bridge-Tunnel, which connects the Delmarva Peninsula to Norfolk, Virginia, and US Route 13, which runs the entire length of the peninsula until it merges with DE Route 1.

Regardless of origin, from the west visitors to the Maryland District access the seashore from US Route 50, either via Berlin using MD Route 376 or via West Ocean City using MD Route 611. From the south, visitors access the seashore via Snow Hill and Berlin using US 113 and MD Route 374. All visitors ultimately use MD Route 611, the only access road to the Maryland District, and the Verrazano Bridge (or the adjacent bicycle-pedestrian bridge), which connects the mainland to Assateague Island.

Bicycle/Pedestrian Access. Bicycles and pedestrians can access the seashore via the bicycle and pedestrian bridge that is adjacent to the Verrazano Bridge. There are 4.6 miles of paved bike path beginning at the visitor center on the mainland, crossing the pedestrian bridge on MD Route 611, and continuing on the paved bike path along Bayberry Drive and Oceanside Campground. The number of visitors who access the seashore on foot or by bicycle is also not known. Anecdotally, some visitors bicycle from Ocean City and other nearby communities, but few if any visitors arrive on foot.


DELAWARE
MARYLAND
50
13
353
50
113
528
Ocean
Pines
90
Ocean
City
Salisbury
350
Berlin
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376
354
611
Seashore
Headquarters
Complex
113
12
WORCESTER
COUNTY
Snow Hill
13
Assateague
Island
National
Seashore
113
Pocomoke City
MARYLAND
VIRGINIA
Chincoteague
175
175
CHESAPEAKE
BAY
13
ATLANTIC
OCEAN
ACCOMACK
COUNTY
Onancock
Exmore
13
Figure 3.7
Regional Access to the Seashore
Assateague Island National Seashore
Assateague State Park
Chincoteague National Wildlife Refuge
Public Access Sites
Miles
0
5
10

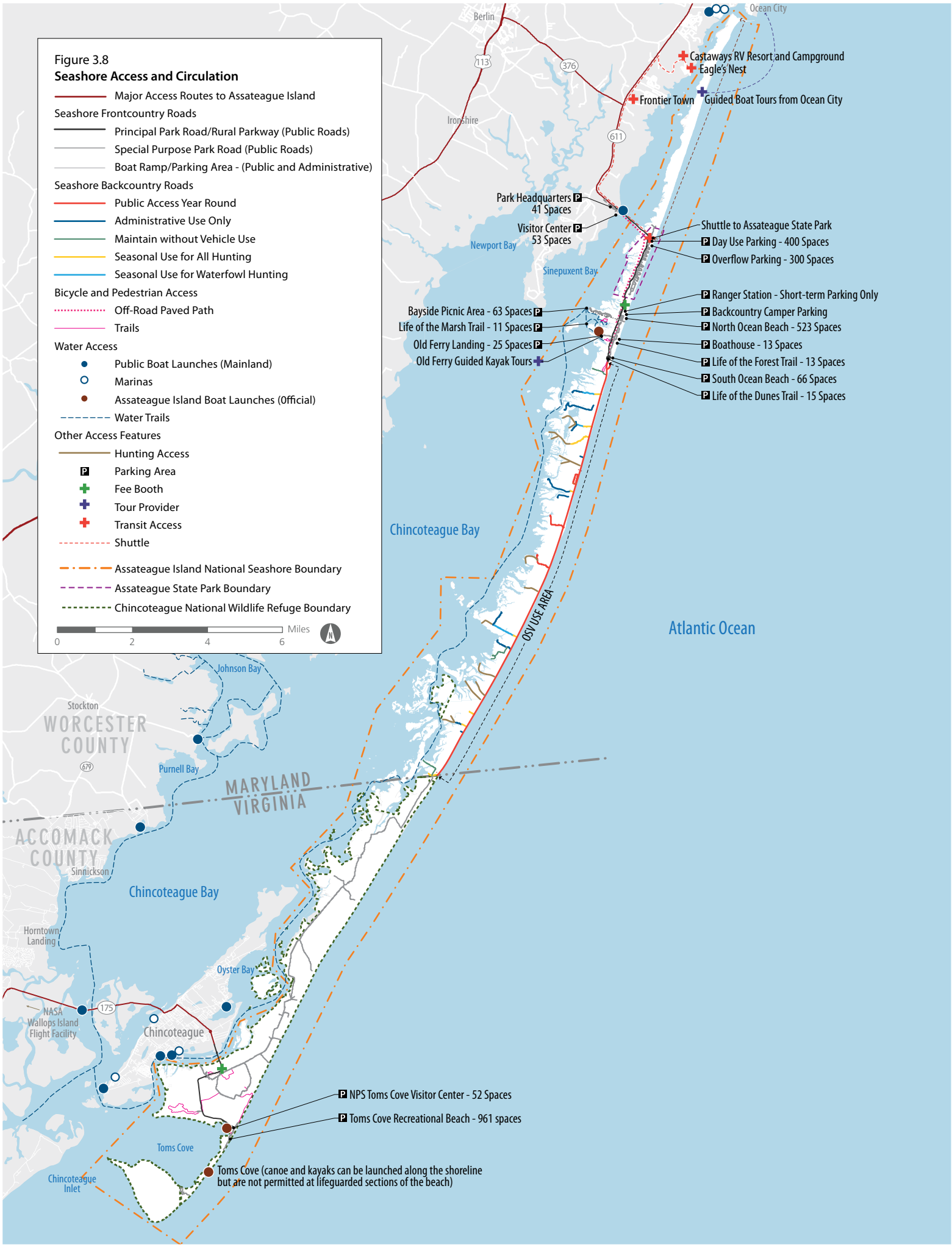


Figure 3.8
Seashore Access and Circulation
Major Access Routes to Assateague Island
Seashore Frontcountry Roads
Principal Park Road/Rural Parkway (Public Roads)
Special Purpose Park Road (Public Roads)
Boat Ramp/Parking Area - (Public and Administrative)
Seashore Backcountry Roads
Public Access Year Round
Administrative Use Only
Maintain without Vehicle Use
Seasonal Use for All Hunting
Seasonal Use for Waterfowl Hunting
Bicycle and Pedestrian Access
Off-Road Paved Path
Trails
Water Access
Public Boat Launches (Mainland)
Marinas
Assateague Island Boat Launches (Official)
Water Trails
Other Access Features
Hunting Access
Parking Area
Fee Booth
Tour Provider
Transit Access
Shuttle
Assateague Island National Seashore Boundary
Assateague State Park Boundary
Chincoteague National Wildlife Refuge Boundary
Miles
0
2
4
6
Ocean City
Berlin
Ironshire
Castaways RV Resort and Campground
Eagle's Nest
Frontier Town
Guided Boat Tours from Ocean City
Park Headquarters P 41 Spaces
Visitor Center P 53 Spaces
Newport Bay
Sinepuxent Bay
Shuttle to Assateague State Park
P Day Use Parking - 400 Spaces
P Overflow Parking - 300 Spaces
P Ranger Station - Short-term Parking Only
P Backcountry Camper Parking
P North Ocean Beach - 523 Spaces
P Boathouse - 13 Spaces
P Life of the Forest Trail - 13 Spaces
P South Ocean Beach - 66 Spaces
P Life of the Dunes Trail - 15 Spaces
Bayside Picnic Area - 63 Spaces P
Life of the Marsh Trail - 11 Spaces P
Old Ferry Landing - 25 Spaces P
Old Ferry Guided Kayak Tours
Chincoteague Bay
OSV USE AREA
Atlantic Ocean
Johnson Bay
Stockton
WORCESTER COUNTY
Purnell Bay
MARYLAND
VIRGINIA
ACCOMACK COUNTY
Sinnickson
Chincoteague Bay
Horntown Landing
Oyster Bay
NASA Wallops Island Flight Facility
Chincoteague
P NPS Toms Cove Visitor Center - 52 Spaces
P Toms Cove Recreational Beach - 961 spaces
Toms Cove
Toms Cove (canoe and kayaks can be launched along the shoreline but are not permitted at lifeguarded sections of the beach)
Chincoteague Inlet

Worcester County and Ocean City have developed bicycle maps that identify several bike routes that provide connections to MD Route 611. Bike routes include portions of MD Routes 611, 50, 90, 628, 364, 354, 12, and 346. Some of these routes have limited bicycle and pedestrian infrastructure in the form of wide shoulders and striping for bicyclists. MD Route 611, the route that all visitors must take to access to the Maryland District, has limited bicycle infrastructure and as such is more suited to experienced bicyclists. The nearest activity centers are in Berlin and Ocean City, each located about eight miles from the Barrier Island Visitor Center. Casual bikers or families might not want to bike this distance and the distance is typically too long for pedestrians. There are also safety concerns along parts of the bicycle route between Ocean City and Assateague Island NS. In particular, the bridge along US Route 50, which provides the most direct route to reach the seashore, has a narrow shoulder and sidewalk, which is often frequented by fishermen.

Motorized Water Access. There are currently few options for motorized water transport to the seashore. Motorized boats can launch from mainland access sites at Ocean City Harbor, Assateague State Park, Public Landing, and a few other public boat launch sites along Chincoteague Bay. There are no docking facilities at the seashore. Boaters who go ashore do so by mooring offshore or by pulling their boats up onto the beach.

There are several water tour companies based out of Ocean City that pass by Assateague or land on the island for brief periods of time. These water transport operations are tourism-based and are not in business to transport visitors to the seashore who might wish to spend extended time on the beach or carry recreational equipment.

Non-Motorized Water Access. Canoes and kayaks can be launched from Old Ferry Landing, Bayside Picnic Area, Fox Hills bayside access road, and along the ocean beach. At Bayside Picnic Area, a concession offers canoe and kayak rentals by the hour, day, overnight, or weekend, as well as guided interpretive kayak and canoe tours every Friday afternoon in June through September. Other commercial outfitters on the mainland offer hourly and daily kayak rentals and guided tours. Some outfitters also provide a shuttle service to Bayside and Old Ferry Landing.

Seashore Parking Areas. The seashore has 11 parking areas open to the general public as well as additional parking facilities for employees and for campers. Most parking (over 80 percent) serves the beach but several additional areas provide access to bayside activities, trails, and other visitor attractions (table 3.9). Two parking areas are on the mainland. One provides access to the visitor center and has 53 parking spaces plus spaces for 10 buses or recreational vehicles. The adjoining headquarters complex parking area has 41 spaces that can be used for visitor center overflow.

Seashore Entrance Booths. Visitors entering the developed area in Maryland must pass through one of two entrance booths located two miles down Bayberry Road from the Verrazano Bridge. One booth is staffed during daytime hours; the other is commonly

Table 3.9

Assateague Island National Seashore
Parking Areas (for public use)

Maryland Mainland

- Visitor Center (53 auto spaces; 10 bus/RV spaces)
- Headquarters Complex (41 spaces)

Maryland Island – Beach Parking

- North Ocean Beach (523 spaces)
- South Ocean Beach (66 spaces)
- Ranger Station (short-term parking only)

Maryland Island – Other Parking

- Bayside Picnic Area (53 spaces)
- Life of Marsh Trail (11 spaces)
- Life of Forest Trail (13 spaces)
- Life of Dunes Trail (15 spaces
- Boathouse (13 spaces)
- Old Ferry Landing (25 spaces)

Virginia District

- Toms Cove Recreational Beach (NPS Assigned Area) (961 spaces)
- Toms Cove Visitor Center (12 spaces)

unstaffed. The unstaffed booth allows visitors with annual passes to enter more quickly by swiping their pass through a card reader; this works well except when access to the second lane is blocked by vehicles waiting to pay (typically occurring when more than 10 vehicles are in line).

Oversand Vehicle (OSV) Use Area and Backcountry Roads. The seashore contains a network of unpaved sand roads and ocean beach travel corridors that provide vehicular access within its boundaries. Network components generally include 1) a public OSV use area providing access along portions of the ocean beach and to the bayside of the seashore at two locations, and 2) backcountry roads providing access to additional interior and bayside locations for administrative and seasonal hunting use. Most of the existing backcountry roads are remnants of private land use occurring prior to the seashore's establishment. Similarly, use of motor vehicles to access remote portions of the seashore is a traditional activity that continues today as a popular recreational use.

OSV use at the seashore is managed to accomplish the following objectives (NPS 2010h):

- provide appropriate, resource-based recreational opportunities
- minimize the effects of oversand vehicle use on seashore resources and values
- minimize conflicts between oversand vehicle use and other uses of the backcountry
- ensure use is conducted safely and in accordance with regulations
- reduce and eliminate non-essential oversand vehicle use

The framework for managing OSV use at the seashore is provided by Executive Order 11644 (as amended by EO 11989), *NPS Management Policies* (NPS 2006c), 36 CFR§7.65(b), and the *Superintendent's Compendium* (NPS 2015d). In general, public OSV use is managed to provide safe and appropriate recreational opportunities while minimizing adverse effects on the seashore's natural, cultural, scenic and aesthetic resources, and other recreational uses. Administrative oversand vehicle use is limited to that necessary to manage public use of the OSV use area and to conduct emergency operations and other essential maintenance, resource protection, and management activities that cannot be accomplished reasonably by other means.

- **OSV Use Area**. The public OSV use area consists of a 12-mile long ocean beach driving route and two cross-island bay access roads. The OSV use area provides public access for traditional recreational activities including surf fishing, hunting, beach activities, and scenic touring. It also supports administrative activities such as resource protection patrols, research and resource management activities, and the maintenance of backcountry campsites. The primary travel corridor in the public OSV use area is the seaward portion of the ocean beach. The western limit of the route is located at or near the average winter storm tide line. This definable feature (winter storm berm) provides a point of demarcation which limits vehicular travel to that portion of the ocean beach receiving significant natural disturbance (tidal action) on an annual basis. It intentionally segregates vehicles from sensitive biological communities that

occur on the upper beach face and adjacent dune fields. The public OSV use area also includes two cross-island roads that provide access to the bay for activities such as clamming and launching non-motorized boats. The number and location of these roads was formalized in the 1980s and has remained unchanged since that time. The bay access roads are located at Fox Hills (km 23.4) and Fox Hill Levels (km 25.3).

- **Backcountry Roads**. In addition to the public OSV use area, a network of single track sand roads provides access to the Island interior and bayside at multiple points within the backcountry. In general, the use of these backcountry roads is limited to administrative activities, including resource protection patrols, research and resource management activities, access to and maintenance of backcountry campsites, and search and rescue operations. On a seasonal basis, portions of some backcountry roads are opened to registered hunters to provide off-beach parking and access for deer and upland game hunting, and access to the bayside for waterfowl hunting. The entrance to these routes is controlled through the use of gates placed at strategic locations along each backcountry road. Each is posted with an "authorized vehicles only" sign.

Local and Regional Transit Providers. The region has a number of public and private transit providers, but none currently directly serve the seashore.

- **Ocean City Transit**. Ocean City offers a variety of transit services for both visitors and residents traveling largely within Ocean City and West Ocean City, including the Boardwalk Tram, the Coastal Highway Transit Bus, the West Ocean City Park & Ride, and a special events trolley. None of these services provide access to the seashore.

- **Shore Transit**. Shore Transit operates regional bus services in the three counties within Maryland's Eastern Shore: Worcester, Wicomico, and Somerset. These services encompass ten bus routes. While no route directly serves the seashore, two routes serve nearby communities, including Berlin, Pocomoke, and Ocean City. These routes also serve the West Ocean City Park and Ride, where riders can make connections to Ocean City Transit and Greyhound Bus services.

- **Transit Services to Assateague State Park.** Two local commercial campground sites – Frontier Town and Castaways RV Resort and Campground (formerly Eagle's Nest) – provide shuttle service to the seashore for their guests; however, service is provided only to Assateague State Park and the shuttles do not serve Bayberry Drive or NPS facilities.

In some years, the state has cooperated with a vendor and with Ocean City Transit to provide a shuttle service for the annual Maryland Coast Day that carried visitors from satellite parking lots on the mainland to the festival.

In 1998 and 1999 a seasonal bus service called the Worcester County Ride linked campgrounds at the seashore and Assateague State Park with the South Division Street Transit Center in downtown Ocean City. The bus service, which utilized a 15-passenger van, offered three daily round-trips for a $2.00 round-trip fare and had an average of five to 10 passengers per day.

- **Transportation Issues and Needs (Maryland)**

Regional Traffic Congestion. Regional traffic congestion is primarily associated with beach traffic accessing Ocean City. US Route 50 becomes congested on summer weekends; signage directs travelers going to the seashore to use MD Routes 113 and 376 in order to bypass roadways congested by vehicles bound for Ocean City. It is not clear how many visitors to the seashore follow the designated route.

Traffic volumes on major roadways near the seashore are expected to increase 30 to 200 percent over the next twenty years, with likely adverse impacts on the travel experience of visitors headed for the seashore. The largest traffic growth is expected along US 113 largely due to a planned 946-acre mixed-use development in Snow Hill; however, ongoing expansion of U.S. 113 from a 2-lane to a 4-lane divided highway is expected to provide adequate capacity to mitigate the increase in traffic along this roadway.

Future anticipated changes to the transportation system have implications for planning visitor transportation to the seashore. Congestion and road design will play a role in assessing demand and route planning for public transportation, bicycle and pedestrian routes, and signage strategies.

Seashore Entrance Booth Congestion. Traffic congestion approaching the seashore fee booths has been a persistent issue on peak weekend days for a number of years. The queue of vehicles waiting to enter the seashore can stretch more than one-quarter of a mile from the booths. Recently completed improvements to the fee booths have enhanced the functionality of the entrance booths but have not eliminated much of the congestion during peak weekend days. Planned roadway improvements will increase the number of lanes serving the entrance booths and should help alleviate some of the current congestion.

Circulation Congestion. Two main challenges with traffic circulation at the seashore are visitors looking for parking and “pony jams”. NPS policy is to allow visitors to enter the seashore even when it is known that all parking is full; this leads to visitors driving around in search of parking. In addition, even when some parking is available, there is no system in place to direct visitors to available parking. Pony jams are caused when wild horses enter a parking lot or road right-of-way or when visitors pull to the side of the road or stop in the road to observe wild horses adjacent to the road. Creating additional designated pull-off areas for wildlife viewing might improve traffic circulation on the island.

Illegal Parking. During peak times the seashore experiences problems with illegal parking, or parking outside of designated parking areas. Illegal parking is both a safety concern and a resource management concern. It primarily occurs in and around the traffic circle at the southern end of Bayberry Drive and on Bayberry Drive between the ranger station and traffic circle. According to seashore staff, visitors park illegally in these places because there is a desire to access South Beach, which has more space for visitors to spread out and is served by significantly less parking than North Beach. Even when parking is available in the North Beach parking area, visitors choose to park at the southern end of Bayberry Drive closer to South Beach.

Parking Demand. While the seashore has implemented strategies to manage the illegal parking issue, the pressure for more convenient parking remains, leading some visitors to choose to park illegally. The seashore has about 770 parking spaces for day-use parking. The number of visits – an estimated 2,000 day-use vehicles – on a peak day indicates that current parking capacity is insufficient, although observed parking occupancy shows that there is some available capacity even at peak times. Not all parking is equally desirable to visitors. For example, the South Beach parking lot fills first and its popularity and small capacity is the main contributor to illegal parking.

Regional Wayfinding. There are some opportunities to improve both wayfinding and traveler information on the regional level. Additional signage along US Route 50, directing visitors to alternative routes for accessing the seashore may help divert traffic and reduce congestion. Web, radio, and phone systems could provide other types of information, as could the state owned variable message signs (VMS) located on US Route 50.

On-Site Wayfinding and Traveler Information. The NPS is pursuing opportunities for improvements in wayfinding and traveler information provision at the seashore, both on the mainland and on the island. Visitors have expressed frustration with the lack of information about the OSV use area occupancy status, weather-related beach and seashore closures, parking availability, and congestion leading to the seashore and in the parking lots. The NPS has recently installed two vehicle messaging systems; one on the mainland near seashore headquarters and one at the island entrance station. These signs provide several types of information, including OSV and parking status, and compliment the information provided at the visitor center and information provided via phone, radio or web systems

There may also be an opportunity for improvements to the signage near the parking lots on Assateague Island. Currently, signage directing visitors to parking immediately after the entrance booths is both inadequate and confusing.

Inadequate signage at the traffic circle at the south end of Bayberry Drive leads to driver confusion and misdirection, as well, and would benefit from improvements

Emergency Evacuation. MD Route 611 is a designated evacuation route for both Assateague Island and Ocean City; however, it is also located in a flood zone.

Emergency evacuation planning needs to ensure that the evacuation routes can accommodate the total anticipated visitors to the area.

Temporary shelter on the island is also needed to accommodate people in the event of a summer pop-up thunderstorm. Currently, there are no buildings in the Maryland District that are recommended for emergency shelter.

Merging traffic from the seashore and Assateague State Park to exit off the island is another emergency evacuation issue. Seashore traffic must turn left to merge into the access road leading to the Verrazano Bridge from Bayberry Drive, while vehicles departing from Assateague State Park have the right-of-way in proceeding straight. Actions to potentially address this issue include placement of a ranger to direct traffic during evacuations, reconfiguring or redirecting traffic to improve the merge, or reversing the eastbound lane across the Verrazano Bridge.

Lack of Alternative Transportation. Lack of alternative transportation options limits access to the seashore by people without a vehicle, makes it impossible for visitors with a vehicle to get to the seashore once parking capacity is reached, and generally continues to maintain high numbers of vehicles on the island. Implementation of an alternative transportation option would address many transportation issues by reducing the number of vehicles on the island, thereby reducing entrance station congestion, circulation congestion, and parking demand. It would also have a positive impact on the environment and visitor experience by reducing air pollution and ambient noise levels during peak use periods.

OSV Use Area Management. The NPS recently installed an automated gate system and traffic counter at the entrance to the OSV use area to better manage vehicle access. The system allows vehicles onto the beach up to the 145 vehicle limit, at which point it transitions to one-on, one-off. Planned future improvements include linking the vehicle counter with the VMS signs to provide information on OSV use area status before visitors reach the island.

3.12.2 ACCESS AND CIRCULATION IN VIRGINIA

The FWS has primary responsibility for providing access and circulation to and within Assateague Island in Virginia, including the seashore's Virginia District facilities. NPS management responsibilities for the transportation system in Virginia include management of in the public road from the Toms Cove Visitor Center to the beach, parking areas, pedestrian trails in the Toms Cove area, and maintenance of the two bridges over the channel between Chincoteague and Assateague Islands. NPS also assists with OSV use management.

- **Assateague Channel Bridges**

The NPS acquired the Assateague Channel Bridge in 1966, as directed by the seashore's enabling legislation. The original bridge, erected in 1962, was acquired from the Chincoteague-Assateague Bridge and Beach Authority along with its other interests on

Assateague Island. The steel truss bridge was replaced by the current Assateague Channel and Sheepshead Creek bridges in 1979. Since then the two bridges have been inspected annually, and have received routine maintenance and periodic repairs on an as needed basis. Most recently, the abutments were reinforced and the support pilings covered with protective collars to extend the lifespan of the bridges. An ongoing project will replace portions of the concrete decking on the Sheepshead Creek Bridge damaged by exposure to salt water during high tides. Within the next five years, if funding is available, it is hoped that the entire span will be replaced and the overall bridge elevated to prevent future water damage. Bridge inspections, maintenance and repairs are funded through the US DOT's Federal Lands and Highways Program.

- **Toms Cove Recreational Beach Access and Parking**

Four parking areas with a crushed shell surface provide a minimum of 961 spaces for day-use visitors at Toms Cove Recreational Beach. Capacity is sufficient for most days of the year, although demand occasionally exceeds capacity on peak summer days, resulting in temporary closures lasting from 30 minutes to four hours, typically between the hours of 11:00 AM and 3:00 PM. In 2009, CNWR reported thirteen closures due to parking areas reaching capacity.

Maintenance of the beach parking areas is a major activity supported by NPS operations funds as well as, in part, by CNWR entrance fees. The lots require routine maintenance twice weekly from April through November and weekly from December through March. Maintenance generally consists of removing wind-blown or over-washed beach sand, filling washouts, smoothing washboard in the parking areas and on the access road, and adding and leveling crushed shell.

Located on a narrow strip of sand adjoining the beach, the parking areas are frequently overwashed during coastal storms (table 3.10). Damage from erosion and sand deposition results in closures until repairs can be completed. Time needed for storm repairs has varied from two weeks to three months. Repairs have ranged from fixing washed-out parking areas and road to total relocation of parking lots and roads to the west.

In response to repeated storm damage at Toms Cove, since 2000 the NPS has implemented a new management strategy, shifting from permanent facilities that can be damaged by storms to temporary facilities that can be removed to a safe location on the mainland in advance of storms.

- **Access to Former Assateague Beach U.S. Coast Guard Station.**

Public access to the former coast guard station occurs primarily by boat. Coastal storms and moving sand have destroyed the one-lane asphalt road previously used for access by the public and staff. OSV access is possible at times, but is subject to periodic long-term closures to protect piping plover (*Charadrius melodus*) habitat. NPS offers kayak tours from Toms Cove that include a stop at the site.

Table 3.10 Storm Damage to Toms Cove Recreational Beach Facilities (1991 through 2011)

Storm Date	Type of Storm	Storm Effects	Repair Costs
October 31, 1991	northeaster	• extensive damage to facilities and infrastructures	>$1.2 million
January 4, 1992	northeaster	• extensive damage to facilities and infrastructures	(included in above)
September 25, 1992	northeaster	• shoreline erosion and damage to artificial dunes	no records
December 10, 1992	northeaster	• shoreline erosion and damage to artificial dunes	no records
August 31, 1993	Hurricane Emily	• shoreline erosion and damage to artificial dunes	no records
March 2-3, 1994	northeaster	• artificial dunes breached in several locations	no records
September 22, 1995	coastal storm	• shoreline erosion and damage to artificial dunes	no records
November 18, 1995	Hurricane Gordon	• shoreline erosion and damage to artificial dunes	no records
September 4, 1996	Hurricane Eduardo	• shoreline erosion and damage to artificial dunes	no records
October 8, 1996	Tropical Storm Josephine	• shoreline erosion and damage to artificial dunes	no records
January 27, 1998	northeaster	• extensive damage to facilities and infrastructures	>$1.0 million
February 5, 1998	northeaster	• extensive damage to facilities and infrastructures	(included in above)
August 26, 1999	Hurricane Dennis	• shoreline erosion and damage to artificial dunes	no records
September 18, 1999	Hurricane Floyd	• shoreline erosion and damage to artificial dunes	no records
January 15, 2003	northeaster	• shoreline erosion and damage to artificial dunes	$157,700
September 18, 2003	Hurricane Isabel	• extensive damage to facilities and infrastructures	$477,400
August 24, 2006	Hurricane Ernesto	• shoreline erosion and damage to artificial dunes	$746,200
October 6, 2006	coastal storm	• shoreline erosion and damage to artificial dunes	(included in above)
September 6, 2008	Hurricane Hanna	• shoreline erosion and damage to artificial dunes	$196,900
November 12, 2009	Hurricane Ida	• damage to facilities and parking infrastructure	$343,800
August 27, 2010	Hurricane Irene	• damage to facilities and parking infrastructure	$724,100
October 29, 2012	Hurricane Sandy	• damage to facilities and parking infrastructure	$1,286,000

3.13 Visitor Use and Visitor Experience

3.13.1 VISITOR USE

- **Visitation and Visitor Profile**

Annual Visitation. During the first two decades of Assateague Island National Seashore – from 1967 to 1987 – the number of visitors to the seashore grew rapidly from 0.7 million to a peak of 2.3 million (table 3.11). The seashore then experienced a 13-year decline in visitation during which the number of people visiting dropped by 30 percent to a low of 1.8 million in 2000. Since 2000 visitation has again grown and currently hovers around 2.0 to 2.2 million annually. Approximately 60 percent of visitation occurs at the Toms Cove area in Virginia and 40 percent of the visitation occurs in Maryland.

Seasonal Visitation. Summer and early fall is the time of year when the most people visit the seashore (table 3.12). Approximately two-thirds (68%) of the visitation occurs in June, July, August, and September. July and August are busiest, with 20 to 23 percent of the visitors experiencing the seashore during the warmest summer months. The quietest time at the seashore occurs during the months of December through February.

Visitor Profile, Group Size and Length of Stay. A visitor survey conducted at the seashore in the summer of 2006 provides information regarding visitor demographics, motivations, expectations, interests, and needs (Eppley Institute 2007). Following is a summary of findings based on the responses received (Eppley Institute 2007):

- 74 percent of visitor groups were families with an average group size of five people. The average age was approximately 46-years-old. Over 97 percent identified their race as white.
- Approximately 56 percent of the respondents reported either a bachelor's degree or graduate degree. An additional 26 percent of respondents had completed at least some college coursework.
- 77 percent of the visitors had visited the seashore at least once before. 11 percent were local visitors, 87 percent were not local, and 1.5 percent were international.
- 49 percent of the respondents purchased a weekly pass. 27 percent reported having an annual pass, while 24 percent reported purchasing no pass.
- 80 percent of the respondents planned to see horses during their visit. 79 percent also planned to visit the beach.
- 52 percent of respondents indicated their primary reason for visiting the area was to visit Assateague. 18 percent indicated Ocean City, Maryland was the primary reason for their visit to the area.
- Over 60 percent of the respondents indicated that they visited the seashore more than one day on their most recent trip. Of those who did not visit more than one day, the average length of stay was approximately ½ day. For those who did visit more than one day, the average number of days visited was 4.6.

Assateague Island National Seashore
Fundamental Values – Visitor Experiences at the Seashore

The natural resources of the seashore provide visitors with a wide variety of active and passive recreational and educational opportunities. Expansive seascapes of ocean and bay, panoramic views, natural sounds, inviting waters, ocean breezes, and dark night skies provide a dramatic setting for an exceptional seashore experience. Visitors have the opportunity to experience the seashore in a variety of ways from walking on the beach to counting the stars by a camp fire, and from ranger guided educational activities to self-guided explorations.

Table 3.11

Assateague Island National Seashore
Total Visitation
(1967-2014)

Year	Total Visits
1967	738,700
1970	1,648,100
1975	1,885,800
1980	1,967,525
1985	2,304,906
1990	2,050,593
1995	1,928,397
2000	1,810,501
2001	1,897,634
2002	2,117,458
2003	2,020,666
2004	2,048,789
2005	1,996,502
2006	1,932,817
2007	2,110,918
2008	2,011,438
2009	2,129,658
2010	2,106,090
2011	2,105,419
2012	2,154,859
2013	2,056,828
2014	2,170,681

Source: NPS 2015b

Table 3.12 Assateague Island National Seashore – Visitor Use Statistics (2000 – 2014)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Main Visitor Center	261,738	258,652	243,929	203,371	214,115	243,674	267,631	272,851	272,164	283,226	256,252	214,478	236,278	228,545	142,314
Toms Cove Visitor Center	80,730	104,082	135,509	134,771	122,742	108,816	85,007	71,603	57,368	70,989	79,156	60,268	85,793	65,593	68,502
Bus Visitors	30,330	30,060	28,890	25,830	22,680	24,120	54,990	55,665	84,690	48,330	44,460	55,710	45,360	44,460	46,395
Oversand Vehicles	79,001	78,984	58,308	51,104	53,687	53,899	39,811	35,115	38,903	44,198	44,248	51,981	36,856	34,391	48,170
Horseback Riders	6,659	5,224	598	385	621	1,778	2,658	2,974	3,042	2,713	3,232	3,522	4,457	3,725	3,893
Tent Campers	52,629	59,280	52,354	49,379	60,476	80,738	54,882	52,742	49,114	51,779	39,523	35,928	39,185	35,782	38,428
RV Campers	17,958	19,881	18,968	17,579	22,204	21,171	22,098	22,009	20,121	23,404	23,228	22,130	22,878	17,986	21,515
Backcountry Campers	2,241	2,609	3,005	2,048	2,681	2,014	2,101	2,125	1,991	2,063	2,249	2,100	4,299	1,584	2,034
Miscellaneous Campers	14,221	13,603	13,143	10,254	11,037	12,338	16,495	26,546	24,329	35,435	17,461	14,550	14,618	15,142	15,915
Visitors on Commercial Vessels	Na	Na	Na	Na	Na	Na	Na	Na	31,368	30,795	31,075	28,006	23,101	26,865	29,605

Source: NPS 2015b

3.13.2 VISITOR ACTIVITIES AND RELATED FACILITIES

- **Beachcombing, Swimming and Surfing**

Assateague Island's 37 miles of beaches are some of the East Coast's most beautiful beaches, drawing visitors from throughout the country and the world who enjoy beachcombing, swimming, surfing, and sunbathing. Going to the beach and all the activities associated with a day at the beach is the experience that 80 percent of visitors report as a primary reason for their visit to the seashore (Eppley Institute 2007). Beaches throughout the seashore are open for public use, except for periodic closures of certain areas during the breeding season for protected species, such as Piping Plover. Closures vary from year-to-year depending upon where breeding activity occurs. During the summer, lifeguard-protected beaches are provided at Toms Cove in Virginia and at North Beach in Maryland; nearby parking for South Ocean Beach (MD), North Ocean Beach (MD), and the Toms Cove Beach (VA) enables relatively easy access for visitors to the beach.[1] At each day-use parking area there is a bathhouse with rinse-off showers, changing stalls, toilets, and drinking water. On many summer afternoons, particularly on weekends, demand for parking at the beach exceeds capacity. Experiencing remote beaches on the island is possible by hiking or by oversand vehicle within designated OSV use areas in Maryland and Virginia (see Driving on the Beach).

[1] *Additional lifeguard-protected beach facilities are available at Assateague State Park which is owned and operated by MD DNR.*

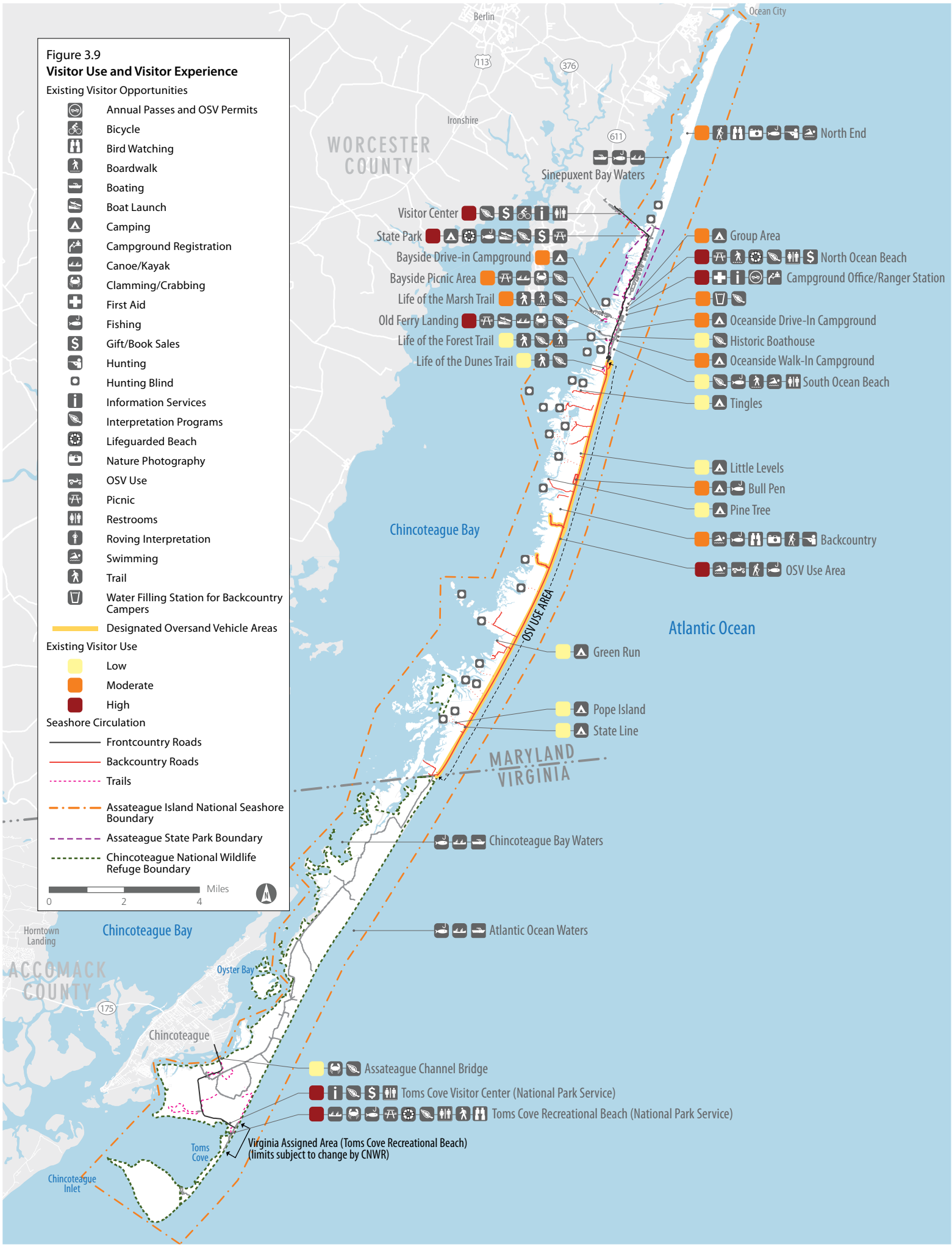


Figure 3.9
Visitor Use and Visitor Experience
Existing Visitor Opportunities
Annual Passes and OSV Permits
Bicycle
Bird Watching
Boardwalk
Boating
Boat Launch
Camping
Campground Registration
Canoe/Kayak
Clamming/Crabbing
First Aid
Fishing
Gift/Book Sales
Hunting
Hunting Blind
Information Services
Interpretation Programs
Lifeguarded Beach
Nature Photography
OSV Use
Picnic
Restrooms
Roving Interpretation
Swimming
Trail
Water Filling Station for Backcountry Campers
Designated Oversand Vehicle Areas
Existing Visitor Use
Low
Moderate
High
Seashore Circulation
Frontcountry Roads
Backcountry Roads
Trails
Assateague Island National Seashore Boundary
Assateague State Park Boundary
Chincoteague National Wildlife Refuge Boundary
Miles
0
2
4
Berlin
Ocean City
113
376
611
Ironshire
WORCESTER COUNTY
North End
Sinepuxent Bay Waters
Visitor Center
State Park
Bayside Drive-in Campground
Bayside Picnic Area
Life of the Marsh Trail
Old Ferry Landing
Life of the Forest Trail
Life of the Dunes Trail
Group Area
North Ocean Beach
Campground Office/Ranger Station
Oceanside Drive-In Campground
Historic Boathouse
Oceanside Walk-In Campground
South Ocean Beach
Tingles
Little Levels
Bull Pen
Pine Tree
Backcountry
OSV Use Area
Chincoteague Bay
Atlantic Ocean
OSV USE AREA
Green Run
Pope Island
State Line
MARYLAND
VIRGINIA
Chincoteague Bay Waters
Atlantic Ocean Waters
Horntown Landing
Chincoteague Bay
ACCOMACK COUNTY
Oyster Bay
175
Chincoteague
Assateague Channel Bridge
Toms Cove Visitor Center (National Park Service)
Toms Cove Recreational Beach (National Park Service)
Toms Cove
Virginia Assigned Area (Toms Cove Recreational Beach)
(limits subject to change by CNWR)
Chincoteague Inlet

Assateague Island National Seashore
Other Important Resources – Horses

Horses have been present on Assateague Island for hundreds of years. The seashore provides a unique opportunity to view wild horses in a natural setting, and a majority of visitors indicate that seeing horses is one of the primary reasons for visiting Assateague Island.

- **Viewing Horses**

Assateague Island's wild horses attract thousands of visits to the seashore. Seeing horses is the experience that 80 percent of visitors report as a primary reason for their visit (Eppley Institute 2007). Two herds of horses live on Assateague Island, separated by a fence at the boundary between Maryland and Virginia. The horses have a well-developed social structure and are organized into bands of two to twelve animals, each band occupying a home range generally within the island's marshes close to their best food sources. In Maryland, the horses roam freely and are often seen around roads and campgrounds and from the Life of the Forest and Life of the Marsh Trails. In Virginia, they are seen in Black Duck Marsh from observation platforms along Beach Road and the Woodland Trail.

The NPS owns the Maryland herd which it manages to protect long-term herd health and viability, to protect characteristics such as their free-roaming nature, and to protect the seashore's habitat health and ecosystem function (NPS 2008a). The Chincoteague Volunteer Fire Company owns and manages the Virginia herd, which is allowed to graze on Chincoteague National Wildlife Refuge through a permit issued by the FWS. Each year, horses from the Virginia herd are rounded up and foals are sold at the Pony Penning and Auction held in late July – an event that draws thousands of visitors to the town of Chincoteague and the seashore.

- **Driving on the Beach**

Oversand vehicle enthusiasts and other beach goers can access approximately 15 miles of the seashore's beaches within the designated OSV use area in Maryland and Virginia. In recent years anywhere from about 30,000 to 50,000 visitors have explored the seashore's beaches and enjoyed beach recreation activities by driving on the beach. In general, approximately 23 percent of OSV users are interested in surf fishing and 10 percent are interested in going to the beach to swim or surf (Eppley Institute 2008). Most OSV users spend many days each year at the beach with two-thirds visiting more than ten times; 13 percent visit more than 50 times a year (Eppley Institute 2008). The OSV use area encompasses the beach area below the winter storm berm and east of a designated line marked by black and white posts. Vehicles must stay on marked oversand vehicle routes. All sand dunes and vegetated areas are closed, even those within a designated OSV use area. Partial or total closure of the OSV use area to all vehicle, boat, and pedestrian use can occur during the nesting season for protected species – particularly the piping plover (*Charadrius melodus*). Permits are required for all vehicles. The number of vehicles allowed at any one time within the OSV use area is limited to 145 in Maryland and 48 in Virginia (18 when Toms Cove hook area is closed due to bird nesting). When these limits are reached a closure becomes effective, and vehicle access is managed on a one off/one on basis. In Virginia, visitors with a valid overnight fishing permit can remain after hours. In Maryland, overnight parking on the beach is prohibited except for those who are actively engaged in fishing. Sleeping is strictly prohibited. Self-contained vehicles are allowed to park overnight within a

designated area (known as the Bull Pen) if they are equipped with an approved toilet and permanently installed waste storage tank capable of holding two days volume of waste for each person remaining in the area overnight.

- **Camping at the Beach**

Seashore camping at Assateague has been the focus of a family vacation experience for many visitors since the seashore was established. Approximately 15 percent of visitors indicated that they planned to camp during their visit (Eppley Institute 2007). Annually for the past ten years an average of approximately 82,000 visitors camped at NPS campgrounds, of which 72 percent camped in tents and 28 percent camped in recreational vehicles. NPS operates campgrounds in Maryland at Bayside and Oceanside, with some sites available year-round.[1] Oceanside offers approximately 40 drive-in sites for tents, trailers, and recreational vehicles (no hookups) and approximately 60 walk-in sites located 100 to 200 feet from centralized parking areas; each site has a picnic table and an upright grill. Bayside offers approximately 50 drive-in sites for tents, trailers, and recreational vehicles (no hookups); each site has a picnic table and ground fire grill. Other camping facilities are "primitive," including toilets, cold water showers, and drinking water. Organized clubs and affiliated groups are able to use the five group campsites at Oceanside. Group campsites are designed for tent-only use and are walk-in, with a centralized parking area located 100 to 200 feet from each campsite. A reservation system is in place for all campsites from April 15th through October 15th. During summer months the campgrounds are typically full every night.

- **Backcountry Camping**

Backcountry camping is popular with some visitors who want to explore the seashore by foot, canoe, or kayak, and who seek a more primitive experience. October through March – when biting insects are less bothersome – is the preferred time of year for backcountry exploration. Campsites include two oceanside sites in the open dunes that are open year-round and four bayside sites set among pine forests that are open year-round, except for a brief period in the fall during hunting season. Backcountry camping is not permitted outside these sites. Each campsite has a chemical toilet and picnic table but no drinking water. Bayside sites also each have a fire ring. Distance to the backcountry sites from the Sinepuxent Ranger Station in Maryland is 2.5 to 13 miles; from the Toms Cove Visitor Center in Virginia the distance is 12.5 to 22.5 miles. On average 2,500 visitors have camped at backcountry campsites annually over the past ten years (NPS 2013b). Pine Tree is most popular with backcountry users.

- **Fishing**

Public fishing within the seashore boundaries is recognized as an appropriate recreational activity and is authorized in the legislation that established the seashore

[1] *Additional camping facilities are available at Assateague State Park which is owned and operated by MD DNR.*

(Public Law 89-195) (appendix A). Assateague Island offers some of the best surf fishing on the Mid-Atlantic coast and because large stretches of beach can be accessed by car, it is very popular with anglers. Many popular gamefish occur in the waters near the island, including croaker, bluefish, sea trout, and drum. Anglers can fish from all of the seashore beaches that are not lifeguarded beaches. Overnight fishing is permitted. While fishing takes place during all times of the year, the best seasons are late spring, early summer, and early fall. Flounder fishing is usually good from April through October. Fishing the back bays of the island is also popular.

- **Shellfishing and Shell Collecting**

The back bays of Assateague Island offer some of the best opportunities for recreational shellfishing along the coast of Maryland and Virginia. Many local areas of the seashore are subject to light shellfishing pressure. The most accessible and popular areas are accessed from the Old Ferry Landing and the Bayside Drive Picnic Area, where a concession offers standard clam rakes for rent. Many visitors discover other areas of the back bays as they wade the shallow waters crabbing, raking for clams, and searching for mussels. Clamming requires visitors to wade further to reach outlying areas where clams are more abundant. In contrast, mussels are more easily reached at the edges of most saltmarshes. Crabs are generally ubiquitous. Some crabbers also fish from small boats, exploring the back bays more widely. Dockside crabbing takes place at Old Ferry Landing and on the mainland at the state park crabbing dock and the South Point boat ramp. Crabbing is not permitted from the Assateague Bridge and Sheepshead Bridge in Virginia or the Verrazano Bridge in Maryland.

Shelling is also very popular among seashore visitors. 33 percent of visitors indicated that they planned to look for seashells on their trip (Eppley Institute 2007). The most productive beaches for shelling are on the southern tip of Toms Cove Hook in Virginia or at the north end in Maryland. After a storm is the best time for shelling.

- **Hiking**

In Maryland, one-half mile self-guiding loop walks are available on the Life of the Marsh, Life of the Forest, and Life of the Dunes Trails. Hikers can also enjoy miles of undisturbed beach hiking. Visitors can hike north to the Ocean City Inlet at the north end or south within the OSV use area. Those hiking to backcountry campsites walk on the beach, crossing the dunes by way of designated routes to campsites.

- **Bicycling**

In Maryland, cyclists can use 4.6 miles of paved bike path beginning at the visitor center on the mainland, crossing the Verrazano Pedestrian Bridge, and continuing on the paved bike path along Bayberry Drive and Oceanside Campground. Summer bike rentals are available at Bayside Drive. In Virginia about half of the refuge trails are paved for bicyclists. A bike path leads from the town of Chincoteague to the refuge with routes to the Refuge Visitor Center and the Toms Cove Visitor Center.

- **Birding**

Assateague Island is one of the finest places for birding on the East Coast, attracting many visitors particularly during the spring and winter months. Approximately 20 percent of visitors to the seashore say that birding is one of the reasons for their visit (Eppley Institute 2007). Spring is a good time to see large number of migrating shore birds, song birds, and other transient species. In the summer the marshes along the back bays host a variety of herons, egrets, and other wading birds. Late summer brings migrating shorebirds and peregrine falcons to the island. Thousands of water fowl winter at the seashore. While birding is possible on foot and by vehicle, many bird watchers travel by private boat in the back bays or more frequently as part of a commercial tour.

- **Boating**

The protected waters of Chincoteague and Sinepuxent Bays within the seashore are ideal for boating. In Maryland, the Bayside and Old Ferry Landing areas are the focal points for canoeing and kayaking, offering access to the back bays for visitors who bring their own boats and providing canoe, kayak, and paddle board rentals for others. Water trail maps are available that guide visitors interested in exploring the coastal bay and saltmarsh flats around Little Egging Island near Bayside and Old Ferry Landing. Guided canoe trips also leave from Bayside. Paddlers can explore the back bays in Maryland, departing from Bayside or Old Ferry Landing on the island or from mainland access sites at Ocean City Harbor, Assateague State Park, or Public Landing. Multi-day trips are possible by using the four canoe-in backcountry campsites which are marked by signs located on the marsh edge. Many visitors travel by power boat from Ocean City to the island, landing at the north end where they picnic and enjoy the beach. Power boats can be rented in Chincoteague or Ocean City.

- **Horseback Riding**

In recent years approximately 2,000 to 3,500 horseback riders annually have enjoyed riding on the seashore's beaches in Maryland and Virginia (NPS 2013b). Horseback riding is permitted on the beach in Maryland within the oversand vehicle (OSV) use area each year from October 9th through May 14th. During other periods riding is not permitted due to the presence of biting insects known to spread disease, such as equine infectious anemia. Riders check in and park at the North Beach Ranger Station. Horses must be led to the top of the dune, where riders can then mount and ride south on the beach. Riders can use the 1.5 mile stretch of beach between the ranger station and the beginning of the OSV use area only as a corridor for entrance and exit. Horse camping is permitted early-October through mid-May within a designated horse camping area.

In Virginia, horseback riding is permitted on the beach within the OSV use area at all times of the year, except during migratory bird nesting periods when the OSV use area is subject to closures. Horse trailers park within a designated parking lot.

- **Hunting**

Public hunting within the seashore boundaries is recognized as an appropriate recreational activity and is authorized in the legislation that established the seashore (Public Law 89-195) (appendix A). The regulations for hunting within the seashore are designed to provide a meaningful and safe experience for hunters. State laws governing hunting on public lands in Maryland and federal regulations (Title 36 CFR) apply to both the lands and the waters within the seashore boundaries. Hunting is legal only in specifically designated areas of the seashore. Hunting seasons and regulations are in place for deer (white-tailed deer (*Odocoileus virginianus*) and sika deer (*Cervus nippon*)); upland game and furbearers (fox); webless migratory birds (doves); and waterfowl (ducks, coots, mergansers, sea ducks, geese, and brant). Hunting for squirrels is prohibited due to the potential presence of the endangered Delmarva Peninsula fox squirrel (*Sciurus nigra cinereus*).

Areas open for hunting north of Assateague State Park are accessible by boat and foot only. Areas open for hunting south of the Maryland developed area are generally accessible by walking from the OSV use area or by walking from the Life of the Dunes Trail (creating a conflict between visitors walking on the trail and hunters carrying guns). Within this area access is also permitted by vehicle to one backcountry campsite during hunting season for deer. Waterfowl hunting occurs from a network of permanent blinds, portable blinds placed in designated sites, and anchored boats.

Table 3.13

Assateague Island National Seashore
Accessible Facilities

Administrative Offices
- Seashore Headquarters Complex
- Sinepuxent District Ranger Station

Visitor Centers
- Assateague Island Visitor Center
- Toms Cove Visitor Center

Parking Facilities
- all parking areas at developed seashore facilities

Restrooms
- all comfort stations at developed park facilities
- portable toilets at Toms Cove Beach

Beach Access
- boardwalk to North Beach from the parking area

Developed Campgrounds
- one accessible site at Oceanside Campground
- one accessible site at Bayside Campground

Developed Picnic Facilities
- hardened surface, accessible picnic tables, and accessible grills available at developed picnic facilities

Trails
- Life of the Marsh Trail
- Life of the Forest Trail

Hunting Facilities and Program
- North End hunting site

3.13.3 OPPORTUNITIES FOR VISITORS WITH DISABILITIES

The NPS is committed to implementing all practicable efforts to make NPS facilities, programs, services, employment, and meaningful work opportunities accessible and usable by all people, including those with disabilities. Accordingly, most administrative offices, some camping facilities, and most interpretive and visitor service facilities are accessible (NPS 2006c). Undeveloped areas, such as those outside the immediate influence of buildings and roads, will not normally be modified (NPS 2006c).

In accordance with NPS policy, the seashore has made numerous improvements to seashore facilities in recent years to enhance accessibility. Today most developed visitor facilities are generally accessible to visitors and employees with disabilities (table 3.13). Of primary interest to disabled visitors is access to the beach. A boardwalk provides access to the North Ocean Beach; although visitors report that the long distance to the beach from the parking area makes it difficult to get to the beach and once there it is impossible to maneuver a wheelchair on the sand (Eppley Institute 2007). Beach-compatible wheelchairs are available on a first-come first-served basis free-of-charge at North Beach and Toms Cove recreational beaches. In recent years the seashore has made available a deer hunt in the developed area for persons with disabilities. Interpretive programs offered at visitor contact facilities and some other facilities are wheelchair accessible.

3.13.4 COMMERCIAL SERVICES, SPECIAL USES, AND TOURS

- **Commercial Services**

In July of 2014 a 10 year concessions contract was awarded to Maryland Coastal Bays Program/SuperFun Ecotours Joint Venture, trading as Assateague Outfitters. The managing partners are the executive director of Maryland Coastal Bays Program (a local non-profit organization) and the two owners of SuperFun Ecotours. In its first season of operation, the concessioner served 16,468 visitors at its two locations within the Maryland developed area.

The Kayak Shed at the bayside day use area provides rental kayaks/canoes, paddleboards, bicycles, and clam rakes; kayak tours; and retail items, such as camping supplies, snacks, firewood, bait and ice. The bayside location served 7,783 visitors in 2014.

The Beach Hut at north beach day use area served 8,685 visitors in 2014. The Beach Hut is a small retail outlet primarily for beach goers that provides items such as snacks, gifts, educational materials, beach and camping supplies, firewood, ice, and beach chair rentals.

The Assateague State Park also has a concessioner providing gifts, snacks and prepared foods.

In 2014 there were 39 out-of-park commercial use authorizations operating to provide commercial services to visitors in the Park, such as guided kayak tours, boat tours, and waterfowl hunting. Ten of these were issued to new service providers in 2014, and ten expired permits were reissued in 2014. A total of 2,657 packages were provided to 50,167 people in Maryland and in the waters around the island in Virginia in 2014.

- **Special Uses**

In 2014 the Park issued 4,945 Oversand Vehicle Permits for use in MD and an additional 315 permits for use only in Virginia, for a total of 5,260 permits.

In 2014 there were 238 waterfowl hunting permits issued for use in Maryland, and 368 permitted deer hunters signed in, including 18 for a special hunt for persons with disabilities. Only 2 permitted upland game hunters signed in.

Another 60 special use permits were issued in 2014 for a variety of uses, including special events, such as beach parties/bonfires, weddings, fishing tournaments and the AMSA Camporee.

3.13.5 VISITOR ORIENTATION, INTERPRETATION, AND EDUCATION

- **Pre-Visit Information and Orientation**

Visitors planning their first trip to the seashore primarily rely on information obtained from friends and relatives who have been to Assateague Island, travel guides, tour

books, and the internet (Eppley Institute 2007). Other sources of information used less frequently include tourist information centers outside the seashore, pre-visit calls to the seashore office, media, newspapers, county visitors bureaus, and school programs (Eppley Institute 2007). The seashore website, used by approximately 19 percent of visitors in advance of a trip, provides directions to the seashore and includes a variety of information useful for trip planning, such as seashore activities, interpretive programs, downloadable maps and brochures, rules and regulations, and general seashore management news.

- **On-Site information and orientation**

Visitor Contact Facilities. Seashore staff manages three visitor contact facilities. Each is open year-round. The Assateague Island Visitor Center is the seashore's primary visitor center, located on MD Route 611 on the mainland side of the Verrazano Bridge entrance. The Maryland District Ranger Station/Campground Office, located on the island immediately beyond the entrance station, is the primary contact station for campers, hunters, backcountry travelers, and OSV users. In Virginia, the Toms Cove Visitor Center, adjoining the beach parking area, provides information, and interagency passes to beachgoers and others.

Park Publications. Most visitors to the seashore rely on the official map and guide for basic information on attractions, recreational opportunities, and travel directions. Special topic brochures address resource concerns such as wild horse viewing safety, OSV use, camping, backcountry use, horseback riding, hunting, swimming safety, and other subjects.

Information Boards. Information boards located at attractions and facilities throughout the seashore provide site-specific orientation, safety information, rules and regulations, information on activities and events, and interpretive information.

Signage. The NPS, state transportation agencies, and the FWS cooperate to provide signage on regional roadways and on local roads that provide access to the seashore entrance in Maryland and in Virginia.

- **Interpretive Media**

Visitor Center Exhibits. The Assateague Island Visitor Center and the Toms Cove Visitor Center include exhibits, a touch tank, and marine aquariums. A film about the wild horses of the island is shown at the Assateague Island Visitor Center, which also offers expanded exhibits describing barrier island dynamics, island ecology, and cultural history.

Wayside Exhibits. Wayside exhibits are in place at trail heads, along trails, at visitor centers, at beach access sites, some cultural resource sites, and elsewhere in the seashore.

Publications. A variety of publications provide interpretive information for natural resource areas and cultural resources. Brochures include wildlife viewing, horse brochures, nature trail guides, resource protection, surf fishing, crabbing and clamming, local area brochures, and activity publications.

- **Interpretive Programs**

Walks and Talks. Ranger-guided programs are held throughout the year, with an emphasis on summer interpretive and recreational opportunities. Programs are publicized on the seashore website, social media, at visitor contact facilities, and on information boards. Full immersion programs such as kayaking, bay seining, crabbing, and surf fishing programs can be found in both the Maryland and Virginia districts. Beach and marsh walks, children's programs, campfire programs, and bird walks are also popular. During July and August 2014, almost 14,490 visitors received on-site ranger-led programs, with the popular aquarium talks reaching approximately 2,600 people.

Informal Contacts (Roving Rangers). Roving interpretation occurs throughout the developed area in Maryland and in Virginia along the Toms Cove lifeguarded beach, parking lot closure areas, and on some refuge trails. These are excellent opportunities to increase visitor understanding and appreciation of the seashore. In 2014 rangers, volunteers, and Coastal Stewards (a youth group) provided informal interpretive experiences for approximately 24,700 visitors.

Junior Ranger Program. The Junior Ranger Program is available for families who visit the seashore. The booklets can be picked up at any seashore contact facility and provide youngsters ages 6 and up an enjoyable and meaningful way to explore the resources and history of the seashore. Upon completion of the program, Junior Rangers receive a certificate and patch. In 2014 approximately 1,800 young people participated in this program.

Discovery Trailer. The Discovery Trailer enables seashore staff to create mobile events for schools, special request programs, and events. The trailer can transport all the equipment needed for activities and programs. The Discovery Trailer is covered with an Assateague mural designed by local children and makes a great backdrop for marine life exhibits and programs. It can be seen at Junior Ranger activities, Maryland Coast Day, and similar events.

Special Request Out-of-Seashore Programs. Special requests for off-site programming fall into several categories. Rangers can be called upon to speak on resource topics for special interest groups such as garden clubs, Kiwanis, boat clubs, and others. They can be requested to present at workshops, and along with volunteers and Coastal Stewards represent the NPS at local events.

- **Educational Programs**

Assateague Island National Seashore provides curriculum-based education programs meant to enhance classroom instruction and support Maryland and Virginia Standards

of Learning. Educational opportunities are also provided for adult life-long learners. Programs employ classroom activities as well as hands-on, sensory-based activities and encourage problem-solving and critical thinking. They convey stewardship concepts and the mission of the NPS. Programs take place on the island and in local communities.

Curriculum-based Educational Program. The seashore has worked with local schools since 1986 to present curriculum-based educational programming for pre K through 12th grade students. In Maryland, environmental literacy courses are now required as part of the educational experience. Experiential activities include beach explorations, marsh and bay studies, and laboratory exercises. The new Climate Change and Coastal Bays Program (CCCB) engages high school students with hands-on immersive learning activities. Field studies enhance student understanding of climate change science, island geomorphology, chemical nutrient cycling, sea level rise modeling, and coastal bays ecology. The majority of curriculum-based education for pre K through 12th grade students takes place in the Maryland District.

Continuing Education. Continuing education opportunities at the seashore take many forms. Life-long learners participate in programs offered through outreach, on-site activities and workshops, and as interns and volunteers, take part in authentic field activities alongside NPS staff. Teacher and informal educator workshops are also offered. Groups include Rhodes Scholars, nature clubs, birders, master naturalists, and those interested in barrier island dynamics and climate change.

Coastal Stewards Program. The Coastal Stewards Program is a youth partnership program. The Maryland Coastal Bays Program pays a small group of diverse young people from low income neighborhoods to sign up as NPS volunteers to work on and around Assateague. This is a work/education experience designed to provide authentic non-traditional work and education opportunities. Students learn about cultural and natural resource issues, take part in concentrated interpretive training, and provide informal interpretive contacts to the public under the guidance of paid staff. In 2013 the Coast Stewards presented stewardship messages to approximately 21,000 people on the island and during outreach events.

3.14 Socio-economic Environment

Adjoining the seashore, the two coastal counties of Worcester County, Maryland, and Accomack County, Virginia, are destinations for millions of visitors annually. Tourism is the region's number one industry, fueled in large part by Ocean City, Maryland's premier Atlantic oceanfront destination, attracting an estimated 10 million visitors each year. Complimenting Ocean City are the natural and cultural resources along the coast of Worcester and Accomack Counties that attract vacationers, fishermen, nature lovers, and others to the area – including Assateague Island National Seashore and the famous Assateague Island "wild ponies". Increasingly, the area is a retirement location for older Americans investing in new permanent homes or in second homes for seasonal use.

3.14.1 REGIONAL CONTEXT – WORCESTER AND ACCOMACK COUNTIES

- **Regional Context – Demographic Profile**

In 2010 approximately 84,618 people lived in the two-county coastal area adjoining the seashore (US Bureau of the Census 2011) (table 3.14). Over the past decade, growth continued in Worcester County, Maryland, while Accomack County lost residents. During the 10 years from 2000 to 2010 Accomack County experienced a net loss of 5,141 residents, resulting in a 13.4 percent decline in total population. In contrast approximately 4,911 residents moved into Worcester County during the last decade, resulting in 10.6 percent growth.

Table 3.14 Housing, Employment, and Income Overview – 2000 and 2010

	Worcester County (MD)	Accomack County (VA)	Total
POPULATION[1]			
2000	46,543	38,305	84,848
2010	51,454	33,164	84,618
Numerical Change	4,911	-5,141	-230
Percent Change	10.6%	-13.4%	-2.8%
HOUSING[2]			
2000 Housing Units	47,360	19,550	66,910
2010 Housing Units	55,749	21,002	76,751
Numerical Change	8,389	1,452	9,841
Percent Change	17.71%	7.43%	14.71%
EMPLOYMENT[2] (annual not seasonally adjusted labor force)			
2000	24,468	17,482	41,950
2010	24,389	18,667	43,056
Numerical Change	-79	1,185	1,106
Percent Change	-0.32%	6.78%	2.64%
INCOME[1]			
Median Household Income	$56,277	$39,638	

Source: [1] *U.S. Census Bureau 2011b* [2] *Virginia Department of Labor and Industry*

The two-county population is fairly old – in 2010 the median age in Worcester County was 48. 1 years and in Accomack County was 44.7 years. These median ages considerably exceed the median statewide ages of 38.0 years in Maryland and 37.5 years in Virginia, as well as the national median age of 37.2 years. Despite the older median age, there was a strong base of younger residents; about 26 percent of the two-county's population was under the age of 25. But those over the age of 55 represented 37 percent of all residents, leaving fewer people in the middle of the age profile.

Approximately one-quarter of residents were minorities in 2010. At that time about 75 percent were white, 20 percent were Black or African American, and 5 percent were other races. In 2010, 85 percent of adults over the age of 25 reported having a high

Table 3.15 Employment by Industry – 2010 Annual Average

	Worcester County (MD)		Accomack County (VA)		Total
	Number	%	Number	%	%
Total Employment	**22,950**		**12904**		
Government – Total	**3,754**	**16%**	**2,803**	**22%**	**18%**
Federal	262	1%	656	5%	3%
State	372	2%	388	3%	2%
Local	3,120	14%	1,759	14%	14%
Private Sector – Total	**19,196**	**84%**	**10,099**	**78%**	**82%**
Natural Resources and Mining[1]	70	0.3%	280	2%	1%
Construction	1,065	5%	471	4%	4%
Manufacturing	707	3%	3,202	25%	11%
Trade, Transportation and Utilities	3,988	17%	1,845	14%	16%
Information	114	0.5%	75	1%	1%
Financial Activities	1,106	5%	317	2%	4%
Professional and Business Services	1,133	5%	1,112	9%	6%
Education and Health Services	2,065	9%	1,137	9%	9%
Leisure and Hospitality	8,249	36%	1,320	10%	27%
Other Services/ Unclassified	699	3%	340	3%	3%

1 *also includes agriculture, fishing and hunting* *Source: MD LLR 2011; VA EC 2012*

school diploma and 23 percent reported also having degrees from four-year colleges. This is comparable to the national average of 85 percent and 28 percent, respectively.

- **Regional Context – Economic Profile**

As of December 2010, the two-county labor force included 35,854 workers, representing about 42 percent of the total population. Approximately 41 percent of the area's jobs were in services, leisure, and hospitality and retail trade. Another 18 percent were in the government sector. In Worcester County the tourism industry is stronger when compared to Accomack County, largely due to Ocean City. In contrast Accomack County has a stronger manufacturing sector, which composes 25 percent of the county's jobs compared to 3 percent in Worcester County. The natural resources sector including agriculture – historically the major industry for both counties – has declined to only 1 percent of total jobs. Household income varies widely between the two-county area. In 2010 Worcester County median income was $56,277 (8 percent over the national average) while in Accomack County median income was $39,638 (24% below the national average). Approximately 10 percent of Worcester County residents and 16 percent of Accomack County residents were living below the poverty level in 2010 (national average = 13.8%).

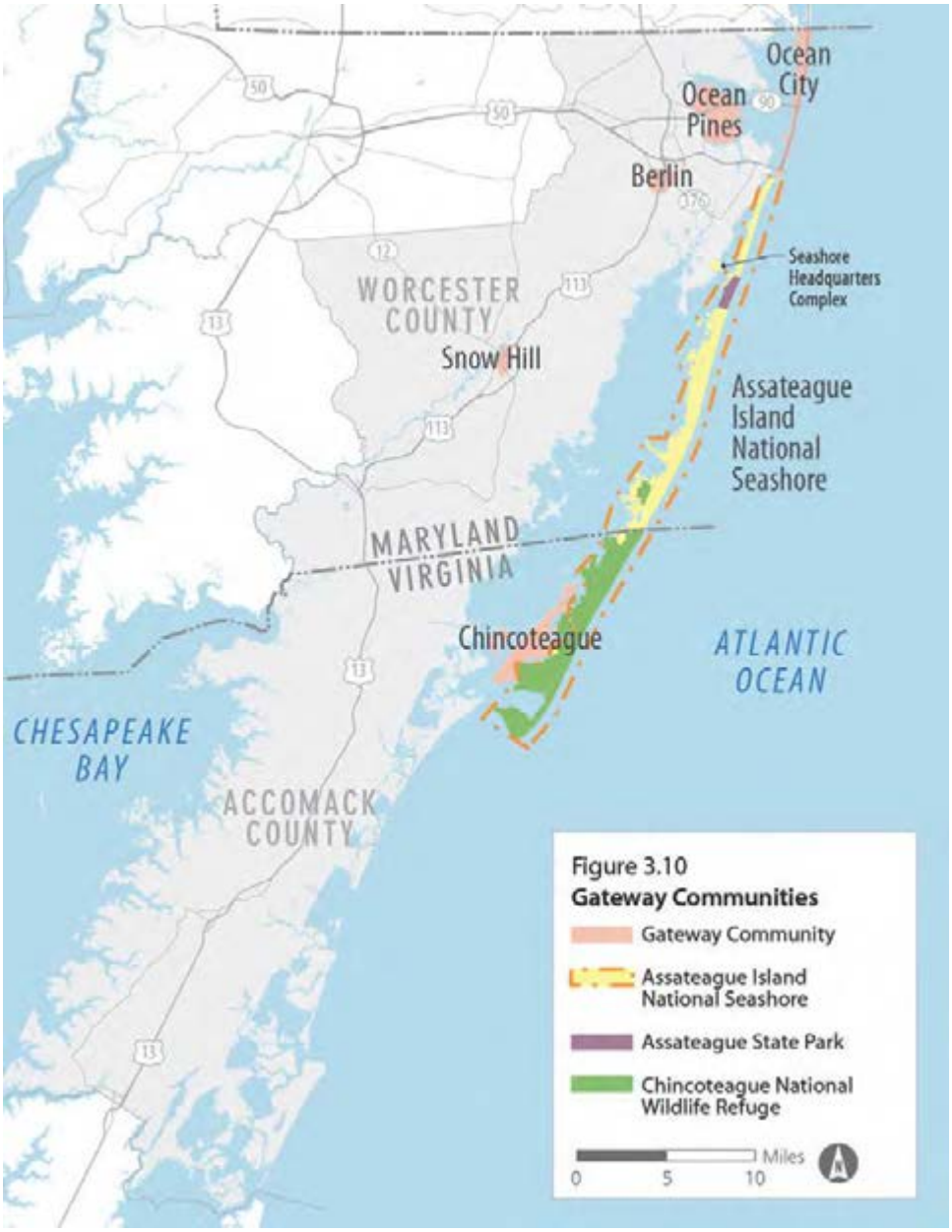
3.14.2 GATEWAYS TO THE SEASHORE

Six coastal communities are gateways to the seashore, each with a distinct character and different relationship to the seashore.

- **Berlin, Maryland**

Berlin is a small historic town that is both a designated Main Street Maryland community and an Arts and Entertainment District. The town is recognized for its traditional downtown, its historic architecture, and its locally-owned businesses. Since 2000, Berlin has experienced considerable change due to new residential development that has occurred in areas adjoining the downtown.

From 2000 to 2010 Berlin's population grew by 29 percent (994 new residents) and the number of housing units increased by 37 percent (526 new units). The community is generally a year-round community with relatively few seasonal housing units (only 3.7% in 2010), although there is a high percentage of rental units (41% in 2010). With a median age of 38.4 years (in 2010) Berlin is generally younger and families are generally larger with more children when compared to other gateway communities. Berlin's median household income from 2006 to 2010 of $51,004 was just below the national average of $51,900; during that period approximately 11.6 percent of the population was living below the poverty level. In 2010, 30 percent of the residents were minorities (Black, African American or Other). When compared to the rest of the country, the percentage of high school graduates was above average while the percentage of those who have some education beyond high school was below average.



- **Chincoteague, Virginia**

The town of Chincoteague is a small coastal community that attracts a million or more vacationers annually, many returning year after year to spend their summer holiday as seasonal residents, renters, or campers. Most visitors are drawn to Chincoteague by its small-town character, the fishing history and seafood, the nature-based experiences at Chincoteague National Wildlife Refuge, and the beaches and "wild ponies" of Assateague Island. From 2000 to 2010 Chincoteague's year-round permanent population decreased by 32 percent. Despite the loss of 1,376 residents, an additional 547 new housing units were built in the community during the same period. This marks

Table 3.16 Gateway Community Population, Housing and Employment Overview – 2000 and 2010

	Berlin (MD)	Chincoteague (VA)	Ocean City (MD)	Ocean Pines (MD)	Snow Hill (MD) Total
POPULATION[1]					
2000	3,491	4,317	7,173	10,496	2,409
2010	4,485	2,941	7,102	11,710	2,103
Numerical Change	994	-1,376	-71	1,214	-306
Percent Change	28.5%	-31.9%	-1.0%	11.57%	-12.7%
AGE PROFILE, 2010[1]					
Under 18	1,155	454	644	1,581	487
18-24	331	178	478	537	167
24-34	561	238	780	793	188
35-44	567	310	699	1,002	219
44-55	593	417	1,051	1,493	316
56-64	483	542	1,349	2,260	301
65+	795	802	2,101	4,044	425
Median Age	38.4	52.0	54.2	57.6	44.7
RACE[1]					
White	3,219	2,884	6,641	11,201	1,237
Black or African American	1,128	44	235	362	860
Other	291	103	335	295	57
HOUSING UNITS[1]					
2000	1,427	3,970	26,317	7,083	964
2010	1,953	4,517	30,119	8,870	1,005
Numerical Change	526	547	3,802	1,787	41
Percent Change	38.9%	13.8%	14.5%	25.2%	4.3%
AVERAGE HOUSEHOLD SIZE[1]					
2000	2.46	2.08	1.91	2.28	2.37
2010	2.55	2.06	1.84	2.14	2.32

Table 3.16 Gateway Community Population, Housing and Employment Overview – 2000 and 2010

	Berlin (MD)	Chincoteague (VA)	Ocean City (MD)	Ocean Pines (MD)	Snow Hill (MD) Total
HOUSEHOLD INCOME[1]					
less than $25,000	378	594	879	586	344
$25,000 - $49,999	371	370	1,107	1,445	208
$50,000 - $74,999	340	185	694	1,048	205
more than $75,000	454	444	1,224	2,025	203
Median Household Income	$51,004	$33,109	$49,000	$63,370	$40,313
Persons Living below Poverty Level	11.6	13.4	18.1	8.3	7.6
HOUSING TENURE[1]					
Owner-Occupied	999	1,070	3,852	4,649	494
Renter-Occupied	689	347	1,216	2,084	377
Seasonal Units as a % of Total Housing Units	3.7%	59.5%	74.2%	33.6%	0.9%
EDUCATIONAL ATTAINMENT[2]					
Population 25 Years and Older	2,809	2,529	6,131	9,188	1,808
Less than 9th Grade	6.7%	6.6%	1.8%	0.7%	5.0%
9th to 12th Grade, no diploma	8.1%	10.0%	6.5%	3.8%	13.5%
High School Graduate	37.0%	37.0%	27.1%	28.6%	41.9%
Some College, no degree	15.8%	15.1%	23.7%	21.3%	16.2%
Associate's Degree	10.7%	5.5%	8.2%	10.4%	3.2%
Bachelor's Degree	14.9%	12.1%	23.3%	22.3%	11.3%
Graduate or Professional Degree	6.8%	13.7%	9.5%	12.9%	9.0%

3 2010National Average Median Income = $51,900

4 2010 National Average for Percent Living Under the Poverty Level = 13.8%

Source: [1] *U.S. Census Bureau 2011b* [2] *U.S. Census Bureau 2011a*

an increasing trend toward seasonal residences; in 2010, 60 percent of the housing units were seasonal residences and one in four units was a rental. Most new homes were built or purchased by people who live permanently elsewhere, many of whom are older and retired or nearing retirement; some ultimately plan to live permanently in

Chincoteague while many others have purchased units as investment properties which they use part-time and otherwise rent whenever possible. In 2010, the average age was 52 years, much older than the national average of 37.2 years. From 2006 to 2010 Chincoteague's median income was $33,109 – well below the national average of $51,900; during that period approximately 13.4 percent of the population was living below the poverty level. In 2010 only 4 percent of the residents were minorities (Black, African American or Other). When compared to the rest of the country, the percentage of high school graduates was above average while the percentage of those who have some education beyond high school was below average.

- **Ocean City, Maryland**

Ocean City is a year-round resort that attracts 8 million vacationers annually who enjoy its 10 miles of beachfront, three-mile boardwalk, and huge array of lodging facilities, shops, and restaurants. Today Ocean City is a diverse community with a wide variety of residents and visitors. From 2000 to 2010 Ocean City's year-round permanent population declined slightly (-1%). Despite the loss of 71 permanent residents, an additional 3,802 new housing units were built in the community during the same period. This marks a continued increasing trend toward seasonal residences; in 2010, 74 percent of the housing units were seasonal residences and one in four units was a rental. Most new homes were built or purchased by people who live permanently elsewhere, many of whom are older and retired or nearing retirement; some ultimately plan to live permanently in Ocean City while many others have purchased units as investment properties which they use part-time and otherwise rent whenever possible. In 2010 the average age was 54 years, much older than the national average of 37.2 years. From 2006 to 2010 Ocean City's median income was $49,000 – slightly below the national average of $51,900; during that period approximately 18.1 percent of the population was living below the poverty level. In 2010, 8 percent of the residents were minorities (Black, African American or Other). When compared to the rest of the country, the percentage of high school graduates was slightly below average while the percentage of those who have some education beyond high school was well above average, reflecting the retiree population.

- **Snow Hill, Maryland**

Surrounded by farmland, Snow Hill is a small town along the Pocomoke River. It is the county seat of Worcester County and one of the oldest towns in Maryland. Still known for its agricultural and maritime history, Snow Hill today is emerging as an arts community on the Lower Eastern Shore. From 2000 to 2010 Snow Hill's year-round permanent population decreased by 13 percent. Despite the loss of 306 residents, an

additional 41 new housing units were built in the community during the same period. The community is generally a year-round community with very few seasonal housing units (only 1% in 2010), although there is a high percentage of rental units (43% in 2010). With a median age of 44.7 years (in 2010) Snow Hill – like its neighbor Berlin – is generally younger and families are generally larger with more children when compared to other gateway communities. Snow Hill's median household income from 2006 to 2010 of $40,313 was below the national average of $51,900; during that period approximately 7.6 percent of the population was living below the poverty level. In 2010 43 percent of the residents were minorities (Black, African American or Other). When compared to the rest of the country, the percentage of high school graduates was well above average while the percentage of those who have some education beyond high school was also above average.

- **Ocean Pines, Maryland**

The planned community of Ocean Pines, established in 1968, encompasses 3,500 acres of former farm and wooded land with nine miles of waterfront in Worcester County. Originally marketed as a summer retreat for retirees, Ocean Pines today offers housing and lifestyle options for all ages. From 2000 to 2010 Ocean Pine's population grew by 12 percent (867 new residents) and the number of housing units increased by 25 percent (1,787 new units). The community is a mixed community with approximately 2/3 year-round units and 1/3 seasonal units, although there is a high percentage of rental houses (31% in 2010). A median age of 57.6 years (in 2010) reflects Ocean Pines' early years when it was marketed as a retirement community. Median household income from 2006 to 2010 of $63,370 was well above the national average of $51,900; during that period approximately 8.3 percent of the population was living under the poverty level. In 2010 only 5 percent of the residents were minorities (Black, African American or Other). When compared to the rest of the country, the percentage of high school graduates was average while the percentage of those who have some education beyond high school was well above average.

3.14.3 ECONOMIC BENEFITS OF TOURISM

Maryland reports that in 2010, visitors to Worcester County spent $1,220.9 million during their visit, supporting 12,000 jobs in the tourism economy (Tourism Economics 2011) (table 3.19). Payroll paid by travel-related firms and directly attributable to local visitor spending was $390.5 million. Combined visitor spending and payroll expenditures generated $249.4 million in state and local sales tax revenues.

Virginia reports that in 2010, visitors to Accomack County spent $145.08 million during their visit, supporting 1,850 jobs in the tourism economy (US Travel Association 2011) (table 3.19). Payroll paid by travel-related firms and directly attributable to local visitor spending was $31.39 million. Combined visitor spending and payroll expenditures generated $6.95 million in state sales tax revenue and $4.15 million dollars in local sales tax revenues.

Table 3.17 Economic Impacts of Tourism (2010)

	Worcester County (MD)	Accomack County (VA)
Expenditures	$1,220.9 million	$145.08 million
Payroll	$390.5 million	$31.39 million
Employment	12,000	1,850
State and Local Tax Receipts	$249.4 millions	$11.1 million

Source: Tourism Economics 2011 (for Maryland), U.S. Travel Association 2011 (for Virginia)

3.14.4 ECONOMIC BENEFITS OF ASSATEAGUE ISLAND NATIONAL SEASHORE

- **Visitor Spending**

In 2014 all visitors to the seashore spent approximately $90,417,200 in the local economy (NPS 2015a, located at http//www.nature.nps.gov/socialsciend/economics.cfm). That spending had a cumulative benefit to the local economy of $102,346,900. Generally, visitors from outside the local region spent the vast majority of these dollars; local resident visitors spent relatively little. In general, lodging (30.6%) and restaurant/bar (20.3%) accounted for almost half of spending. Transportation expenses (mainly auto fuel) accounted for 11.9 percent, admission and fees (10.2%), and souvenirs and other expenses (9.9%).

- **Employment Impacts and Value Added**

In 2014, visitor spending supported creation of approximately 1,241 jobs in the local economy (NPS 2015a). These jobs generated approximately $35,689,000 in labor income and $62,774,000 in total value added (NPS 2014a).

Table 3.18

Assateague Island National Seashore
Local-Level Impacts of NPS Visitor Spending

Benefits (2014)

Visitor Spending

- all visitors – $90,417,200

Impacts of Non-Local Visitor Spending

- jobs – 1,241
- labor income – $35,689,000
- value added – $93,783,000

Source: NPS 2015a

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