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August 2007

ASSATEAGUE ISLAND NATIONAL SEASHORE

A Resource Assessment



National Parks Conservation Association®
Protecting Our National Parks for Future Generations®

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Center for State of the Parks

More than a century ago, Congress established Yellowstone as the world's first national park. That single act was the beginning of a remarkable and ongoing effort to protect this nation's natural, historical, and cultural heritage.

Today, Americans are learning that national park designation alone cannot provide full resource protection. Many parks are compromised by development of adjacent lands, air and water pollution, invasive plants and animals, and rapid increases in motorized recreation. Park officials often lack adequate information on the condition of critical resources.

The National Parks Conservation Association initiated the State of the Parks® program in 2000 to assess the condition of natural and cultural resources and to determine how well equipped the National Park Service is to protect the parks—its stewardship capacity. The goal is to provide information that will help policy-makers, the public, and the National Park Service improve conditions in national parks, celebrate successes as models for other parks, and ensure a lasting legacy for future generations.

For more information about the methodology and research used in preparing this report, or to learn more about the Center for State of the Parks®, visit www.npca.org/stateoftheparks or contact: NPCA, Center for State of the Parks®, 230 Cherry Street, Fort Collins, CO 80521; phone: 970.493.2545; email: stateoftheparks@npca.org.

Since 1919, the National Parks Conservation Association has been the leading voice of the American people in protecting and enhancing our National Park System. NPCA, its members, and partners work together to protect the park system and preserve our nation's natural, historical, and cultural heritage for generations to come.

- * More than 325,000 members
- * 22 regional and field offices
- * 35,000 activists

A special note of appreciation goes to those whose generous grants and donations made this report possible: Dr. Dorothy Canter, Ben and Ruth Hammett, Alec Rhodes, John Ben Snow Memorial Trust, MSST Foundation, and anonymous donors.

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REPORT SUMMARY



As part of the Atlantic coast's network of coastal barriers, Assateague Island is in a state of constant flux under relentless buffeting from wind and water. Sand dunes alternately are built up and washed away, moved and restructured. Populations of vegetation emerge or die off with changes in geography and hydrology. Over time, the islands are drifting west and south. Paradoxically, the very forces that make the islands dynamic also help maintain the relative

stability of their natural ecosystems.

The difficulty of maintaining human structures on Assateague Island has resulted in limited development. However, the effects of that development persist to this day and in many respects, the island remains a "work in progress." For example, artificially stabilized dune systems were constructed over the length of the island during the 1950s and 1960s. These unnatural features effectively curtailed storm

Assateague Island National Seashore consists of a 37-mile-long barrier island running along the Atlantic coasts of Maryland and Virginia and the adjacent marsh islands and waters up to one-half mile from shore.

ASSATEAGUE ISLAND NATIONAL SEASHORE AT A GLANCE

- Assateague Island National Seashore consists of a 37-mile-long barrier island running along the Atlantic coasts of Maryland and Virginia and the adjacent marsh islands and waters up to one-half mile from shore. In total, the seashore encompasses 48,700 acres of land and water. At its widest point, the island is only about 1.5 miles across. Assateague State Park and Chincoteague National Wildlife Refuge both lie within the national seashore boundaries but are managed by the Maryland Department of Natural Resources and U.S. Fish and Wildlife Service, respectively.
- Like most barrier islands, Assateague is the product of complex interactions among various physical processes, including wind, waves, sediment supply, and tides. Coastal erosion, storms, changing sea levels, and ocean currents constantly reshape and restructure the island. Plant and animal residents have evolved to cope with the constant challenges presented by the harsh barrier island environment.
- The park is famous for its “wild ponies,” feral horses that have inhabited Assateague Island since the mid-1600s. Settlers brought horses and other livestock to the island to avoid the penning laws on the mainland. Although an important component of the park, the horses are adversely affecting the island ecosystem at the current population size.
- The National Audubon Society lists Assateague Island National Seashore as one of the top ten birding hot spots in the country. The park protects critical stopover habitat for many migrants as well as suitable habitat for a wide diversity of permanent and seasonal resident species. For this reason, the island has been designated as a Globally Important Bird Area and is part of the Western Hemisphere Shorebird Reserve Network, a collection of protected sites in North America and South America critical to migratory shorebirds.
- Although the challenging conditions of the island have limited human development throughout its history, archaeological sites on and around the island include the remains of Spanish shipwrecks from the 18th and 19th centuries, U.S. Coast Guard lifesaving stations built in the 19th and 20th centuries, a presidential yacht that sank in 1891, and several former villages and commercial facilities.

overwash for more than three decades until powerful storms in 1991, 1992, and 1998 eliminated most of the relic dunes from the Maryland portion of the island. In the absence of regular overwash, vegetation communities changed, habitat for rare beach-dwelling species disappeared, and the cross-island movement of sand critical to the island’s persistence was halted. Although storm overwash is once again a potent force influencing the evolution of the island, it will be many years before the effects of historic dune building activities fully disappear.

Assateague Island, which is part of both Maryland and Virginia, is one of the few fully federally protected barrier islands on the East Coast. The role that it plays in buffering these coastal states from storms will likely become increasingly important if hurricanes and extratropical storms such as northeasters increase in intensity—a predicted effect of global climate change. The critical role the island plays for waterfowl and other bird species was recognized in 1943 when most of the Virginia portion of the island was designated as Chincoteague National Wildlife Refuge. Assateague State Park was established along a two-mile stretch of the island in 1964. The next year, the island and its surrounding waters were established as Assateague Island National Seashore.

About 3.2 million people visit the national seashore annually to boat, bird-watch, fish,

Assateague Island is one of the few fully federally protected barrier islands on the East Coast.



hunt, crab, clam, camp, ride over-sand vehicles (OSVs), see wild horses, or just meditate. Other visitors to the island include a host of migratory birds that depend upon Assateague's diverse habitats for resting and foraging during seasonal passages. At least five federally listed threatened or endangered species—piping plover, loggerhead and green sea turtles, seabeach amaranth, and Delmarva fox squirrel—breed on the island. Endangered whales and other protected marine animals regularly visit Assateague's offshore waters.

Several archaeological sites in the park speak to Assateague's human history. Throughout the last 400 years, Assateague's treacherous offshore waters, shoals, and inlets claimed many vessels ranging from Spanish warships to a presidential yacht. Several of these shipwrecks lie within park waters. Terrestrial sites include the remains of four U.S. Coast Guard lifesaving stations, which were built in the late 19th century. A more recent vestige of the past, constructed in 1922, the Assateague Beach Coast Guard Station still stands intact, protected from the elements by the ongoing efforts of park staff. Other sites include evidence of 19th century fish and salt factories. Visitors can learn about the island's history and see artifacts, photos, and newspaper clippings in the park's visitor centers and museum.

RATINGS

Current overall conditions of Assateague's **natural resources** rated a "fair" score of 75 out of 100. Ratings were assigned through an evaluation of park research and monitoring data using NPCA's Center for State of the Parks® comprehensive assessment methodology (see Appendix). **Challenges include contamination of bayside waters with nutrient and sediment runoff from agriculture and residential development on the mainland, and from atmospheric deposition of nitrogen. Non-native feral horses and sika deer overgraze native plant communities, disrupt island soils, and interfere with natural processes such as dune**



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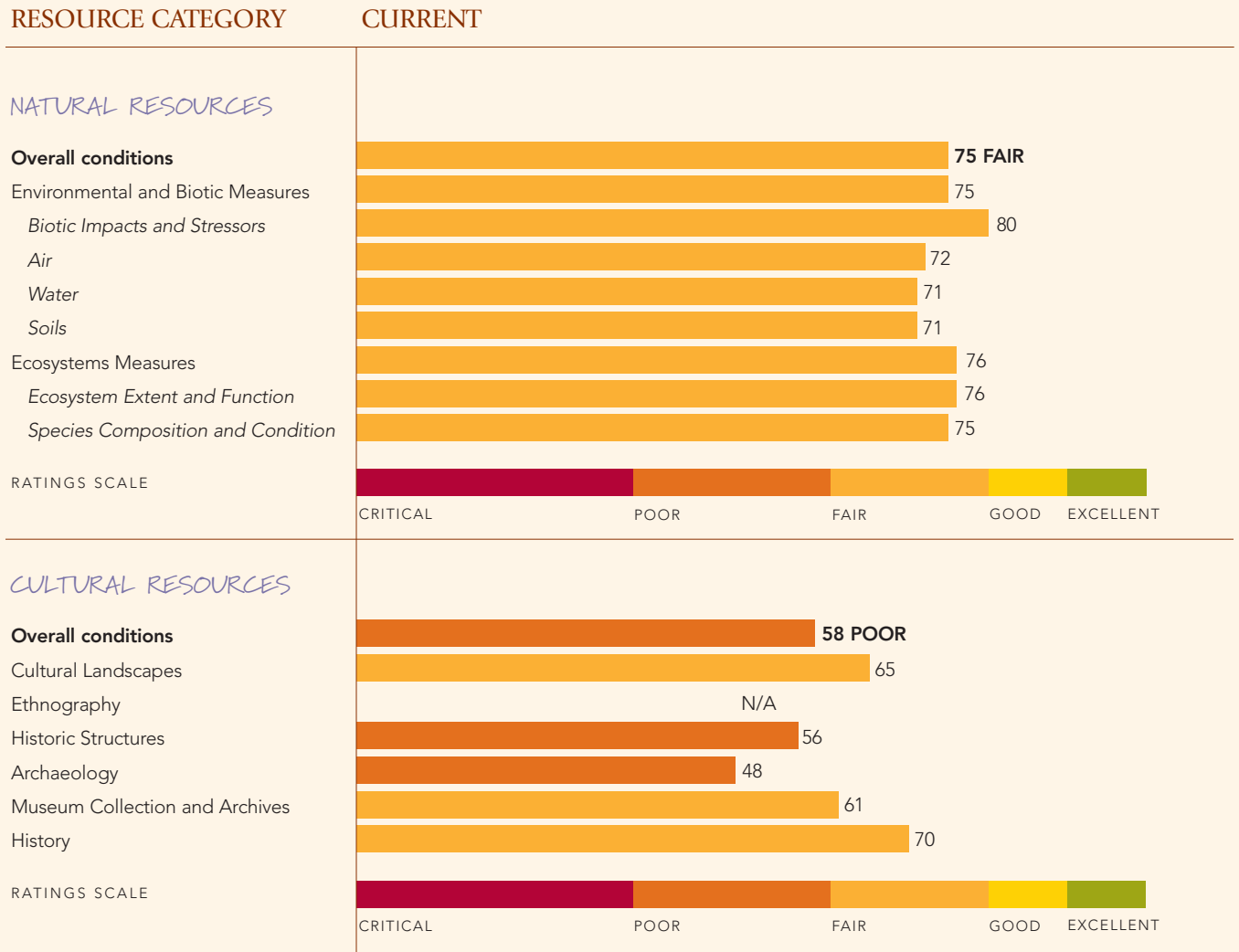
formation. Recently introduced aquatic invasive species may threaten the integrity of the estuarine ecosystem, and a number of non-native plants, including the common reed, are found throughout the island. These and other threats are being systematically addressed through monitoring, assessment, mitigation, and protection by park staff and a broad-based coalition of partners.

Overall conditions of the park's known **cultural resources** rated a score of 58 out of 100, indicating "poor" conditions. **Significant challenges include the lack of baseline data for terrestrial archaeological resources, a large backlog of archival materials requiring treatment and protection, and deteriorating historic structures and cultural landscapes.** As directed by its enabling legislation, the park's management philosophy emphasizes the dominance of natural features and processes, and limits alterations of the natural landscape to protect human structures. The majority of resource management funding is directed toward natural resources. No staff are devoted exclusively to cultural resources management, which limits the park's ability to study and care for cultural resources.

Seabeach amaranth, a federally listed threatened plant, was absent from the island for 30 years but reappeared in 1998 and is now thriving.



Note: When interpreting the scores for natural resource conditions, recognize that critical information upon which the ratings are based is not always available. This limits data interpretation to some extent. For Assateague Island National Seashore, 90 percent of the information required by the methodology was available.



The findings in this report do not necessarily reflect past or current park management. Many factors that affect resource conditions are a result of both human and natural influences over long periods of time, in many cases pre-dating the park's creation. The intent of the Center for State of the Parks is to document the present status of park resources and determine which actions can be taken to protect them in the future.

KEY FINDINGS

- Assateague's estuarine habitats are crucial to regional biodiversity and ecosystem health. By acreage, nearly 90 percent of Chincoteague Bay's submerged aquatic vegetation occurs along the island's protected shores. The park faces major challenges in protecting these resources as population growth and agricultural practices in the watershed alter water quality. Significant declines in aquatic grasses and a recent reversal of water quality trends from improving to deteriorating illustrate the severity of threats and the pressing need for greater protection efforts.
- Assateague is unable to fill nine existing permanent staff positions and add several needed new positions because of a chronic lack of funds, which translates to difficulties providing adequate resource protection, maintenance, and visitor services. Nearly all facets of resource management, interpretation, and park operation are suffering as a result of staffing shortfalls.
- Assateague has successfully managed its populations of federally protected piping plover and seabeach amaranth; both have dramatically increased over the last decade. However, funding shortfalls are reducing the park's ability to maintain the intensive efforts necessary to ensure continued success, particularly in times of naturally occurring habitat decline such as periods of low storm frequency and intensity.
- Assateague's feral horse management program, which involves collaboration with scientists, animal welfare groups, and volunteers from the local community, has reduced horse numbers from more than 170 to 140. However, the horses continue to severely affect native species and ecosystems. The park's goal is to reduce the herd to 80 to 100 horses. As this management program continues, park staff must engage the public in dialogue about the ecological necessity of reducing horse numbers while protecting the well-being of the herd.
- Assateague provides important habitat for a suite of rare beach-dwelling plants and animals, including numerous federally and state-listed species. Increasing public use and demand for recreational access, including off-road vehicle use within the park's 16-mile over-sand vehicle route, is creating new conflicts and may threaten the future value of Assateague's beach habitats for both resident and migratory species.
- Assateague lacks a comprehensive overview and assessment of its terrestrial archaeological resources and a comprehensive study of its historic resources. The park also needs updates of its administrative history and general management plan, both decades old and out-of-date, and a resource stewardship plan based upon desired future conditions for the park's natural and cultural resources.
- Lacking any staff solely devoted to cultural resources management, Assateague is unable to adequately care for its historic structures, archaeological sites, and archives. The park needs at least two full-time cultural resources staff to develop and oversee an appropriate cultural resources management and protection program.
- Assateague's limited budget prevents the park from fully caring for its most significant historic structure, the Assateague Beach Coast Guard Station. To address this shortfall, the park is seeking a partner such as a university or nonprofit organization to occupy and maintain the building as a research or education facility. Until an agreement is reached, however, the Park Service must continue to find funds to maintain the structure.
- The Atlantic Ocean plays a dominant role at Assateague, yet managers have very little information describing the nature, status, and trends of ocean resources within and adjacent to the park. Baseline inventories of ocean resources, new research, and an institutionalized long-term monitoring program are needed to ensure appropriate stewardship in the face of increasing threats from commercial, military, and offshore energy development activities.

RESOURCE MANAGEMENT HIGHLIGHTS

- Seabeach amaranth, a federally listed threatened plant, was absent from the island for 30 years but reappeared in 1998 and is now thriving. The species depends on undisturbed upper beach and storm-created overwash areas—habitats that have disappeared along much of the Atlantic seaboard. Intensive restoration and protection activities by the Park Service have yielded a reproducing population that numbered more than 1,500 plants in 2006.
- The development and use of an innovative contraceptive vaccine has enabled the Park Service to reduce the population of feral horses inhabiting the national seashore from a high of 176 to its current size of 140. Other measures will be needed, however, to reduce the population to a size that balances the welfare of the horses against their ecological impacts. A recent population and habitat viability assessment determined that a population of 80 to 100 horses may be an appropriate compromise.
- The Park Service has embraced the use of new technologies and manages several automated monitoring stations in support of cooperative efforts to protect estuarine water quality in the bays adjacent to Assateague. A National Atmospheric Deposition Program station measures atmospheric deposition of nitrogen, a major source of excess nutrients to the estuary. Other stations include one that documents weather conditions and three sites that continuously monitor ambient water quality and tides.
- The ambitious Assateague North End Restoration Project was recently initiated to counteract decades of sand starvation at the north end of the island that resulted from the construction of the Ocean City inlet and jetty system. A 25-year collaboration between the Park Service and the U.S. Army Corps of Engineers, phase one was completed in 2002 and involved a large-scale one-time deposit of sand mined from offshore shoals onto the island's north end. In 2004, phase two began a long-term program of biannual sand bypassing in which sand is transported from areas of entrapment at the Ocean City

Inlet to the nearshore waters adjacent to sand-starved northern Assateague.

- A 2004 archaeological identification study of submerged maritime archaeological resources found four previously unidentified shipwreck sites within the boundary of the national seashore. One of these is the remains of the *U.S.S. Despatch*, a 174-foot steamer that served as the first presidential yacht and sank off the shore of Assateague during a storm in 1891. It is likely eligible for the National Register of Historic Places.



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The Ocean City inlet and jetty system has disrupted along-shore sand transport since the 1930s. The North End Restoration Project was implemented to resupply Assateague Island with sand.



THE ASSATEAGUE ISLAND NATIONAL SEASHORE ASSESSMENT



NATURAL RESOURCES— PARK PROTECTION BENEFITS A WIDE ARRAY OF WILDLIFE

The assessment rated the overall condition of natural resources at Assateague Island National Seashore a score of 75 out of 100, which ranks park resources in “fair” condition. Prominent factors influencing the ratings include the high diversity and relative good health of the park’s native plant and animal populations, which

include federally and state-listed threatened and endangered species such as seabeach amaranth, piping plover, and tiger beetles. Ratings are lowered by reductions to air and water quality associated with nearby development and by habitat degradation caused by overgrazing and soil disruption from non-native sika deer and feral horses.

Assateague Island provides important habitat for numerous bird species, including tree swallows.

ISLAND HABITATS AND WILDLIFE—BIRDS FLOCK TO ASSATEAGUE

Assateague Island and its surrounding waters are a mosaic of habitats, including beaches, sand dunes, salt marshes, freshwater wetlands, maritime forests, submerged aquatic vegetation, coastal estuaries, and nearshore ocean. The widest parts of the island have the highest elevations and typically support the greatest diversity of habitats. Narrow parts of the island are subject to salt spray and storm overwash, resulting in a lower diversity of plant communities. Assateague widens from north to south, thus the southern end supports a greater variety of habitats.

Many bird species take advantage of the diversity of ecosystems protected on Assateague Island. Situated on the Atlantic migratory flyway, Assateague provides critical stopover habitat for raptors such as peregrine falcons (*Falco peregrinus tundrius*) and neotropical songbirds such as scarlet tanagers (*Piranga olivacea*) and American redstarts (*Setophaga ruticilla*). Shorebirds by the tens of thousands use Assateague's ocean beaches and other intertidal habitats to forage and rest during spring and fall migrations. For this reason, Assateague is a part of the Western Hemisphere Shorebird Reserve Network, a network of coastal areas critical to the conservation of international shorebird populations. Assateague also offers winter habitat for numerous waterfowl and breeding habitat during spring and summer for colonial

waterbirds and the threatened piping plover (*Charadrius melodus*). Because of its diverse bird life, Assateague has been designated one of the National Audubon Society's top ten birding hot spots and a Globally Important Bird Area.

Reptile and amphibian diversity at Assateague is relatively limited owing to the island's isolation and harsh environmental conditions. Documented species include one lizard, seven nonvenomous snakes, seven frogs and toads, and 11 turtles. Northern fence lizards (*Sceloporus undulatus hyacinthinus*) are very rare on the island and have not been observed in recent years, while gray tree frogs (*Hyla versicolor*) were just recorded for the first time in recent surveys. One freshwater species, the spotted turtle (*Clemmys guttata*), is known only from a small group of ponds located in the oldest part of the island. Four species of federally listed sea turtles use Assateague's ocean and bay waters: leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretta caretta*), and green sea turtle (*Chelonia mydas*). Loggerhead and green sea turtles occasionally nest on the island's sandy beaches. Due to the infrequency of nesting activity, park staff do not conduct routine surveys, but when found, nests are protected.

Insect populations on Assateague have been the focus of recent research and inventories. Mosquitoes are monitored annually to assess public health threats from West Nile virus and eastern equine encephalitis. An ongoing inventory of select insect groups has identified several new state records and is contributing important new information to the understanding of island ecology. Long-term studies of two Maryland state-listed endangered beetles—the white tiger beetle (*Cicindela dorsalis media*) and little white, or ghost, tiger beetle (*C. lepida*)—have identified conflicts between recreational use and conservation of the island's insect community. White tiger beetles use the beach zone in areas shaped by tidal wave processes, while little

Because of its diverse bird life, Assateague Island National Seashore has been designated one of the National Audubon Society's top ten birding hot spots and a Globally Important Bird Area.

MICHAEL CARLSON





Assateague Island's diverse array of habitats includes beaches, sand dunes, salt marshes, maritime forests, freshwater wetlands, and coastal estuaries.

white tiger beetles live in drier dune habitats. Both species appear to avoid areas disturbed by over-sand vehicles (OSVs). Limiting OSV use could improve habitat quality and increase the populations of these endangered beetles.

Assateague Island supports relatively few terrestrial mammal species. Among its more common residents are white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), cottontail rabbit (*Sylvilagus floridanus*), and several species of rodent. From time to time, park visitors spot other mammals, including muskrat (*Ondatra zibethicus*), river otter (*Lutra canadensis*), opossum (*Didelphis marsupialis*), gray squirrel (*Sciurus carolinensis*), and three species of bat. The endangered Delmarva fox squirrel (*Sciurus niger cinereus*) was introduced to Chincoteague National Wildlife Refuge as part of a regional recovery effort, but is not known to occur in the Maryland portion of Assateague Island.

MARINE WILDLIFE—ALGIAL BLOOMS AND DISEASES HARM SOME SPECIES

Assateague hosts many marine mammals, although most visitors are generally unaware of their presence. With the exception of several common dolphins and seals, most marine mammals occur as occasional transients or seasonal migrants, and most documented observations are of dead animals that have washed ashore. However, anecdotal observations suggest at least half of the documented species regularly visit park waters. Documented marine mammals include six species of baleen whales, of which five are endangered; 16 species of toothed whales (includes dolphins), one of which is endangered; one sirenian, the West Indian manatee (*Trichechus manatus*), which is endangered; and four species of seals. Most at risk is the northern right whale (*Eubalaena glacialis*), with a North Atlantic population of perhaps 200. A number of right whales winter



Visitors who walk the beaches of Assateague Island may encounter evidence of the many marine mammals that pass through park waters.

along the local coastline and can sometimes be seen from the beach. Although Park Service jurisdiction at Assateague covers just a tiny fraction of these animals' range, enforcement of park regulations, stranding response to dead or dying animals, and educational activities help contribute to overall efforts to save the species.

While park staff do not monitor fish, data collected through regular seine and trawl surveys by the Maryland Department of Natural Resources provide information about trends in the fish populations of Assateague's bayside waters. Since 1972, there has been a documented decrease in the abundance of forage species such as bay anchovy (*Anchoa mitchilli*), menhaden (*Brevoortia tyrannus*), spot (*Leiostomus xanthurus*), and Atlantic silverside (*Menidia menidia*). Small forage fish are most susceptible to fish kills when summer algal blooms create anaerobic conditions in shallow bays and canals. Algal blooms become more common when runoff from agricultural land and wastewater discharge increases nutrients in bay waters. As the algae die and decay, oxygen levels in waters plummet, which can kill other organisms. Brown tide, a harmful algal bloom stimulated by excess organic nitrogen, has

exceeded thresholds for concern in the bay every year since 1999. Bays such as Chincoteague are particularly prone to algal blooms because their waters are exchanged with open ocean waters relatively slowly. At Chincoteague, flushing may take as long as 63 days.

Other finfish populations in Chincoteague and Sinepuxent Bays appear relatively stable. Summer flounder (*Paralichthys dentatus*), however, are still recovering from a 1989 population crash. The collapse of the stock led to fishing quotas for summer flounder enacted by the Atlantic States Marine Fisheries Commission. While summer flounder have partially recovered and are currently fished, their population numbers are still below optimum. Declining populations of forage fish commonly eaten by the flounder may be slowing recovery rates. Disease also presents a threat of unknown magnitude as different species of fish in the bays periodically show symptoms such as lesions. Scientists are currently attempting to better understand these afflictions and how they may be related to observed changes in water quality.

Historically, the mollusks and crustaceans of Assateague's waters were an important food source for American Indians and a commercial resource for local communities dating back to the earliest settlers. Oysters were abundant in Assateague's bays until the mid-1930s, when construction of the Ocean City inlet and jetty system dramatically altered the salinity regime and the abundance of native predators. Coupled with chronic overharvesting and the introduction of two aggressive single-celled oyster parasites during the 1950s, MSX (multi-nucleated sphere X, *Haplosporidium nelsoni*) and dermo (*Perkinsus marinus*), the oyster population plummeted and is now in danger of disappearing altogether.

The molluscan community was further disrupted during the mid-20th century by the virtual disappearance of eelgrass (*Zostera marina*) resulting from a viral disease that

affected sea grasses worldwide. Atlantic bay scallops (*Aequipecten irradians*), once regionally abundant, were nearly extirpated by the outbreak. With the resurgence of eelgrass during the 1980s and 1990s, scallops have begun to repopulate the bays, though numbers remain very low.

Hard clams (*Mercenaria mercenaria*) showed greater resistance to the forces driving population decline in other mollusk species and remain an important component of the estuarine ecosystem. Introduction of the hydraulic clam dredge during the 1960s increased the efficiency of clam harvest and fueled the development of commercial clam industries in Maryland and Virginia. Unfortunately, hydraulic clam dredging damages sea grass beds and other bottom habitats, reducing habitat value and altering community structure. For this reason, more than 15,000 acres of sea grass habitat in Assateague's bayside waters are currently closed to commercial clam dredging, though recreational clamming is still allowed.

Harvest of hard- and soft-shelled blue crabs (*Callinectes sapidus*) is important both recreationally and commercially. After declines in the 1950s and increases through the 1970s and 1980s, crab populations currently seem stable. In recent years, the crab population has been affected by *Hematodinium*, a previously unidentified parasite. It affects adult crabs during the summer when water temperatures rise, and has significantly reduced late-season catch.

Although the park's enabling legislation authorized commercial shellfishing, it was silent on other commercial fishing activities. Park Service regulations prohibit commercial fishing within park boundaries unless explicitly authorized. As such, commercial fishing is not a legal activity within the national seashore, although the park has never enforced the ban. The issue is further confounded by Virginia's definition of shellfish as including crabs, which are crustaceans, while Maryland does not define shellfish in the context of its commercial fishing

regulations. The upcoming revision of the park's general management plan will provide an opportunity to resolve this outstanding issue.

WILDLIFE MANAGEMENT—STAFF WORK TO PROTECT AT-RISK SPECIES

Piping plovers are considered highly imperiled on a global scale by the U.S. Shorebird Conservation Plan, a framework for identifying species, sites, and habitats in need of conservation. Park staff have intensively monitored and managed this species since it was federally listed as threatened in 1986. The piping plover population using the Maryland portion of Assateague Island has increased from a low of 14 breeding pairs in 1990 to 66 pairs in 2006. The birds prefer to nest on the upper beach and sparsely vegetated overwash fans and inter-dune areas. They find the most productive forage along sound-side mudflats and low, moist sand flats in the island's interior—habitats created and maintained by storms. These same areas also support a suite of other rare plant and animal species that require early successional habitats, including the least tern (*Sterna antillarum*), black skimmer (*Rhynchops niger*), and American oystercatcher (*Haematopus palliatus*), all of which are considered to be "of management concern."

The breeding population of piping plovers experienced good productivity and expansion following major storms in 1991, 1992, and

The least tern is one species that requires the unique habitat found along sound-side mudflats and low, moist sand flats in the island's interior. These habitats are created and maintained by the frequent storms that batter the island.



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1998, when abundant early successional habitat was created. Reproductive success has declined during periods lacking storm overwash as habitats evolve towards unsuitability. Because of the critical relationship between habitat quality and reproductive success, the piping plover can be considered an important indicator of a healthy barrier island ecosystem and intact natural processes. Currently, most Assateague plovers breed along the northern end of the island, where storms have created the most suitable habitat, while about 8 percent of nesting pairs are scattered along the over-sand vehicle zone.

From 1991 through 2006, a cooperative effort among the park, Maryland's Wildlife Heritage Program, and the Student Conservation Association permitted a robust management program. Activities included regulating public access around breeding sites, building cages around nests to protect them from predators, and controlling populations of both native and non-native species that influence productivity. These management measures helped ensure plover populations

were able to expand during periods of good habitat quality and then remain stable when conditions deteriorate. Funding for seasonal staff from all three organizations was cut in 2007, resulting in a significant reduction of management and monitoring efforts. Monitoring of several state-listed colonial waterbirds has also been discontinued due to staffing shortfalls.

PLANTS—MANY RARE NATIVES BENEFIT FROM PROTECTION

In 1998, two seabeach amaranth (*Amaranthus pumilus*) plants were discovered on Assateague Island, marking the first time in more than 30 years that the federally listed threatened species was known to occur on the island. During subsequent years, another five plants were discovered, and greenhouse-grown progeny from these plants were used to conduct a species restoration project between 2000 and 2002. In 2006, wild recruits resulting from the restoration totaled more than 1,500.

Seabeach amaranth is an annual plant species that occurs on the upper beach and sparsely vegetated overwash fans and inter-dune areas. Like the piping plover, seabeach amaranth is dependant upon disturbance from storms to create and maintain favorable habitat conditions. In its absence, other plants less tolerant of disturbance colonize the sparsely vegetated areas and ultimately outcompete amaranth.

In 2005, park managers initiated a large-scale program to protect amaranth from deer and horse grazing and over-sand vehicle use by placing small cages around individual plants and, in the OSV zone, by marking individual plants with signs. This resulted in greater seed productivity and a tripling of the population in 2006 to more than 1,500 plants, up from 535 in 2005.

In addition to seabeach amaranth, Assateague supports 29 state-listed rare plants. Many of these species, including seabeach

Small cages protect seabeach amaranth from being crushed by over-sand vehicles or eaten by deer and horses.



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knotweed (*Polygonum glaucum*), sea purslane (*Sesuvium maritimum*), seabeach orach (*Atriplex arenaria*), and seabeach sandwort (*Honkenya peploides*), occupy beach habitats similar to amaranth. Public use closures established to protect piping plover and seabeach amaranth also benefit these species.

Fragile communities of submerged aquatic vegetation along Assateague's bay side are an important component of the estuarine ecosystem. Beds of sea grasses such as eelgrass and less abundant widgeon grass (*Ruppia maritima*) provide shelter for mollusks such as the Atlantic bay scallop, critical nursery habitat for fish and crustaceans, and foraging grounds for waterfowl, river otters, and other animals.

Sea grasses are extremely sensitive to water quality. Excess suspended sediments and algal blooms caused by nutrient enrichment can kill sea grass by blocking sunlight. Boats can also destroy sea grasses in shallow waters when they become grounded or when propellers churn through and tear up the grasses. Boating restrictions help protect against this damage. There are only two corridors through which personal watercraft may travel to reach Assateague Island. A southern corridor provides access to the north side of Toms Cove for personal watercraft from nearby Chincoteague Island. Another corridor provides access to the north end of the island close to Ocean City where boat traffic has traditionally been heaviest. All other personal watercraft use within Assateague Island National Seashore is prohibited.

The fact that 90 percent of the submerged aquatic vegetation in Chincoteague Bay occurs in the waters of Assateague reflects the unique habitat conditions found in the waters adjacent to the island and is testimony to the importance of protection provided by park regulations.

NON-NATIVE SPECIES—BOTH BERATED AND BELOVED

From feral horses to dead man's fingers (a type of seaweed), Assateague contends with a variety



of non-native species that can threaten the existence of the park's native species and natural ecosystems. Park managers employ a host of tactics to mitigate these threats.

Assateague's feral horses have a higher profile than any other species on the island, native or otherwise. The horses' status as an introduced species and their many detrimental effects on the island's dunes, salt marshes, and forests is at odds with the fact that they are a beloved feature of the park, representing living links to the region's rugged past. Accordingly, the park is committed to managing their numbers to maintain the horses as part of a healthy barrier island ecosystem. Much research has been devoted to this end, and the park is making excellent progress towards its horse management goals (see sidebar on page 15).

The sika deer (*Cervus nippon*), another non-native herbivore, originates from East Asia and is a member of the elk family. Sika deer are thought to have arrived on Assateague Island in the 1920s, prior to the establishment of the national seashore, when a Boy Scout troop intro-

Non-native sika deer eat native plants and host ticks that may carry Lyme disease.

While popular with visitors, Assateague's non-native feral horses threaten the existence of the park's native species and ecosystem health. Park staff manage the population to maintain the horses as part of a healthy barrier island ecosystem.



duced them to the island. Sika deer far outnumber native white-tailed deer (*Odocoileus virginianus*) on Assateague, and their influence on island resources is far greater. Deer have been shown to influence the abundance of many native plant species, some of which are listed as species of management concern in Maryland, including yellow thistle (*Cirsium horridulum*) and beach pinweed (*Lechea maritima*). During the 2006 growing season, deer and horse herbivory combined was shown to reduce seabeach amaranth survival by 27 percent and seed production by 65 percent. Sika deer also serve as hosts for ticks, facilitating the spread of Lyme disease to other park mammals and humans.

The park manages sika deer through a congressionally authorized recreational hunting program; it is one of two public areas east of the Mississippi River where sika deer can be hunted. On average, about 130 sika deer are taken annually. Despite this hunting pressure, the sika deer

population has remained relatively stable, with an estimated 300 to 400 deer inhabiting the Maryland portion of the island. In addition to recently completed research investigating the effects of deer herbivory, the Park Service and scientists from Penn State University have initiated a study to learn more about sika and white-tailed deer habitat selection and use. Information gained will be used to develop an adaptive management strategy to reduce deer impacts to acceptable levels.

Although cars, birds, wind, and other sources transport many non-native plants to Assateague Island, relatively few are able to gain enough of a foothold to threaten native populations. Harsh environmental conditions such as exposure to saltwater spray and periodic storm overwash may help prevent their introduction and spread. Although one-third of the park's plant species are non-native, most are species long naturalized in the eastern United States and

MICHAEL CARLSSON

THE WILD HORSES OF ASSATEAGUE ISLAND

The so-called “wild ponies” of Assateague Island are among its most famous features. They have achieved an almost mythical status amidst a number of misconceptions. First, they are not truly “wild” but feral, being descended from domesticated stock. They are not actually “ponies” either, but are more closely related to horse breeds despite their diminutive stature. Finally, the horses probably did not swim to the island after the shipwreck of a Spanish galleon as legend has it, but were more likely brought to the island by mainland settlers to avoid penning laws and taxation. The misconceptions are more romantic, however, and Marguerite Henry’s famous Newberry honor book *Misty of Chincoteague*, first published in 1947, helps perpetuate them. Through the book, thousands of children have read about a pony of Spanish descent born wild on Assateague Island. In the story, Misty is bought by Paul Beebe and his sister during the annual pony penning on Chincoteague Island.

Because the horses are not native to Assateague Island, they have not achieved the balance with their ecosystem that characterizes species that evolve over thousands of years with other local native species. Instead, the horses overgraze and trample sensitive vegetation, disturb soils, and displace other native wildlife by altering habitat conditions. They also disrupt important natural processes such as the formation and stabilization of sand dunes by eating dune-building plants such as American beach grass (*Ammophila breviligulata*). Cumulatively, the horses are having a serious impact on the condition and evolution of the island ecosystem.

There are two herds of horses on Assateague Island, separated by a fence that runs along the border between Maryland and Virginia. The Maryland herd is managed by the Park Service and the Virginia herd by the Chincoteague Volunteer Fire Company. The Fire Company limits the size of the Virginia herd through its famous annual “pony penning” and public auction, which was formally instituted in the 1920s. Every year in July, the Virginia horses are rounded up and guided across a narrow stretch of water to Chincoteague Island

where most of the foals are auctioned to the public.

When the Park Service acquired ownership of the Maryland herd in 1968, it included only 28 horses, all descendents from nine horses bought from the Virginia herd by a Maryland landowner. With no natural predators on the island, the horses’ population grew at an annual rate of 10 to 15 percent. At its peak, the population reached 176 horses. With this growth came increasing evidence of environmental damage and the recognition that active management was needed.

The Park Service has been using contraceptive vaccines since 1994, initially to stabilize population growth and more recently to effect a gradual reduction. At present, the population is about 140 horses. In 2006, the park hosted a team of subject matter experts and interested parties to conduct a horse population and habitat viability assessment (PHVA). The process resulted in recommendations designed to reduce the impacts of horses while protecting the long-term health of the population. That effort is being followed up with an environmental assessment (EA) to develop and assess several long-term horse management strategies. The EA should be completed in late 2007, with new management programs beginning as early as 2008. Based on the PHVA recommendations, the park seeks to maintain the herd at about 80 to 100 horses.

While horses are highly visible and popular with park visitors, they are not tame and like any wildlife can be dangerous when approached. Every year, several visitors are bitten or kicked, often when attempting to feed the horses. The animals also suffer from interactions with the public: Automobiles have killed horses that were roaming park roads looking for handouts. Negative interactions between horses and park visitors are limited by the park’s “pony patrol,” a group of volunteers that contributes more than 1,200 hours annually, educating visitors and working to keep both horses and humans safe.

OVER-SAND VEHICLES DISRUPT NATURAL PROCESSES

Within Assateague Island National Seashore, there are 16 miles (12 in Maryland, four in Virginia) of beach open to use by over-sand vehicles (OSVs) such as jeeps and pickup trucks. OSV driving is extremely popular, attracting visitors from all over the Mid-Atlantic region. A permit is required and driving is restricted to a designated route located between the water's edge and the winter storm berm on the upper beach face. The Maryland OSV route is limited to a maximum of 145 vehicles at any one time; the Virginia route is limited to 48.

Park OSV regulations aim to reduce impacts to beach dwelling species and habitats, but are only marginally successful. OSV use disrupts the beach surface, leads to increased sand movement, and impedes the formation of new embryo dunes that would naturally form. Driving is known to significantly reduce the abundance of invertebrate species such as ghost crabs (*Ocypode quadrata*) and to degrade habitat value for resting and foraging shorebirds. The existing route includes about 20 percent of the island's beach habitat, and as such, limits the potential for expansion of recovering populations of threatened species such as seabeach amaranth and piping plover. Although park staff exert considerable effort attempting to reduce impacts through temporary closures and the use of signs, exclosure cages, and other protective measures, OSV use will continue to limit the distribution of rare species and reduce habitat quality. It is likely that OSV use will be a topic of considerable debate and contention during the upcoming revision of the park's general management plan.

There are 16 miles of beach open to over-sand vehicles within the boundaries of Assateague Island National Seashore. While the park regulates the number of vehicles allowed and the travel routes, OSV use still harms plants and animals.



ELIZABETH MEYERS/NFCA

they make up very little of the island's vegetative cover. Park staff are actively engaged in control efforts and regularly work with Park Service exotic plant management teams to identify and treat invasive plant infestations. By far the worst invasive plant found on Assateague is common reed (*Phragmites australis*), which accounts for about 200 of the 228 acres estimated to be affected by invasive plants. Common reed spreads rapidly and is present throughout the island, although it has only been able to establish homogeneous stands in a few limited areas.

Non-natives in park estuaries and intertidal zones may prove to be a more formidable threat. Several invasive species have recently established themselves in portions of the bays, particularly along shorelines armored with rock such as bridge abutments and jetties. Three species of crabs—green crabs (*Carcinus maena*), Asian shore crabs (*Hemigrapsus sanguineus*), and possibly Chinese mitten crabs (*Eriocheir sinensis*)—may threaten native species and ecosystem health. Asian shore crabs were transported to the Atlantic via ship ballast water in the 1950s, while green crabs were probably introduced as bait for tautog (*Tautoga onitis*), a fish popular with anglers. An additional invasive marine species is dead man's fingers (*Codium fragile*), a macro algae or seaweed that arrived in New York in 1957 and has been making its way south along the coast. In parts of the northeast, dead man's fingers has outcompeted native algae species and overrun shellfish beds by monopolizing limited space on suitable substrate in intertidal areas.

Other non-native species of concern include nutria (*Myocastor coypus*), a large South American aquatic rodent capable of devastating tidal marshes and other wetland habitats, and nonmigratory Canada geese (*Branta canadensis*). Fortunately, the spread of nutria up the Atlantic seaboard has not yet reached Assateague, although occasional sightings have been made on the adjacent mainland. Nonmigratory Canada geese, however, present a continuing



Common reed (foreground) is the worst invasive plant on Assateague Island. In a few areas, it forms dense stands.

challenge as regional populations are rapidly expanding and causing a variety of conflicts with both humans and native wildlife. For example, the geese like to nest in areas where plovers forage, and can be aggressive towards both the birds and humans. The park currently manages the geese in selected areas, but lacks the staff to implement control measures throughout the island.

AIR QUALITY—NEW MONITORING PROGRAM IN PLACE

Air quality within Assateague Island National Seashore is influenced both by local sources of pollutants, such as ammonia from agricultural operations, and by industrial and automobile emissions occurring hundreds of miles away. In 2000, a National Atmospheric Deposition Program (NADP) monitoring station was installed adjacent to the park to quantify atmospheric (wet) deposition of nitrogen, a major

source of the nutrient load affecting the coastal bays adjacent to Assateague. The NADP station collects rainwater samples weekly and measures them for nitrogen compounds. While trend data are not yet available due to the short period of operation, atmospheric deposition is now known to make up more than 30 percent of the overall nitrogen load to the bays.

Other air pollutants such as mercury seem to be less problematic as recurring surveys of aquatic sediments have failed to detect heavy metals at levels of concern. Three years of ozone monitoring data from 2004 to present indicate that the park does experience periodic high levels during the summer months, but that local meteorological conditions serve to moderate the potential threat.



A combination of low dissolved oxygen and high water temperatures killed thousands of small fish in September of 2005. The fish kill is an indicator of deteriorating water quality.

WATER QUALITY—OCEANSIDE, BAYSIDE, AND FRESHWATER SYSTEMS CONFRONT DIFFERENT THREATS

The water resources of Assateague Island National Seashore include more than 31,000 acres of the Atlantic Ocean to the west, Chincoteague and Sinepuxent Bays to the east, and numerous freshwater and brackish ponds fed by rainfall and the shallow groundwater aquifer underlying the island. Water quality in these aquatic systems faces a variety of threats, the most severe stemming from land use practices and rapid growth and development in the watershed along the coasts of Maryland and Virginia. Population growth in Maryland's Worcester County has exceeded 3 percent per year over the past two decades and is expected to continue at that pace for the foreseeable future. Accomack County to the south in Virginia is poised to experience similar rates of growth with the projected expansion of the

NASA Wallops Island Flight Facility and other development pressures.

Chincoteague and Sinepuxent Bays suffer from an influx of excess nutrients, primarily nitrogen and phosphorus. Scientists believe that as much as one-half of the excess nutrients come from agricultural sources such as chemical fertilizers and manure generated by intensive chicken production facilities on the mainland. Other significant sources include atmospheric nitrogen deposition and effluent from residential septic systems and municipal wastewater treatment plants. Deforestation and a proliferation of impervious surfaces such as roads, roofs, and parking lots result in more nutrients entering the bay, as the filtering capacity of natural landscapes is lost. Because nitrogen and phosphorus promote the growth of algae, waters with excess levels are prone to algal blooms, which deplete dissolved oxygen when the algae die and decompose. Fish and other marine organisms cannot survive under the low oxygen conditions.

Newport Bay, which lies to the north of and drains into Chincoteague Bay, has poor water quality according to a 2004 report by the Maryland Coastal Bays Program. The watershed of Newport Bay includes the town of Berlin, which has a wastewater treatment plant that periodically discharges into the bay's primary tributary. Chronic nutrient loading has resulted in recurring episodes of low dissolved oxygen, algal blooms, fish kills, and low diversity in the benthic invertebrate community inhabiting the bay bottom. While in better overall condition than Newport Bay, Chincoteague and Sinepuxent Bays are also affected by these same problems.

Although the quality of Assateague's bayside waters actually improved in the 1980s and 1990s, population growth and development are threatening to negate those positive changes. A recent analysis of long-term water quality monitoring data indicates that a tipping point occurred around the turn of the 21st century and that since then, water quality has begun

deteriorating. The findings are supported by observed changes in the condition of estuarine biota. Brown tide, a harmful algae that can kill sedentary species such as shellfish at high levels, was documented for the first time in 1999. Since then, brown tide blooms have been observed every year. Submerged aquatic vegetation, which had experienced steady expansion since the mid-1980s, has decreased in acreage more than 40 percent since 2002. Although the proximal cause was likely record high bay water temperatures in 2005 and 2006, the grasses have been increasingly stressed by deteriorating water quality conditions and the associated proliferation of water column algae, macro algae, and epiphytic algae, all of which reduce light availability.

Tides and ocean currents regularly flush the oceanside waters of Assateague Island so pollution—aside from floating debris—is not currently a cause of concern. Fecal-origin bacterial monitoring is conducted weekly during the summer months at the park's swimming beaches to assure public health. Since monitoring began in 1992, bacterial indicators have exceeded acceptable levels only once.

Park management is continually challenged by a variety of region-wide problems resulting from activities occurring beyond park boundaries. Floating debris and "ghost gear" from fishing vessels—gear that breaks loose or is lost or abandoned—can be ingested by or ensnare marine species such as marine mammals, sea turtles, and birds. Bycatch, another product of commercial operations where nontarget species get caught in fishing gear, is also known to result in significant mortality.

In addition to fishing-related issues, Assateague Island and the surrounding area are always vulnerable to oil spills, although the number and severity of spills has been limited owing to the park's location away from major inshore shipping lanes. With the growth of interest in alternative energy sources, the park may face new challenges should the ocean waters

RESTORATION PROJECT FEEDS SAND-STARVED SHORES

Between 1933 and 1935, a massive coastal engineering effort was undertaken to permanently stabilize a new storm-created inlet by building a jetty system at Ocean City, Maryland, just north of Assateague Island. The goal was to create a permanent navigation channel between the sheltered back bays and the Atlantic Ocean, enhance commercial fishing, and stimulate the development of tourism and offshore recreational fishing. Although the project achieved those ends, it also altered conditions in the back bays to the detriment of existing biotic communities, and severely disrupted alongshore sand transport to Assateague Island.

The sand starvation caused by the Ocean City inlet and jetty system led to more than 60 years of unnaturally high rates of erosion and shoreline migration along the north end of Assateague Island. The resulting changes affected virtually every aspect of the ecosystem, and without action, coastal geologists predicted that the north end of the island would soon destabilize and ultimately fragment and disappear. In response, the Park Service collaborated with the U.S. Army Corps of Engineers and other regional stakeholders on a two-phase restoration project. Phase one, undertaken in 2002, consisted of a one-time large-scale beach replenishment to help compensate for historic sand losses. Phase two, which began in 2004, replicates natural alongshore sand transport processes by "bypassing" the physical barrier created by the jetty-stabilized inlet. Twice yearly, sand is mined from the shoals in and around Ocean City Inlet where the sand that would have naturally fed Assateague is trapped, and then moved by ship and deposited in the nearshore waters of northern Assateague where it re-enters the alongshore sand transport system and nourishes the island.



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adjacent to the park be targeted for wind energy development. Current technologies limit wind turbines to relatively shallow waters (less than 30 meters), most of which are well within the view from Assateague's beaches. While the park supports the concept of wind energy, the presence of large wind turbines within the island's ocean viewshed would significantly affect the quality of what is now a pristine landscape.

With a few exceptions, Assateague's freshwater systems are largely unaffected by human activities and face limited threats. The park and the Maryland Department of Natural Resources are discussing the possibility of removing septic systems from Assateague State Park and treating wastewater at the Park Service wastewater treatment plant on the mainland. In combination with the upcoming removal of the park's primary day use area's septic system, this would entirely eliminate all wastewater discharge from the island.

Recent research has greatly expanded the park's understanding of the island's groundwater. A more complex system than once thought, water movement within the shallow aquifer is controlled by subtle differences in surficial geology, a product of the island's formative processes. Elevation of the water table is governed by the amount of rainfall and rates of evapotranspiration, and so can vary widely over seasons. As a result, many of the island's freshwater ponds, the surface expressions of shallow groundwater, are often ephemeral, forming during the wet winter months and then drying up during the summer. Water quality within these ponds can also vary dramatically depending upon the frequency and extent of storm overwash and the resultant increase in salinity.

Because of the significance of its aquatic resources and severity of threats, the park is engaged in a broad-based water resources management program. Each month, park staff monitor Assateague's bayside waters, measuring dissolved oxygen, temperature, salinity, nitrogen, phosphorus, chlorophyll, pH, silica, light

attenuation, and turbidity at 18 fixed water quality stations. The park also maintains three continuous water quality monitoring stations, and works extensively with other federal, state, and university cooperators on a wide range of monitoring, assessment, and research activities. Ongoing programs include annual monitoring of submerged aquatic vegetation and harmful algal blooms, surveys of bottom sediments and bay bathymetry, and research to better understand sources of pollutants and pathways. Many of these and other activities are coordinated through the Maryland Coastal Bays Program, a regional consortium of government agencies, institutions, and public interest groups dedicated to conserving the coastal bays and watershed. The program is broadly supported by the park and is engaged in efforts ranging from the development of best management practices for homeowners to local land use planning.

Two new stewardship initiatives are being investigated for possible use in the struggle to protect park waters. The first involves designating that portion of Chincoteague Bay occurring within the park, or potentially the entire system, as an Outstanding National Resource Water. This designation would afford park waters the highest level of protection under the state's water quality regulations and prevent new water pollution sources within the watershed. The second initiative would create a "no-take" marine protected area within the park to investigate the consequences and benefits of increased protection from consumptive and resource damaging activities currently taking place in the bays.

Like most parks, Assateague also depends upon assistance from volunteers to help keep local waters and shores clean. In 2006, volunteers removed more than 1.5 tons of trash from Assateague's beaches during the annual International Beach Cleanup Day. Outreach to park visitors includes education about the importance of water quality to the health of the park and the issues of overharvest, pollution, and habitat loss.

GLOBAL CLIMATE CHANGE—THREATS INCLUDE STORMS AND RISING SEA LEVELS

As a barrier island with elevations of no more than 46 feet (14 meters) at its highest points, Assateague Island will be greatly affected by the predicted changes in sea level associated with global climate change. During Assateague's 5,000-year history, oceans have risen about 33 feet (10 meters) globally. In response to rising seas, the island has gradually moved landward, migrating up the continental slope through overwash and inlet formation processes. Evidence of this landward migration can be found in the tree stumps occasionally seen on the island's ocean beaches, the remnants of former maritime forests located on the bay side of the island.

Park Service staff worked with the U.S. Geological Survey in 2004 to assess the risks and predict the effects of sea level rise on Assateague. The project created a coastal vulnerability index for the island, concluding that the

areas most frequently exposed to overwash and shoreline change would likely be the most susceptible to the effects of sea level rise.

Current rates of sea level rise are estimated to be about 0.124 inches (3.16 mm) annually, but may increase by two to five times in the next century. While coastal barriers such as Assateague have an inherent ability to respond to changes in sea level, the predicted rates may overwhelm the island's capacity to adjust. Habitats particularly sensitive to the effects of changing sea level, such as salt marshes, may disappear and overall habitat complexity is likely to decline. Increased storm intensity and wave energy will increase the likelihood of overwash events, erosion, creation of breaches or new inlets, and alter the availability of freshwater. Finally, increases in water temperature may increase the frequency of algal blooms in bay waters, exacerbating existing water quality problems and adding to the stress on aquatic grasses and local fish populations.

Salt marshes are one habitat particularly sensitive to the effects of changing sea levels, and may completely disappear as a result of global climate change.

MICHAEL CARLSON





The boathouse from the Pope's Island Life-Saving Station was rehabilitated in 2000.

CULTURAL RESOURCES—LACK OF STAFF AND FUNDS HINDERS WORK

Assateague Island National Seashore scored an overall 58 out of 100 for cultural resource conditions, including history, historic structures, cultural landscapes, archaeology, and museum collection and archives. Ethnography was not rated at this time due to a pending ethnographic study planned for 2008. A score of 58 indicates that the park's cultural resources are in "poor" condition. The scores for cultural resources are based on the results of indicator questions that reflect the National Park Service's own Cultural Resource Management Guideline and other policies related to cultural and historical resources.

While the park's history, cultural landscapes, and museum collection and archives rated in "fair" condition, archaeological information is lacking, the park does not have enough funds to care for historic structures, and there are not any staff solely dedicated to cultural resources management. Because the park's enabling legislation specifically addresses only the protection of natural resources, funding and staffing are primarily directed to those efforts. The strong influences of wind, water, and salt on the island make the preservation of human structures much more difficult and expensive than in inland environments, and the park follows a policy of not altering or disturbing the natural

landscape for the preservation of historic structures. While the park's chief of resource management and chief of interpretation services each devote portions of their time to caring for cultural resources, significantly more necessary work could be accomplished with full-time cultural resources staff members. The park has requested support for both a museum technician and an archaeologist.

HISTORY—ISLAND PRESENTED CHALLENGES FOR SETTLERS

Because of its challenging environmental conditions, Assateague Island has sustained limited long-term human habitation over its recorded history. According to the accounts of European colonists, American Indians used the island and adjacent bay waters extensively for the harvest of fish, shellfish, and small game, although no known archaeological evidence of these activities exists other than the periodic discovery of prehistoric artifacts from the ocean beaches. The name "Assateague" derives from an American Indian word that translates roughly to "land across the water." The earliest concrete evidence of human influence on the island are the horses and other livestock that appeared in the mid-1600s, probably brought by colonists from the mainland looking to avoid local fencing laws and taxes.

Throughout the colonial period and up until the 1960s, many ships—including several Spanish vessels—wrecked in the coastal waters around Assateague and Chincoteague; park waters harbor evidence of several of them. Blackbeard and other pirates also reportedly sailed the waters around Assateague and used the island as a hideout. The numerous inlets and bays along Assateague's west coast provided ample refuge from colonial law enforcement.

In the mid- to late 18th century, Euro-American settlers established small villages on Assateague Island and cleared parts of the land for crops. Human presence on the islands increased in the late 19th century with the

construction of four U.S. Coast Guard lifesaving stations and one lighthouse. For a time after the construction of the stations, industry on the islands burgeoned. Major businesses included Birch's Saltworks, Scott's Ocean House Hotel, Seaboard Fish Oil and Guano Company, and Conant Brothers Fish Oil Factory. In the early 20th century, the Assateague Beach Coast Guard Station was built.

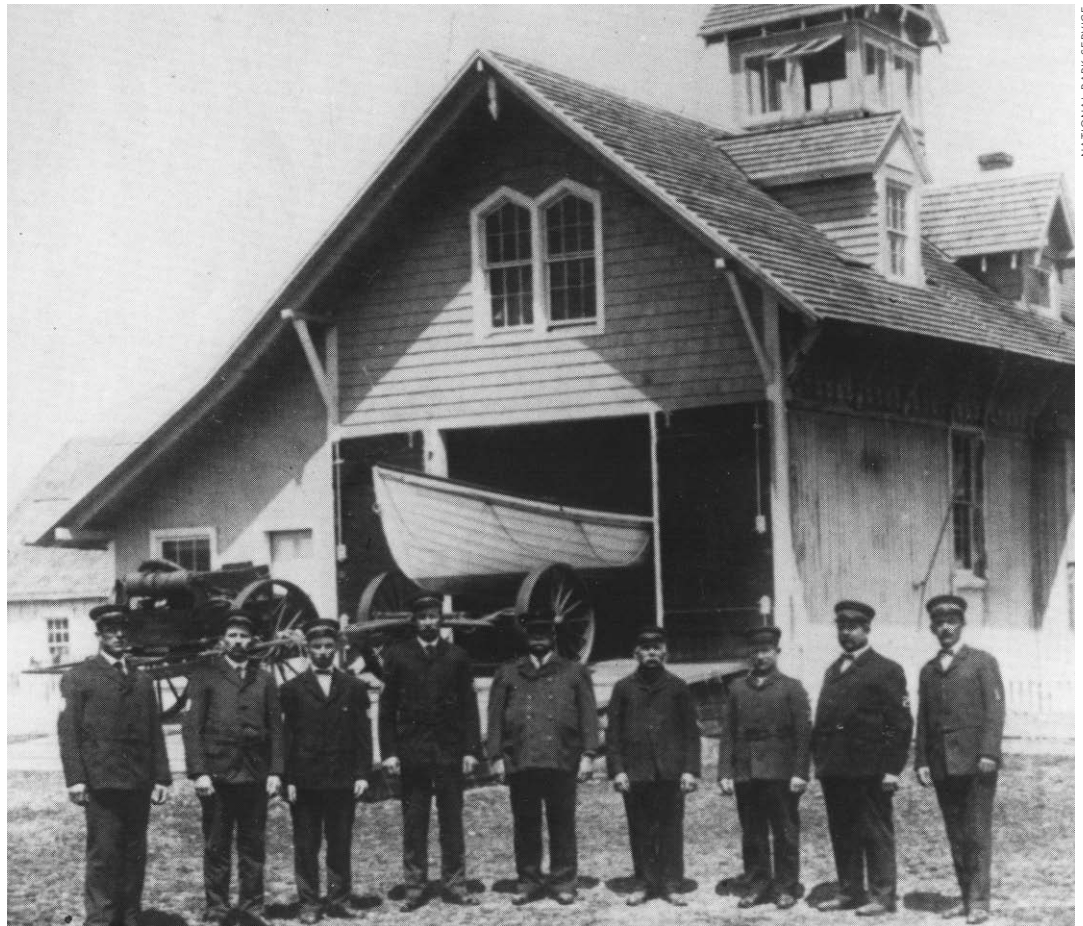
A single man, Leon Ackerman, largely shaped the history of Assateague Island in the mid-20th century. In 1950, Ackerman bought 15 miles of oceanfront property to pursue his vision of real estate development. Over the next ten years, he built a road running the length of the Maryland end of the island and sold 5,850 plots to 3,200 parties, but only 30 structures

Volunteers staff the Pope's Island Life-Saving Station Boathouse. They teach visitors about the history of lifesaving services on Assateague Island.



MICHAEL CARLSON

The Assateague Beach Life-Saving Station was one of four such stations built on the island in the late 19th century. The station's crew risked their lives to aid vessels in distress.



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were ever built on these plots. To encourage visitors and to help gain leverage for a bridge connecting Assateague to the Maryland mainland, Ackerman donated 540 acres, including two miles of coast, for a state park in 1956. Construction of the bridge that Ackerman wanted was completed in 1963, just a year after a huge storm destroyed nearly all the buildings on the island. Real estate development was not destined to be a lasting venture on Assateague Island: In 1964, Maryland's Assateague State Park was created, and in 1965, Congress designated the island as Assateague Island National Seashore, a unit of the National Park System. The state park and Chincoteague National Wildlife Refuge, which was created in 1943, are within the park's boundaries.

Assateague's interesting history has not been extensively researched, in large part,

because the park lacks any staff solely dedicated to cultural resource management. Instead, the park relies largely on regional and national Park Service professionals and contracted historians to accomplish historical research. Though the park has not completed a historic resource study—which would help staff manage historic resources, understand their significance, develop interpretive plans, and determine what additional research is needed—other specific historical studies are in place to help park staff interpret Assateague's history for visitors.

Topics in need of further study include oral histories from people who were associated with waterfowl hunting camps, Coast Guard stations, commercial activity, and real estate development on the island. In addition, a 1982 administrative history of the park is due for update. To

manage cultural resources and help accomplish some of this important research, the park needs two cultural resources staff members and has requested funds to support a museum technician and an archaeologist.

CULTURAL LANDSCAPES—NATURAL FORCES CONSTANTLY RESHAPE LANDSCAPES

Cultural landscapes illustrate how people have used, changed, and adapted to their surroundings through time. A 2004 cultural landscapes inventory at Assateague Island identified two cultural landscapes within the park, though a cultural landscape inventory of 11 historic hunting camps, currently under way, could add to this short list. The first identified cultural landscape is Assateague Island itself. The report defines Assateague Island as a 37-mile-long barrier island off the coast of Maryland and Virginia that is constantly changing shape and size over time and is characterized by dynamic systems.

The park's second cultural landscape is the Assateague Beach Coast Guard Station, which includes the station house, garage, lookout tower, generator house, boathouse, system of wooden walkways, and wharf—all situated on the south end of the island on Toms Cove. The station was built in the early 20th century to replace an earlier Life-Saving Service facility across the cove, and operated until 1967. The only remaining station on Assateague Island, the Assateague Beach Coast Guard Station cultural landscape is eligible for the National Register of Historic Places.

Dynamic forces such as wind, ocean currents, and weather constantly reshape Assateague Island, and allowing these processes to act freely upon the island's landscapes is an important part of the park's management philosophy. Accordingly, park staff do not attempt to maintain static cultural landscapes. These dynamic forces, however, can quickly batter historic structures such as the Assateague

Beach Coast Guard Station. Park staff recognize the importance of the station, but lack the funds to preserve all components of the cultural landscape and are pursuing other options as discussed below.

The Assateague Beach Coast Guard Station cultural landscape is currently in "fair" condition. The wharf was damaged by storms during the 1990s and funds have not been available to make complete repairs.

Park staff interpret cultural landscapes through programs and exhibits that focus on Assateague Island's human history, which includes wildlife hunting, lifesaving services, commercial fishing, real estate development, potential American Indian connections, and shipwrecks. Oral histories from area residents are being collected and will be used to enhance interpretation.

HISTORIC STRUCTURES—FUNDING SHORTFALLS PREVENT CONTINUED CARE

Assateague's list of classified structures includes eight historic structures and ruins. Of these, six structures remain standing—the five structures that make up the Assateague Beach Coast Guard Station and the Pope's Island Life-Saving Station Boathouse. The boathouse was moved from the Pope's Island station complex to a site in the park's developed area, rehabilitated in 2000, and is currently staffed by volunteers to interpret the history of lifesaving operations on the island. It is the only historic structure on the island currently in use. Historic structure reports have been prepared for both the boathouse and the Coast Guard station; park staff use these reports to guide preservation efforts.

Toms Cove Hook at the south end of Assateague Island is home to the Assateague Beach Coast Guard Station and its outbuildings. The complex consists of a station house, lookout tower, garage (the original boathouse), boathouse, and a wharf. Also at the site is a generator house and series of wooden walkways

The Assateague Beach Coast Guard Station includes several historic structures built in the early 20th century. The park lacks the funds needed to care for this cultural landscape.



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that are not on the park's list of classified structures because they were not built during the station's period of significance. The Coast Guard station is listed as a Virginia State Landmark, but has not been listed on the National Register of Historic Places, though it is eligible. Lacking any cultural resources staff, the park is seeking other ways to re-evaluate the eligibility of this and other historic properties and complete the nomination process.

With limited funds and staff, the park struggles to maintain the station. Conditions of the buildings are assessed annually, and staff have put much work into caring for them. All buildings have been stabilized and re-roofed, windows in the station house have been repaired and reglazed, asbestos has been removed, and lead abatement has been completed on the exteriors of the station house, garage, and boathouse. A sprinkler system and

intrusion detection system is in place. Though much work has been done, much more is still needed. Portions of the wharf were repaired during the late 1990s, but most of the damage sustained during 1991 and 1992 storms remains unmitigated, and prevents access to the station by water. The constant assault from wind and seawater makes maintaining these buildings even more challenging. The park's budget is simply not sufficient to keep pace with future upkeep demands of these historic structures. Renovation of the wharf alone is estimated to cost up to \$1 million.

Faced with maintenance costs that far exceed what funds are available in Assateague's budget, the park is seeking a partner such as a university or nonprofit organization to rehabilitate the interiors of the buildings and operate them for education or research. This solution was developed during a series of

public meetings held in 2005 by the park to discuss community-based approaches to maintaining Assateague Beach Coast Guard Station in the face of financial threats.

ARCHAEOLOGY—MORE WORK NEEDED

Human use of Assateague Island is evidenced, in part, by the park's four documented archaeological sites, which include the Green Run Cemetery, and the ruins of the Scott's Ocean House Hotel, Seaboard Fish Oil and Guano Company, and North Beach Life-Saving Station. Other known and suspected sites have not yet been entered into the Archaeological Sites Management Information System, a database used to organize archaeological information. The four documented sites date from the late 19th and early 20th centuries. The North Beach Life-Saving Station was one of four such stations on the island; it has been reduced to rubble. Scott's Ocean House was a privately owned hotel and resort located near Green Run that operated from about 1869 to 1912. The cemetery was part of a village that cropped up around the Green Run Station, a lifesaving station no longer in existence. The Seaboard Fish Oil and Guano Company, built in 1912 and destroyed

by fire a few years later, is tangible evidence of a brief period of industrial development on the island. Most of the park's archaeological sites have not been evaluated for the National Register of Historic Places.

Other archaeological resources within the park include the submerged remains of the U.S.S. *Despatch* and several other 19th century wrecks. The *Despatch*, a 174-foot steamer with a wooden hull, served as the first presidential yacht and was used by Presidents Hayes, Garfield, Cleveland, and Benjamin Harrison before it sank in a storm on October 10, 1891, off the coast of Assateague Island. Although no definitive sites have been located, artifacts from two Spanish vessels dating from the 18th and 19th centuries have also been recovered and are on long-term loan from the government of Spain.

Because the park lacks any cultural resources staff, it relies on archaeologists from the Maryland State Historic Preservation Office, regional Park Service archaeologists, and other private sources to perform needed work. Assateague's four identified terrestrial archaeological sites were surveyed and mapped in 1985. A full archaeological overview and assessment



MICHAEL CARLSON

Throughout the colonial period and up until the 1960s, many ships wrecked in the coastal waters around Assateague. Evidence of these wrecks sometimes washes ashore.

Artifacts from shipwrecked Spanish vessels are preserved in the park's museum collection. The park has requested funds to hire a museum technician to care for these and other historical items.



of terrestrial sites is still needed, however, to identify and evaluate known and potential resources. Recent geologic information suggests that portions of Assateague Island, such as the area around Green Run, are significantly older than most of the island. These older landforms may hold potential for prehistoric archaeological sites. Four studies of submerged archaeological resources were completed between 2002 and 2006: an overview and assessment of maritime archaeological resources, a remote sensing survey (identification study) of maritime resources on the ocean side of the island, a diver investigation of sites identified by the remote sensing survey, and a remote sensing survey of the bayside waters within the park (no sites found).

Natural forces such as wind, water, and weather threaten the continued existence of the

park's archaeological sites. Without active preservation, these sites will likely deteriorate and may disappear over time. At minimum, archaeological sites should be documented and analyzed. The park has requested funds to support a staff archaeologist.

MUSEUM COLLECTION AND ARCHIVES—MAKING THE MOST OF LIMITED RESOURCES

Assateague's museum collection and archives contain artifacts and records that tell of the park's human history and document the island's flora and fauna. Coins and hardware retrieved from shipwrecked Spanish vessels are evidence of 18th and 19th century maritime shipping and commerce, while bricks, glass, and architectural details remain from a 19th century fish factory, and newspaper articles and photo-

graphs document Leon Ackerman's mid-20th century real estate ventures. In sum, the collections include 4,930 items.

The park does not have a museum curator or archivist, but curators from the Park Service Northeast Regional Office and several other parks have assisted the park when needed. In 2005, the regional archivist visited Assateague to survey the archives and investigate the park's archival needs. The survey found that while most of the park's resource management records are being appropriately treated, there is a large quantity of historical information and documentary material scattered throughout the park that needs to be archived. Hiring a museum technician to manage the collection and archives would alleviate these burdens, which now fall on existing staff, and would enhance collection care and interpretation. There is, however, no funding currently available for this position.

In the absence of curatorial staff, resource managers, interpretive staff, and summer interns maintain the museum collection. Museum objects and associated documentation are well conserved and appropriately stored within a facility that is equipped with a heating, ventilating, and air-conditioning (HVAC) system, fire suppression and detection systems, and humidity control. Although space is not currently a problem, Assateague will need expanded storage facilities as archival records are added to the collection.

This need may be met with modifications of the library adjacent to the collection storage room to create additional secure storage space. Construction of a new visitor center, scheduled for 2008, will include more exhibit space for displaying and interpreting artifacts from the museum collection and archive. Current visitor centers are frequently overwhelmed with crowds, and have little space to accommodate schools and other groups.

ETHNOGRAPHY— INITIAL RESEARCH NEEDED

Although early Europeans provided accounts of American Indians using Assateague to hunt and forage, there is no archaeological or historical evidence of any tribe traditionally associated with the island. Detailed ethnographic research is needed, however, before any conclusions can be made. In addition, research is needed to document connections with more contemporary users of the island such as local fishermen and hunters. An ethnographic study of Assateague Island has been tentatively funded and is scheduled to begin in 2008. Because ethnographic research has not yet been done, the Center for State of the Parks did not formally assess and rate the park's ethnographic resources.

Former hunting and fishing camps are found throughout the park. They are being evaluated for their historical significance.



ELIZABETH MEYERS/NPCA



The park provides a variety of interpretive programs for children and adults, but needs more staff and a larger facility to better meet visitors' needs.

STEWARDSHIP CAPACITY

FUNDING AND STAFFING—ADDITIONAL FUNDS AND RESOURCE MANAGEMENT STAFF NEEDED

The most significant factor affecting a park's ability to protect its resources is the funding it receives from Congress and the administration. In fiscal year 2007, Assateague Island National Seashore has an annual field-adjusted operating budget of \$4.02 million to support staff and fund resource protection projects. Currently, about 92 percent of the park's base funding must be used to support full-time personnel, leaving few funds for unexpected emergencies. The

park's budget has not kept pace with inflation and escalating personnel costs; in fact, there is a growing gap between increasing operating expenses and available base funds. This situation is present not only at Assateague but throughout the National Park System and results in critical understaffing and limited resource protection capabilities. Park entrance fees and special use permit fees for activities such as camping and OSV use provide supplemental revenue. To finance upgrades for visitor facilities such as restrooms, the park plans to increase fees.

Chronic underfunding has led to wide-ranging staffing shortfalls at the seashore. Overall, Assateague is unable to fill nine existing

permanent staff positions and add new critical positions because of a lack of funds, which translates to difficulties providing adequate resource protection, maintenance, and visitor services. Programs and resource management activities that are suffering include rare, threatened, and endangered species management and protection, invasive plant and animal management, aquatic resource protection, cultural resource management, information management, planning and coordination with regional partners for improved watershed management, natural resource interpretation, and environmental education.

To adequately protect resources and serve visitors, Assateague needs two additional permanent law enforcement officers to monitor recreational and commercial activities that may affect federally protected species and sensitive habitats, enforce public use closures, conduct water-based patrols and monitoring, and enforce commercial use restrictions and resource protection statutes. Three seasonal resource management staff are needed to monitor and control invasive plants and animals, as well as monitor and manage federally listed piping plover, seabeach amaranth, and the many state-listed plant and animal species. Two permanent interpretive staff are required to expand resource protection, interpretation, and outreach; one resource manager is needed to expand the park's capabilities in understanding and protecting its ocean resources; and another resource manager is needed to coordinate watershed planning and land use management issues. An additional two full-time permanent employees are needed to manage the park's overall cultural resources program, identify and care for archaeological resources, and catalog, curate, and protect the park's museum collection and archives.

The park is also in need of funds for resource management projects, equipment and supplies, and staff travel and training. Unfunded projects at Assateague include both natural and cultural

TABLE 1

Natural Resource Project Needs

- Develop water quality model to assess the effects of changing watershed conditions and nutrient loading on park estuarine resources \$350K
- Inventory, map and assess the status of marine habitats adjacent to Assateague Island \$600K
- Investigate recent die-offs in the salt marsh habitat of Assateague Island \$75K
- Assess the effects of establishing a no-take marine sanctuary in Chincoteague Bay on commercial fisheries, recreational fishing, and ecological conditions ~\$1,000K
- Inventory the small mammal community on Assateague Island \$75K
- Restore wetland habitats affected by historic roads and dikes \$800K
- Control common reed (*Phragmites australis*) in park wetlands \$300K
- Restore salt marsh habitats affected by historic mosquito ditching \$600K
- Develop protocols to monitor the effects of climate change on key attributes of Assateague Island \$150K
- Assess the recovery of overgrazed salt marsh habitats when released from horse grazing \$50K
- Digitize and geo-rectify historic aerial photography of Assateague Island \$30K
- Assess nutrient loading from tidally influenced agricultural lands \$250K
- Establish baseline inventory of night sky conditions at Assateague Island \$30K

Cultural Resource Project Needs

- Rehabilitate the historic wharf at the Assateague Beach Coast Guard Station \$900K
- Complete an archaeological overview and assessment/identification study for terrestrial acreage \$80K
- Complete a historic resource study \$30K
- Complete an ethnographic overview and assessment \$20K

Touch-tank aquaria and other hands-on exhibits encourage visitors to learn about park ecosystems.



resource themes; several top needs are summarized in Table 1.

PLANNING—LACK OF STAFF PUTS PLANS ON HOLD

With a wide array of natural and cultural resources to protect and manage, Assateague Island National Seashore should have in place a number of management plans to guide daily activities and overall goals. The park's general management plan (GMP), which was written in 1982, provides general guidance and direction, but does not adequately address several contemporary issues. To help remedy this situation, Assateague is scheduled to begin revising its GMP in 2008. Once this is completed, the park will begin developing a resource stewardship plan, which will replace its resource management plan, last updated in 2001.

In addition to the general management and resource stewardship plans, which are overarching park documents, Assateague needs a number of plans to address specific resource management issues. These include management plans for seabeach amaranth, feral horses, wilderness, terrestrial archaeological resources, and the museum collection. Only one, the feral horse management plan, is currently under way. Others are on hold primarily because the park does not have enough staff to complete them.

Because the park's boundary includes both the state park and the national wildlife refuge, staff must work closely on planning and management issues with the Maryland Department of Natural Resources and U.S. Fish and Wildlife Service. The park collaborates with both agencies on a regular basis and on a broad range of issues, including sika deer manage-

ment, water quality monitoring, wastewater management, and feral horse management. Additional cooperation may be necessary to reduce fox depredation on piping plover and breeding colonial waterbirds in areas adjacent to the state park.

RESOURCE EDUCATION—THOUSANDS OF VISITORS REACHED THROUGH INTERPRETIVE PROGRAMS

Assateague Island National Seashore provides numerous opportunities to engage and educate visitors about the park's cultural and natural resources. Programs and exhibits help visitors learn about how people have used Assateague Island throughout history, both changing the island and being changed by it. Natural resources interpretation focuses on how the island is constantly reshaped and remade as wind, water, and weather shift sands over time and space. The island sits at the crossroads between land and sea, in a place where fresh and salt water mix. The ebb and flow of competing forces leads Assateague and its surrounding waters to a state of continual change. It is this dynamic nature that defines the island and its living resources.

Park staff and volunteers offer more than

800 programs both on- and off-site each year, which typically reach more than 160,000 people. These programs include guided nature walks, canoe trips, aquarium feeding presentations, surf-fishing demonstrations, and environmental education programs. Visitors can also learn about the park by exploring its three self-guiding nature trails, viewing movies at the Maryland Barrier Island Visitor Center, or by engaging in hands-on exhibits such as the beachcomber rooms and touch-tank aquaria. These exhibits allow children and adults alike to touch living organisms from the surrounding waters such as horseshoe crabs, as well as shells and other items that wash up on the beach.

Although Assateague Island offers a wide variety of resource education opportunities, exhibits are in need of updates and the interpretive staff is too small to meet the needs of visitors, much less reach out to local underserved communities. Until recently, the park had six permanent interpretive staff and three summer seasonal staff per district (Maryland and Virginia). The supervisory positions for both districts have been lapsed in order to balance the budget, leaving the remaining staff struggling to meet the workload. The park's visitor



ELIZABETH MEYERS/NFCA

Interpretive panels teach visitors about the park's natural and cultural history.

ASSATEAGUE OFFERS OPPORTUNITIES FOR HUNTING AND FISHING

Throughout most of the National Park System, hunting is strictly prohibited. In keeping with Assateague's traditional uses, however, legislation allows park visitors to hunt waterfowl, deer, and small game within the national seashore. Hunting on the island is tightly regulated: Hunters must purchase permits, use specified blinds, and check in at a ranger station every day before hunting. Hunting camps and private blinds are not permitted. Most waterfowl except tundra swans are available to hunters with permits at specified times of year. Sika deer may be hunted with crossbows, shotguns, or muzzle-loaders, depending on the season. All hunting is restricted to designated areas of the park. Mortality caused by hunters currently provides the most important population check for the introduced sika deer. More information about hunting seasons and permit fees can be found at www.nps.gov/archive/asis/hunting.htm.

Recreational fishing opportunities also abound on Assateague. Ocean and bay waters hold promise of many different species of sport fish and shark, including black drum (*Pogonias cromis*), channel bass (*Sciaenops ocellatus*), weakfish (*Pseudotolithus typus*), summer flounder, whiting (*Merlangius merlangus*), bluefish (*Girella cyanea*), white perch (*Morone americana*), mullet (*Mugil cephalus*), sand tiger sharks (*Carcharias taurus*), smooth dogfish sharks (*Mustelus canis*), sandbar sharks (*Carcharhinus milberti*), skates (*Raja eglanteria*), tautog, and striped bass (*Morone saxatilis*). Recreational harvest of crabs and shellfish is also permitted in the park.

Assateague Island's ocean and bay waters hold many different species of sport fish and shark, including striped bass.



USFWS

centers, which together reach more than 350,000 visitors, are often overwhelmed with crowds. School groups visiting the Barrier Island Visitor Center in the Maryland district routinely fill the small facility, leaving little room for other visitors to use the center and view exhibits. Plans are under way to build a larger new facility within the next five years to address this and other issues.

The Park Service plans for the new visitor center to meet as many Leadership in Energy and Environmental Design (LEED) standards for energy efficiency and sustainability as funding will allow, aiming for the silver standard. Although the original design was estimated to cost up to \$30 million, the Park Service has received just \$5 million for constructing the facility, forcing dramatic reductions in scale and function.

EXTERNAL SUPPORT—VOLUNTEERS HELP PROTECT AND INTERPRET RESOURCES

Faced with significant funding and staffing shortfalls, the park increasingly relies on partners and volunteers to bridge the gap between what is needed and what the park can afford. In fiscal year 2006, 348 volunteers contributed 12,156 hours of service, helping with visitor center operations, educational programs, resource and visitor protection, campground operations, beach cleanups, and natural resource projects such as water quality monitoring, botanical surveys, and geographic information systems (GIS) operations.

Although the park lacks a formal friends group and would like to see one established, it has cooperative relationships with other organizations such as the Eastern National Parks and Monuments Association (ENPMA), the Assateague Coastal Trust, and the Maryland Coastal Bays Program. ENPMA provides between \$15,000 and \$20,000 each year from proceeds generated by two bookstores located in the park's visitor centers. Assateague Coastal



The park's small interpretive staff, which declined even further due to recent budget shortfalls, struggles to continue to provide sufficient learning opportunities to visitors.

Trust donates about \$15,000 each year from funds generated by the Assateague Foster Horse Program. This program allows the public to "adopt" horses by donating money, which helps protect the horses and their habitat. The Maryland Coastal Bays Program directly benefits the park by coordinating critical watershed conservation programs at the federal, state, and local levels.

Communities surrounding Assateague generally support the park and its mission, but park staff acknowledge the need for further engagement in local and regional planning and land use management issues. By building even closer relationships with surrounding communities, the park can better inform its neighbors and decisionmakers about how watershed growth and development can degrade park water quality, and will be in a better position to advocate for park resource protection to a wider audience.

WHAT YOU CAN DO TO HELP:

- **Support or become a member of a group helping to protect the park**, such as NPCA (www.npca.org/support_npca), Greater Washington National Park Fund (www.gwnpf.org), Maryland Coastal Bays Program (www.mdcoastalbays.org), or another regional organization.
- **Help establish a friends group for Assateague, or sponsor one of the park's outstanding natural or cultural resource project needs.** Contact the park at 410.641.1443, ext. 202.
- **Volunteer.** Many parks are looking for dedicated people who can lend a helping hand. To learn about opportunities at Assateague Island National Seashore, call 410.641.1441.
- **Become an NPCA activist and learn about legislative initiatives affecting parks.** When you join our activist network, you will receive *Park Lines*, a biweekly electronic newsletter with the latest park news and ways you can help. Join by visiting www.npca.org/takeaction.



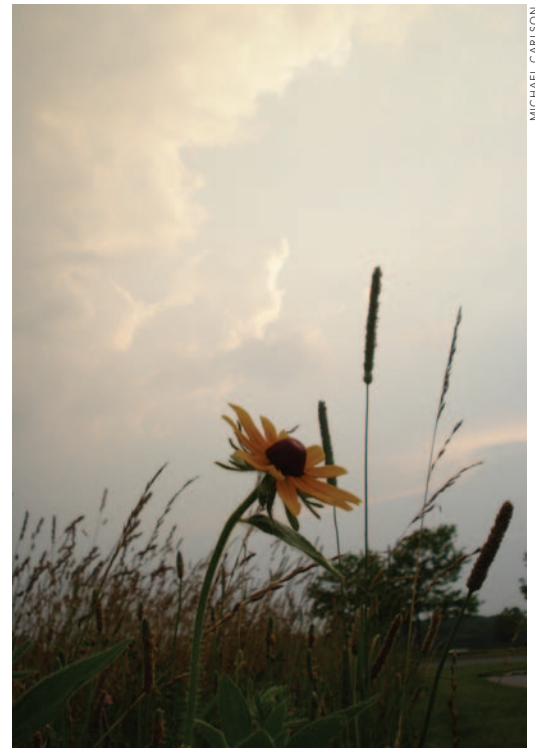
APPENDIX: METHODOLOGY

To determine the condition of known natural and cultural resources at Assateague Island National Seashore and other national parks, the National Parks Conservation Association developed a resource assessment and ratings process. It examines current resource conditions, evaluates the park staff's capacity to fully care for the resources, and forecasts likely conditions over the next ten years. The assessment methodology can be found online at NPCA's Center for State of the Parks® web site (www.npca.org/stateoftheparks/).

Researchers gather available information from a variety of research, monitoring, and background sources in a number of critical categories. The natural resources rating reflects assessment of more than 120 discrete elements associated with environmental quality, biotic health, and ecosystem integrity. Environmental quality and biotic health measures address air, water, soils, and climatic change conditions as well as their influences and human-related influences on plants and animals. Ecosystems measures address the extent, species composition, and interrelationships of organisms with each other and the physical environment for indicator, representative, or all terrestrial and freshwater communities.

The scores for cultural resources are determined based on the results of indicator questions that reflect the National Park Service's own Cultural Resource Management Guideline and other Park Service resource management policies.

Stewardship capacity refers to the Park



MICHAEL CARLSON

Service's ability to protect park resources, and includes discussion of funding and staffing levels, park planning documents, resource education, and external support.

For this report, researchers collected data and prepared a paper that summarized the results. The draft underwent peer review and was also reviewed by staff at Assateague Island National Seashore.

NPCA's Center for State of the Parks represents the first time that such assessments have been undertaken for units of the National Park System. Comments on the program's methods are welcome.

ACKNOWLEDGMENTS

For more information about the **Center for State of the Parks®** and this and other program reports, contact:

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Please visit www.npca.org/stateoftheparks/ to view these reports and to learn more about the Center for State of the Parks®.

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