

## Chapter 3



**Royal tern colony.**  
*USFWS photo*

# Refuge and Resource Descriptions

- Refuge Administration
- Physical Environment
- Biological Resources
- Socio-economic Factors
- Public Use
- Cultural Resources

## Refuge Administration

### Staffing and Budget

Annual appropriations vary from year to year, depending on the Service's overall budget, and how the refuge's needs and requests rank regionally and nationally with other refuges. Table 3-1 summarizes budget and staffing levels from 1996–2003. Fluctuations reflect funding for special projects. For example, the maintenance budget for 1999 includes \$47,000 for Visitor Center repairs.

*Table 3-1. Refuge Complex staffing levels and budgets between 1996-2003.*

Fiscal Year	Operations	Maintenance	Full-time Staff	Part-time Staff
1996	347,200	77,800	6	0
1997	440,900	58,100	6	0
1998	416,600	25,100	7	0
1999	461,900	91,000	8	0
2000	522,200	75,600	9	0
2001	524,000	47,000	9	0
2002	599,500	54,800	9	0
2003	434,695	91,500	6	0

### Resource Protection and Visitor Safety

Law enforcement officers, with full authority to enforce federal regulations, are required to ensure resource protection and visitor safety. Presently, the Refuge Manager has dual function law enforcement responsibilities.

### Refuge Facilities and Maintenance

Existing facilities include the Visitor Center, refuge headquarters, an environmental education building, a conference building, four maintenance buildings, and seven refuge residences (including three houses for university and Non-Governmental Organization researchers and four houses for refuge staff and interns). The maintenance staff are responsible for repairs and upkeep of all these facilities, though some upkeep of the research housing is the responsibility of the respective organizations.

We also have a photo blind, kiosk, trails, three water control

structures, roads, gates, and signs such as boundary and informational signs. Maintenance staff are also responsible for the upkeep of these facilities. Responsibilities include periodically posting or replacing refuge boundary signs, mowing trails, grading and repairing the photo blind and kiosk.

There are several constructed ponds on the refuge. Freshwater is pumped into the Visitor Center pond to create wildlife observation opportunities showcasing migratory waterfowl, waterbirds, and shorebirds. Invasive species such as cattail are removed from that pond to enhance wildlife habitat and water levels are maintained seasonally. Storm water runoff provides freshwater to the northern pond. Four other refuge ponds are naturally fed by rain water.

Adjacent to the communications tower is a switching station that houses communications lines which cross the Chesapeake Bay Bridge-Tunnel and head north to Cape Charles. Although there is an above-ground building associated with the switching station, the lines run underground with several small pedestals. The switching station is owned and maintained by Verizon Virginia, Inc. and is under a lease agreement with the refuge.

The Refuge also owns and maintains 2.1 miles of paved roads on the Eastern Shore of Virginia Refuge. About 1.5 miles of those roads provide safe and easy public vehicular access to areas such as the refuge office, environmental education building, and conference center.

### Volunteer and Intern Programs

Northampton County, a rural community with a population of approximately 13,000, is one of the poorest counties in Virginia. Over a million people live in the Hampton Roads area which is only 25 miles south of the refuge but is separated from the refuge by the Chesapeake Bay. Consequently, the Chesapeake Bay Bridge-Tunnel connects these two land masses. Although the Hampton

Roads area is a prime place to recruit volunteers, most volunteers are unable or unwilling to pay the round-trip toll to cross the Bay Bridge-Tunnel.

As a result, over half the volunteer hours each year come from people participating in long-term volunteer programs, such as the Intern or Workamper programs. Advertisements for interns are placed on several websites and in local publications. These volunteers receive housing and a \$1,200 stipend for 12 weeks of volunteer service. Volunteers perform numerous tasks important to the Refuge including, but not limited to, staffing the



**Workamper sites.**  
*USFWS photo*

Visitor Center, conducting environmental education programs, building bluebird houses, conducting bird surveys, and banding and marking wildlife.

The refuge advertises for the Workamper Program in “Workamper Magazine,” a magazine that caters to the interests of volunteers who travel in motor homes. In 1997, the refuge installed three RV hookups with water, electricity and sewage disposal. Workampers agree to provide at least 20 hours of service weekly and stay at the refuge for at least a month. They perform many of the same duties assigned to interns, as well as numerous maintenance projects.

During an average year, seven people participate in the Intern Program and four to six in the Workamper Program. In all, volunteers contributed a total of 8,000 hours in 2000.

### Cooperating Association/Friends Group

The Chincoteague Natural History Association (CNHA), a Cooperating Association, was established in 1987. Its bylaws were amended in 1992 to include Eastern Shore of Virginia Refuge. The primary purpose of CNHA is to promote a better understanding and appreciation of the natural history and natural environment of Virginia’s eastern shore and Assateague Island, particularly the Chincoteague and Eastern Shore of Virginia Refuges.

CNHA has a sales outlet at the refuge’s Visitor Center that is primarily managed by refuge staff. Twenty-five percent of gross sales are returned to the refuge annually. Gross sales for 2000 were approximately \$32,000. The refuge submits a wish list of funding needs each year, and CNHA chooses which items to fund. In 2001, CHNA provided funds for environmental education, the volunteer program, special events, and stipends for interns.

### Special Use Permits

Special Use Permits (SUPs) are issued to individuals, organizations, and agencies requesting the use of refuge facilities or resources beyond what is available to the general public. SUPs are issued with special conditions and restrictions to minimize or eliminate disturbance to wildlife. They are also issued for variable time periods ranging from one day to one year depending on the request. The largest groups of permit holders are researchers and commercial watermen. An average of 16 research projects per year (based on a three-year period) have received SUPs for studies on northern saw-whet owls, royal terns, monarch butterflies, diurnal avian spring migrants, birds of prey, and rare plants on Fisherman Island Refuge. During 2002, 21 commercial watermen and about 50 recreational anglers purchased an annual SUP to access the boat ramp on the former Wise Point property.



**Tagged monarch butterfly.**  
*Charles Philip*

Other Special Use Permits issued include use of refuge facilities for law enforcement training and access to leased facilities such as the communications tower and U.S. Customs transceiver. We issue an average of eight of these permits per year.

## Research



**Banding a raptor.**  
*Charles Philip*

Research has greatly increased our understanding of the critical role that the Eastern Shore of Virginia and Fisherman Island Refuges play in avian migration. The refuge facilitates biological research by providing funding and housing for groups such as the Center for Conservation Biology at the College of William and Mary, the Coastal Virginia Wildlife Observatory, and Hampton University. Currently, at least seven on-going research projects are being conducted on the Eastern Shore of Virginia and Fisherman Island Refuges. Most research projects focus on migrant stop-over ecology, habitat requirements, and predator impacts on nesting colonies. The knowledge gained has led to many recommendations included in this plan. Much research remains to be done to adequately understand the resource requirements necessary to benefit avian species of concern.

Refuge managerial responsibility also lies with trust resources beyond migratory birds, such as with the Federal-listed Northeastern beach tiger beetle. In addition, refuge staff collect data from sea turtle strandings to contribute to the Virginia Institute of Marine Sciences' state sea turtle stranding database. Staff also collect marine mammal stranding data which contributes to the Virginia Marine Science Museum's State marine mammal stranding database.

---

## Physical Environment

### Land Use

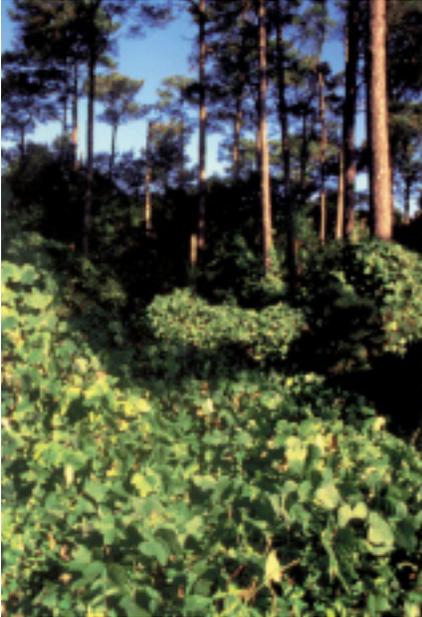
#### *Land use history on the Eastern Shore of Virginia*

The Eastern Shore of Virginia lies on the southern tip of the Delmarva Peninsula. The peninsula is bordered on the east by the Atlantic Ocean and on the west by the Chesapeake Bay. This area has long been a rural agricultural area. Prior to colonization, however, the eastern shore was almost entirely forested with deciduous mixed hardwood (Wesler et al. 1981). According to Wesler, anthropologists believe that the indigenous people of the area were hunters and gatherers who lived in transient hunting camps in the upland and perhaps base camps on the river terraces, correlated with a generalized foraging economy. This type of land use changed with the arrival of Europeans.

During the exploration and early settlement period of the 17th and 18th centuries, forests were cleared to make way for land that could be farmed. Colonists on the lower Delmarva Peninsula cultivated grain, raised livestock, and, to a lesser extent, grew tobacco on relatively small farms. Records indicate that the land upon which the Eastern Shore of Virginia Refuge currently sits was purchased by the Simpkin family in 1766, then sold to the Custis family, another farming family, in 1803. The Custis family sold the land to the Hallett family in 1807. The land changed hands several times beginning in 1895, but by 1940 it was back under the ownership of the Halletts.

Soon after the Halletts reclaimed ownership, the majority of the farmland became Fort John Custis Army Base, later becoming the Cape Charles Air Force Base. Some land remained in agricultural use through 1990. Aerial photographs show that land on the western portion of the base was farmed from the 1960's to 1990 (Mata L. 1997). Crops farmed prior to the establishment of the refuge in 1984 were mainly grains such as wheat, barley, and soy beans. The refuge administered a cooperative farming program on approximately 75 acres from 1984 to 1990. Grains such as sorghum, millet, milo, and sunflower were planted and rotated with legumes (i.e., red clover) for wildlife consumption (Spady, 2000). Farming was discontinued on the refuge in 1990 and the fields were left fallow.

When the Eastern Shore of Virginia Refuge was established in 1984, removal of structures on the refuge was initiated to create habitat supportive of migrating birds and other wildlife. Residences, towers, a non-commissioned officer's club, tennis court, swimming pool, bowling alley, and over one 100 excess military structures were removed or demolished. Most of the once-developed land has revegetated via natural succession, thus increasing the acreage of seedling loblolly pine and shrub habitat. Unfortunately, non-native



**Kudzu, an invasive plant.**  
*Charles Philip*

plant species such as Japanese honeysuckle, fescue grass, phragmites, and kudzu have established themselves throughout much of the disturbed acreage of the former base and farmland. Other invasive species include autumn olive, multiflora rose, mustard, fennel, and lespedeza.

The Eastern Shore of Virginia refuge also includes Skidmore Island, sometimes called, “Long Point Island”, located approximately 1,000 feet off the mainland. The Service purchased the 108.5 acre-island from The Nature Conservancy in 1987. Approximately 40.5 acres lies above the mean high water line of Magothy Bay and consists mainly of brush and wooded upland. There are two buildings found here that are in poor condition. The remaining 68 acres lies below the mean high water line of Magothy Bay, and consists of mud flats, beach, marsh, and is flooded by tides.

#### *Land use history on Fisherman Island*

The earliest documentation of Fisherman Island exists in navigational charts of the Chesapeake Bay in 1815. Local people claim that the island was originally named Linen Island after a ship carrying a load of linen went aground in the early 19<sup>th</sup> century.

In 1886, the federal government leased and subsequently purchased Fisherman Island from its owner William Parker for an immigrant quarantine station. The quarantine station consisted of barracks for up to a thousand people and included a kitchen, mess hall, artesian well, and keeper’s residence. Records indicate the station was only used once in the treatment of yellow fever victims from the ship *Despa* in 1893. At the advent of WWI in 1914, soldiers from the Fourth Company of the Virginia Coastal Artillery National Guard were stationed on the island to protect the entrance of the Chesapeake Bay.

In 1932, the National Audubon Society tried unsuccessfully to influence Congress to transfer Fisherman Island to the Department of Agriculture. However, a letter sent by the War Department and signed by the Secretary of War on September 2, 1933 granted a permit for the period of five years, “revocable at will by the Secretary of War, to use as a migratory bird refuge, Fisherman Island Military Reserve, Virginia.” The Navy used the island as a harbor defense unit and, with the U.S. entry into World War II, as a submarine detection base. In 1943, the permit to use the island as a refuge was terminated by the Navy. In that year, nearly 300 mines were controlled by cables from the island and four radar-controlled 90-millimeter guns were installed. The artillery station was deactivated in 1944 and the land was transferred from the Army to the Navy, who maintained a LORAN radar navigation station on the island until 1969. Fisherman Island Refuge was established in 1969 and transferred to the Department of the Interior in 1973.

The remainder of Fisherman Island (the Isaacs and Adams islands

which had merged, split, then merged again with Fisherman Island in the early 20th century) was purchased from private land owners by the Department of the Interior in 1998. The last 25 acres owned by the Department of Defense was transferred to the Department of the Interior in 2000, putting the entire island under Service ownership.

Today, this southernmost barrier island in Virginia is separated from the Eastern Shore of Virginia Refuge by Fisherman's Inlet, a half-mile-wide body of ocean water. Onshore sand bar movement (accretion) continues to expand the island's size, currently estimated at 1,850 acres.

The Virginia barrier island chain is classified as a "Wetland of International Importance" under the RAMSAR Convention, one of only 17 sites so designated in the United States.

#### *Current land use trends*

Residential construction on the Eastern Shore of Virginia is on the rise. Personal communication with land use planners has revealed a development trend in Northampton County emphasizing the construction of second homes for retirees (McGowan 2000), thus reflecting the demographic trend of an aging population. In the spring of 2000, construction of an "Adult Community" (Wilbur Smith Associates 1999, p. 2-6) was beginning on a 2,000-acre tract of land. The development, located south of Cape Charles on the Chesapeake Bay has a 15-year build-out plan for up to 3,000 residences, plus two golf courses and other amenities. Additionally, a 224 slip marina is being constructed as part of this same development. Second home and recreational developments such as these pose the greatest threat to loss of valuable shoreline habitat on the Chesapeake Bay.

One possible reason for the recent development boom was speculation that the Chesapeake Bay Bridge-Tunnel (Bridge-Tunnel) toll would be reduced. On March 1, 2002 that speculation became reality. Now that the toll has been reduced, the eastern shore is likely to see more development and dramatic changes in its landscape.

However, Northampton County is in need of economic development. Cape Charles, with the largest population in Northampton County, has suffered from a shrinking population and a shrinking employment base for many years (Wilbur Smith Associates 1999). Between 1960 and 1990, the population of Cape Charles declined from about 2,040 to 1,400 residents, undergoing a 30 percent drop. The town's commercial district currently has a high number of vacancies. A tourism push could bring money, jobs, and people back to the area.

### *Roadways*

Future traffic growth is anticipated as land use development on the eastern shore intensifies. In July 1999, a consulting company working for the Accomack-Northampton Planning District Commission completed a “U.S. Route 13 Corridor Plan” (Wilbur Smith Associates 1999) for the Eastern Shore of Virginia. U.S. Route 13 is the principal north-south highway that traverses Virginia’s eastern shore. In addition to its role as the primary corridor for travel on the eastern shore, Route 13 also serves as an alternative route for through travel between the Carolinas, southeastern Virginia, and the Northeast. The study examined the 68-mile corridor of Route 13 that extends between the Maryland/Virginia state line south to the Bridge-Tunnel and includes both Accomack and Northampton counties.



**Double-crested cormorant.**  
*USFWS photo*

The report found that since the completion of the Bridge-Tunnel in 1964, traffic on Route 13 has grown at an average annual rate of 2.7 percent. Traffic volumes vary within the corridor, with a low of about 8,000 vehicles per day at the corridor’s southern end (where the refuge is located) to about 20,000 vehicles per day at the corridor’s northern end. Truck traffic represents between 12 and 15 percent of total vehicular volume, a relatively high percentage for such a rural area (Wilbur Smith Associates p. ES-10 1999).

### **Air Quality**

Virginia’s Eastern Shore currently has attainment status for air quality as required by the Federal Clean Air Act of 1970, which was amended in 1977 and again in 1990 (Wilbur Smith Associates 1999). Attainment status refers to whether a particular area meets or “attains” the National Ambient Air Quality Standards (NAAQS) as set by the Federal government in the Clean Air Act of 1970 (Gaba 1994). Those standards specify the concentrations of pollutants that may be present in the ambient air outside of buildings. As traffic volumes increase, air quality could decrease.

### **Climate**

The climate of the Eastern Shore of Virginia is mild and humid (USFWS 1984). The Atlantic Ocean and the Chesapeake Bay moderate temperatures, with a January average of 42 degrees and a July average of 77 degrees Fahrenheit. Precipitation averages 43 inches annually and is generally well distributed throughout the year with a slight increase during the summer months. Numerous rapidly moving polar fronts from the northwest dominate the weather pattern during the winter, while the summer pattern is characterized by little frontal activity and the domination of the “Bermuda High,” which brings moist air from the south.

The region is subject to two major storm types—northeasters and hurricanes—that bring high tides, strong winds, and heavy



**Red-spotted purple.**  
*Nancy Biegel*

precipitation (USFWS 1984). Northeasters generally occur during the fall, winter, and early spring and are characterized as slow moving low pressure systems that move up the Atlantic coast, generating strong northeast winds. Hurricanes can occur from June through November and may pass offshore in the Atlantic, directly along the coast, or inland. A hurricane's track will determine the extent of flooding and erosion. Although the region does not usually experience the extreme effects of hurricanes that occur further south, storm damage can be significant. The U.S. Army Corps of Engineers has reported that 11 major storms (four northeasters and seven hurricanes) have struck this area during the 20th century.

### Geology and Topography

#### *Eastern Shore of Virginia Refuge*

The Delmarva Peninsula lies in the Atlantic Coastal Plain, a seaward sloping province bounded on the west by a fall line and the Chesapeake Bay, and on the east by the Atlantic Ocean (USFWS 1984). The peninsula extends about 200 miles in a north-south direction and includes the State of Delaware and the eastern shores of Maryland and Virginia. The Virginia portion of the peninsula is approximately 70 miles in length and has an average width of six to eight miles. The peninsula was formed during the last glacial retreat when rising sea levels filled the large valley of the lower Susquehanna River, which became the Chesapeake Bay, thus isolating the area from the mainland. The extensive barrier island and marsh-lagoonal system along the eastern side of the Delmarva Peninsula was formed over several thousand years by broad sea level fluctuations, however, the exact method of island formation has not been determined.

The region experienced earthquakes in 1844, 1899, and 1918. There is also some evidence of recent uplifting of the Delmarva Peninsula, which is being offset by a rise in sea level. A study on elevation changes that have occurred during the past 30 years indicates that sea level is rising at an annual rate of 1.2 millimeters per year in the vicinity of the former Wise Point property (USFWS 1984).

Topographically, the region is nearly flat, indicating the past influence of the ocean and the more recent leveling effects of winds. Elevations of the lower Delmarva Peninsula are generally less than 20 feet, with the highest areas along the interior of the peninsula and bluffs along the Chesapeake Bay reaching elevations of 40 to 50 feet. Numerous tidal creeks extend inland and are fed by intermittent freshwater streams with bottomland forests. Many of the creeks have been dammed at their upper ends to create impoundments used for irrigation. Extensive salt marshes are found within the barrier island lagoonal system and fringing marshes occur along tidal creeks.

Within the refuge, the upland section is flat with elevations between 5 and 20 feet (USFWS 1984). Low bluffs and a narrow beach (20 to 50 feet wide) are present along the Chesapeake Bay shoreline. Low-lying woods, intertidal wetlands and numerous small tidal creeks and ponds are found along the eastern side of the peninsula.

The location of the refuge relative to the Chesapeake Bay and Atlantic Ocean exposes the area to the effects of winds, waves, and currents, causing erosion and accretion of the shoreline. The Chesapeake Bay shoreline experiences moderate erosion, which is slightly greater near the south end. The marsh-island complex of the refuge has exhibited little erosion since 1938.

### *Fisherman Island Refuge*

Fisherman Island has changed dramatically over the years due to geological processes. Dr. George Oertel (1999) of Old Dominion University writes:

“The onshore migration of offshore sand bars was the main process affecting the development of Fisherman Island. The bars appeared to come in from the southeast, and wrapped around to the north. The attachment of bars to the shoreline was spaced over relatively long time intervals. In the 89-year interval between 1863 and 1952 only three major bars welded to the island, an average of only one major event every 30 years. During the 45 subsequent years between 1952 and 1997, five additional major “bar-attachment” events took place. The interval between major events was more frequent at about one major event per 10 years. After each attachment event, a portion of the sand in the bar migrated laterally along the shoreline. However, sand was often transported in opposite directions due to wave refraction at the ends of the bar. The bimodal transport of sand effected the development of the eastern and western ends of Fisherman Island in distinctly different ways. The sand distribution to the west side of the island produced closely spaced beach-dune ridges that developed into sets of secondary dune ridges. The sand distributed to the east side of the island produced hammocks that were separated by wide reaches of marsh” (pp. 10–11).



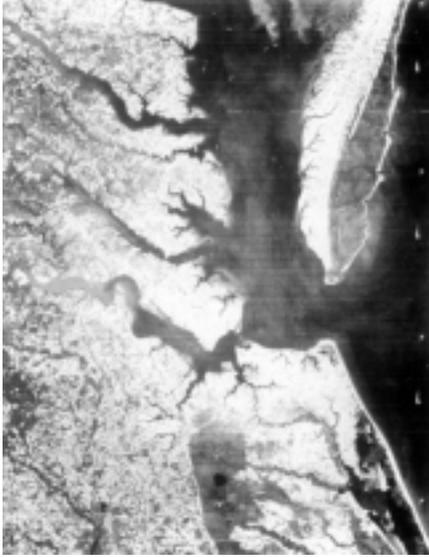
**Fisherman Island NWR.**

*USFWS photo*

### Soils

The soils of the Delmarva Peninsula are predominantly sand, silt, and shell fragments, and comprise six major soil associations, including Bojac, Munden, Nimmo, Newhan, Beaches, and Sulfaquent (USFWS 1984). The upland areas at the north end of the refuge are predominantly Mundane sandy loam and Bojac sandy loam, which have a 0–2 percent slope and are moderately well drained. Both of these soil types are classified by the Soil Conservation Service as prime farmland. The southern end of the

mainland consists primarily of Fisherman and Carteret fine sands. Tidal marshes are of the Sulfaquent and Natraqualf associations and include Chincoteague silty loam in the low marshes and Magotha fine sandy loam in the high marshes. Beaches with fine to medium sands are found along the exposed shorelines of the western and southern ends of the mainland and the barrier islands.



**Satellite image of the lower Delmarva Peninsula.**

*USFWS photo*

### Hydrology

Northampton County is somewhat unique with respect to hydrology because it has no major perennial free-flowing streams. The hydrology of the area can be discussed, therefore, in relation to the estuarine surface waters and groundwater.

### *Surface Water*

The Chesapeake Bay is the largest estuary in North America, encompassing about 2,500 square miles (U.S. Department of Transportation 1994). From its 11-mile wide mouth between Cape Henry and Cape Charles, it extends north about 195 miles almost to the Pennsylvania border. Along with the Delaware Bay estuary to the east, the Chesapeake Bay defines the Delmarva Peninsula. A characteristic of the Chesapeake Bay, and all estuaries, are its daily tides and salinity regime.

Biologically, the Chesapeake Bay is among the most productive bays in the world. Historically, its harvests of shell and finfish have been the highest of any North American estuary. This productivity is rooted in the large number of freshwater tributaries (150) that provide a regular influx of freshwater containing detritus and minerals to facilitate circulation of oxygen and nutrients, and gently sloping borders that allow productive marshlands an opportunity to grow (U.S. Department of Transportation 1994).

Numerous small tidal streams with freshwater headwaters are found on both the Chesapeake Bay and ocean sides of the peninsula. Rainwater percolates into the soil or runs off into natural or constructed drainage swales and ditches with flow into the tidal creeks and their headwaters. Surface drainage is generally east and west. The bayside of the peninsula drains to numerous creeks and ultimately into the Chesapeake Bay. The seaside of the peninsula drains to tidal creeks, backwater bays, and estuaries behind the coastal barrier islands, and ultimately into the Atlantic Ocean (Wilbur Smith Associates 1999). There are brackish ponds within the marshes adjacent to the mainland.

### *Groundwater*

The geology of Virginia's eastern shore (Accomack and Northampton Counties) has led to a complete reliance on groundwater resources for agricultural and residential use (Wilbur Smith Associates 1999). The communities on the eastern shore draw water from four aquifers. The upper aquifer (Columbia aquifer) is used primarily by the agricultural community, which draws 800,000 gallons per day (GPD) from this source. In addition, up to 4.4 million GPD are drawn from farm ponds, which often mix with underlying aquifer waters. Both the Columbia aquifer and individual farm ponds have been identified as having elevated levels of nitrogen. This is a common occurrence in agricultural areas. The remaining three aquifers (upper, middle, lower Yorktown aquifers) are used as a water source for residential and industrial consumption. Water withdrawals by both public supply systems and private wells account for approximately 3.5 million GPD, with about two-thirds of the total consisting of withdrawal from private wells. Private industrial withdrawals account for an additional 3.3 million GPD, primarily in association with poultry and shellfish processing.

In recent years, increasing concerns have been expressed regarding the impact of current and future activities on potable groundwater. As part of the U.S. Route 13 corridor study, a non-point source pollution assessment study was conducted for the Eastern Shore of Virginia (Wilbur Smith Associates 1999). Non-point sources of pollution generally come from roadway run-off and agricultural activity in a predominantly undeveloped environment. The three primary non-point source pollutants within Accomack and Northampton counties are nutrients, such as decomposing organic materials and airborne fertilizer particles; silt/sediment, such as dirt and soil washed off from fields or roads by storm water; and toxins, such as antifreeze, oil, and other materials dumped, dripped, or spilled from vehicles and equipment. If found in high enough concentrations, these pollutants could prove detrimental to wildlife and people.

Specific threats include the aquaculture industry, which has experienced recent growth on the eastern shore (Wilbur Smith Associates 1999). The concerns regarding this type of industry are untreated run-off and toxic spills. Recent studies of shellfish hatcheries, which draw water directly from the creeks both on the seaside and bayside, have found greater evidence of waterborne pollutants. Die-offs of larvae and elevated levels of pollutants following heavy rain have increased concern over the need to reduce non-point sources of pollution.

### *Flood Plain*

The mean tidal range in the area is four feet and the tidal waters are well mixed. Much of the area is subject to tidal flooding (U.S. Department of Transportation 1994). The Federal Emergency Management Agency (FEMA) defines the 100-year flood plain as



**Raccoon Creek, Eastern Shore of Virginia NWR.**

*USFWS photo*

any area that has a one percent chance of being flooded in any given year, or as any area where the land is less than nine feet above sea level on the seaside or eight feet above sea level on the bayside. In 1982, the 100-year flood plain was revised to include the effects of wave action. The maximum 100-year wave crest elevation has been reestablished to an elevation range of 11–13 feet above mean sea level.

Northampton County, which is estimated to contain about 22,500 acres of land in the flood plain (Wilbur Smith Associates 1999), participates in the National Flood Insurance Program. This program, administered by FEMA, requires habitable structures to be constructed with a first floor elevation above the 100-year flood plain and places limitations on other construction and alterations within the flood plain.

The area is also subject to minor rain-induced flooding in low lying areas with poorly drained soils, primarily at the southern end of the peninsula.

#### *Wetlands*

The eastern shore has a wealth of wetlands. Most of these are tidal wetlands comprised of salt marshes and tidal flats on the seaside and salt marshes on the bayside (Wilbur Smith Associates 1999). Freshwater wetlands occur at higher elevations than the tidal wetlands and, on the peninsula, are associated primarily with streams and creeks. The most comprehensive mapping of wetlands in Accomack and Northampton counties comes from the Service's National Wetlands Inventory maps. The evaluation of wetlands within the study area shows the relative abundance of tidal (estuarine) wetlands, such as deep water tidal habitats and adjacent tidal wetlands, tidal creeks, salt/brackish marshes, and mud flats on the edges of the peninsula. Fingers of estuarine wetlands reach inland into the peninsula along the stream channels to the limit of salt/brackish water intrusion.

The next most abundant wetland type on the mainland portions of the Eastern Shore is the inland freshwater wetland (palustrine). Freshwater wetlands include marshes, fens, swamps, bogs, wet meadows, as well as small shallow ponds or lakes. Many of the freshwater wetlands are adjacent to streams and creeks.

A relatively small amount of Lacustrine wetlands occurs within the study area, indicating permanently flooded lakes and reservoirs. The least common wetland type in the study area is the Riverine type, found along freshwater streams and creeks.

*Table 3-2. Wetland Types within Accomack & Northampton counties.*

Type	Subcategory	Total Acreage
Tidal (Estuarine)		145,000
Freshwater	Palustrine	62,250
	Lacustrine	250
	Riverine	49

### Contaminants

#### *Eastern Shore of Virginia Refuge*

Many of the contaminants issues on the eastern shore are related to past activities. Eastern Shore of Virginia Refuge was owned by the Department of Defense in the 1930's and operated as Fort John Custis until the 1950's. Thereafter, the facility was operated as Cape Charles Air Force Station until it was transferred to the U.S. Fish and Wildlife Service in 1984.

In 1999 the Service completed a Contaminant Assessment Process (CAP) for the Eastern Shore of Virginia Refuge (USFWS 2001a). The CAP is a standardized approach for documenting and assessing threats posed by environmental contaminants to lands and biota managed by the Department of the Interior. The completed CAP involved a thorough analysis of information on the ecological and physical characteristics of the refuge and surrounding area relative to possible contaminants issues. Also, it may provide recommendations for additional work to better assess ecological risk. The information summarized through the CAP can also provide the basis by which land managers select options to reduce contaminant impacts on species and their habitats.

According to the CAP for Eastern Shore of Virginia Refuge, the primary contaminant issues are:

- Identifying baseline sampling locations in the event of oil spills. Spills may occur along U.S. Highway 13/Bridge-Tunnel transportation route or from vessels in the Chesapeake Bay and the Atlantic Ocean. Spilled materials may affect the surface waters, marshes, coastline, and the species that use these habitats.
- Addressing remaining ecological risk issues due to former military disposal practices.

- Characterizing and controlling the contaminants related to the active firearms range in-holding which is owned by Northampton County and managed by the Service.

**Baseline Sampling Locations.**—The primary recommended baseline sampling area identified is Raccoon Creek. Due to the considerable shoreline habitat owned by the refuge a minimum of eight baseline sampling locations are recommended. Raccoon Creek consists of tidal creek and marsh habitats that would be sheltered from immediate effects of a spill to the Chesapeake Bay, Atlantic Ocean, or along U.S. Route 13 (including the Bridge-Tunnel). Raccoon Creek is accessible by water from the Wise Point boat ramp. Raccoon Creek provides habitat for a bay crab nursery and supports numerous small mammals and aquatic species including catadromous and anadromous fish. Productive wetlands serve as foraging, loafing, and nesting habitat for migratory birds, waterfowl, and shorebirds. Piscivorous birds also forage and nest on and near the refuge.



**Green tree frog.**  
*USFWS photo*

**Ecological Risk.**—The U.S. Environmental Protection Agency (EPA) prepared a Modified Site Investigation Narrative Report in 1998 to document levels of contaminants in groundwaters, surface waters, soils, and sediments. The EPA report sets forth the agency’s preliminary evaluation of the associated human health risks.

The EPA discovered levels of arsenic measuring 8.3 parts per million in the soils around the occupied refuge residences. This level exceeds three times the background arsenic level and the EPA Region III human health risk-based screening levels. The EPA report recommended a site-specific health risk assessment for the residential area. In September 2000, the Service requested that the EPA evaluate the human health risk, as recommended in the report. In a letter to the Service dated November 27, 2000, EPA Region III stated that it “does not recommend a site-specific health risk assessment be conducted on the soils around the residences” based on the fact that the EPA normally recommends a clean-up goal for arsenic of 17 to 20 parts per million for protection of human health.

The EPA also found that sediment samples from the perennial wetland channel receiving discharges from the former on-site landfill and on-site lagoon contained levels of the organo-chlorine pesticide, DDE. The EPA concluded that DDE was impacting these wetlands.

Although the EPA report was limited in design, results indicate that at several locations within the refuge, organo-chlorine contamination may be impacting ecological receptors such as plants and wildlife. The extent of the contamination throughout the habitat is not adequately described by the sampling that was conducted and the results are not adequate to evaluate the ecological receptor risk. The Service’s Virginia Field Office is currently working with the

U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, and Virginia Department of Environmental Quality to procure funding to conduct sampling that will provide data to thoroughly evaluate ecological risk to wildlife from past military activities. This activity will include identification, characterization, and location of remaining sources of contamination.

**Firearms Range.**—The firearms range, located as an in-holding to the Eastern Shore of Virginia Refuge, is owned by Northampton County but managed and maintained by the refuge. Our Refuge staff schedule use of the range, mow the grass to maintain the firing lines, and maintain the general appearance of the range. Staff also collect and recycle spent brass casings.

Users of the firearms range include the U.S. Coast Guard, Northampton County Sheriff's Department, Bridge-Tunnel Police, U.S. Navy, Federal Bureau of Investigation, Virginia Marine Patrol, Virginia Department of State Police, and the U.S. Fish and Wildlife Service (see Table 3-3).

*Table 3-3. Firearms Range Users from January-December 1999*

User	Number of Days
U.S. Coast Guard	17
Northampton County Sheriff's Dept.	11
Chesapeake Bay Bridge-Tunnel	14
U.S. Navy	6
Federal Bureau of Investigation	4
Virginia Marine Patrol (VMRC)	3
VA Department of State Police	2
U.S. Fish and Wildlife Service	1

The small firearms range berm contains elevated levels of lead and several other metals. EPA sampling also revealed that sediment in the swale which drains the firearms range contained the organochlorine DDT, its breakdown product, DDE, and alpha-chlordane. Although the levels documented did not exceed human health risk-based concentrations, the EPA concluded these organochlorines were "impacting the wetlands on and around the site." However, levels did exceed ecological risk screening values. In August 2002, the Service conducted sampling on the marsh located directly behind the firearms range and on the Virginia Inside Passage. Lead was not detected in any of the samples (n=12), therefore the risk to ecological receptors due to lead outside of the range property is presumed to be insignificant. The results of the metals and organics analyses for these 12 samples are under review.

*Fisherman Island Refuge*

In 2000 the Service also conducted a CAP for Fisherman Island Refuge (USFWS 2001b). Similar to the Eastern Shore of Virginia Refuge, the CAP states that most of the contaminants issues on Fisherman Island Refuge fall into two major categories: 1) past military-related contaminant issues, and 2) potential impacts from spills.

**Contaminants Issues Related to Military Use.**—Contaminant issues on Fisherman Island Refuge related to military use were

resolved in 1996 when cleanup activities at Fisherman Island Refuge were concluded. Completion of those cleanup activities followed recommendations in the Final Corrective Action Plan (USFWS 1994b) for the refuge. Cleanup activities included the removal of fuel tanks, tank vaults (emptied and decontaminated), pipelines, and contaminated soils. In 1995, a hot spot site (less than one-quarter-acre in size and limited to the top few inches of soil) of organochlorine pesticide (DDT) contamination referenced in the Final Corrective Action Plan was remediated.



**Former Military Compound on Fisherman Island NWR.**

*USFWS photo*

**Threats and Potential Impacts from Spills.**—Similar to Eastern Shore of Virginia Refuge, spills on Fisherman Island Refuge could result from vehicular accidents on U.S. Route 13. Although transportation of hazardous materials on the Chesapeake Bay Bridge-Tunnel is limited, small quantities of fuels, gases, and various combustibles and flammables can be transported. If a spill occurred in the vicinity of the refuge, or if a vehicular accident caused a fuel spill, the refuge habitat could be impacted. The impact of the spill would depend on the proximity of the spill to the refuge, the material spilled, the timeliness of spill response and control, and the volume of the material spilled. The Bridge-Tunnel Authority is trained in spill response management. Limited spill equipment is readily available at the Bridge-Tunnel District Offices.

Spills could also arise from vessel accidents in the Chesapeake Bay or Atlantic Ocean. Depending on where a spill might occur, hazardous materials could drift toward and impact the refuge. Spills could be devastating to both habitat and species (particularly nesting species) on the refuge or in the vicinity of the refuge. The CAP says vigilant attention to spill preparedness will be the first and most important line of defense to maintain and protect the refuge from a major catastrophic contaminant event. The extent of impact to the refuge would depend on the same factors listed above for a spill on U.S. Route 13, plus direction of flow and dilution.

**Other Contaminant Threats.**—The CAP also identifies other contaminant threats currently present on the Island. There is a threat of small sources of contamination from boaters arriving from smaller vessels. Most beaching vessels will be recreational boaters

and threat from contaminants is expected to be minimal and limited to small fuel spills, which would be a rare event. Also, it is possible that an aircraft could jettison material over the refuge. Such materials will likely be fuel or pesticides related to agricultural spraying activities.

**Baseline Sampling Locations.**—Fisherman Island Refuge is accessible from U.S. Route 13, which traverses it. In order to achieve a thorough baseline analysis of Fisherman Island, six sampling locations are recommended. Sampling can be conducted either from small boats coming ashore along the shoreline or by beach access using a fourwheel drive vehicle. We recommend analysis of organic and inorganic contaminants.

## Biological Resources

### Threatened and Endangered Species

#### *Northeastern Beach Tiger Beetle*



**Northeastern Beach Tiger Beetle.**

*USFWS photo*

The Northeastern beach tiger beetle is a Federal -listed species occurring on the Eastern Shore of Virginia Refuge. The beetle can be found on the southern tip beach, located on the Chesapeake Bay. A 1999 survey conducted by the Service (Knisley and Hill 1999) found 62 adult beetles on refuge property. Another 18 adults were found on the abutting property, which is owned by the Sunset Beach Resort.

Larger populations of this threatened subspecies occur along western facing beaches of Northampton County. According to the 1999 survey, Pickett's Harbor and Cape Charles beach (south), had population sizes of 2,412 and 512, respectively. Large populations occur all the way to Parker's Marsh in Accomack County.

#### *Piping Plover*

The Federal-listed piping plover has previously nested on Fisherman Island, although refuge records dating from 1975 show nesting to be sporadic at best with a maximum of five adults recorded in the breeding seasons of 1979, 1980 and 1983 during the annual colonial waterbird survey. State records indicate that one nesting pair occurred between 1991 and 1992. No breeding individuals have been observed on Fisherman Island since 1992. However, the piping plover is seen in small flocks during migration. In Virginia, piping plovers have historically nested on barrier beaches of Accomack and Northampton Counties from Assateague Island south to Fisherman Island, where they may sometimes compete for nesting habitat with Wilson's plover. Watts et al. (undated) found that piping plovers nesting on 13 barrier islands in Virginia from 1986 to 1988 were not evenly distributed along the islands. Beach segments used by plovers had wider and more heterogenous beaches, fewer stable dunes, greater open access to bayside foraging areas, and closer proximity to mudflats. They also note that the characteristics of beaches selected by plovers are maintained by storms. Needed improvements in breeding population numbers in Virginia have not been realized despite protective efforts, and volatility and uneven distribution have characterized recent plover numbers (Terwilliger and Cross, 1999). Census records from 1986–1999 indicate a declining trend in the breeding population from Parramore Island south to Fisherman Island. The 2001 Virginia piping plover census recorded only two breeding pairs on these southern islands, down from 30 pairs recorded in 1988. The combination of low recruitment in the southern Virginia barrier islands and limited availability of optimal nesting habitat may explain the absence of breeding birds (Terwillinger 2001).

The breeding history for the entire Southern Recovery Unit



**View from Bunker Overlook,  
Eastern Shore of Virginia NWR.**  
*Matthew Akel*

(Delaware, Maryland, Virginia, and North Carolina) also reflects fluctuating low numbers. A steep decrease in the North Carolina population (from 52 pairs in 1997 to 23 pairs in 2001) exacerbates concerns regarding the decline on the southern Virginia islands. The Piping Plover Recovery Team set a minimum target of 400 nesting pairs of piping plovers for the Southern Recovery Unit. However, 2001 census figures reported 208 nesting pairs, which is just 52 percent of the recovery goal (USFWS 2002). The Southern Recovery Unit average productivity in 2001 was 1.22 chicks per pair. This was substantially lower in 1997-99 than in 1993-96, and is still well below the 1.5 chicks/pair threshold that is needed to maintain a secure population. This decline is of particular concern given the small number of breeding pairs, and their distribution over a large geographic area. Thus, neither the population nor the productivity goal for the Southern Recovery Unit is being met, and the small piping plover population in these four states remains vulnerable to further declines.

We believe there is suitable breeding piping plover habitat on Fisherman Island, and dynamic coastal formation processes are likely to cause changes in the quantity and quality of breeding habitat over time. Even with suitable habitat, however, breeding activity will depend on availability of dispersing breeding birds. The presence of roosting herring and great black-backed gulls may also function as a deterrent. Since maximizing piping plover productivity and repairing gaps in their breeding range are critical to their recovery, our increased monitoring effort, which will allow us to detect presence of breeding pairs and implement prompt protection (particularly from predation) is of vital importance to the coastwide recovery program (Hecht 2001).

If breeding piping plovers occur on Fisherman Island in the future, our increased monitoring efforts will allow us to detect the presence of breeding pairs and protect them according to Recovery Plan guidelines.

#### *State-listed Species*

When State recovery plans for State-listed species become available, we will use them whenever practical to manage these species found on the refuges.

#### **Plant Communities**

The Delmarva Peninsula is part of the Mid-Atlantic Coastal Plain and is located along Virginia's southeast coast, an area characterized as an overlap between the northern and southern temperate zones where numerous northern plant species reach their southern limit and many southern species reach their northern limit. The Chesapeake Bay is a natural barrier to plant dispersal. Species more common further south in the Carolinas and southeastern Virginia are not found on the Delmarva Peninsula.

The Delmarva Peninsula is classified as the southeastern mixed forest province (Bailey 1995). The climax vegetation on the Delmarva Peninsula is dominated by loblolly pine and a variety of hardwoods including oaks, hickory, red maple, yellow poplar, sweet gum, and black gum. Clearing activities since European settlement in the 1600's have resulted in the creation of several successional habitat types including grasslands, shrubs, agricultural fields, and monotypic loblolly pine stands.

*Eastern Shore of Virginia National Wildlife Refuge*



**Grassland habitat.**  
*Charles Philip*

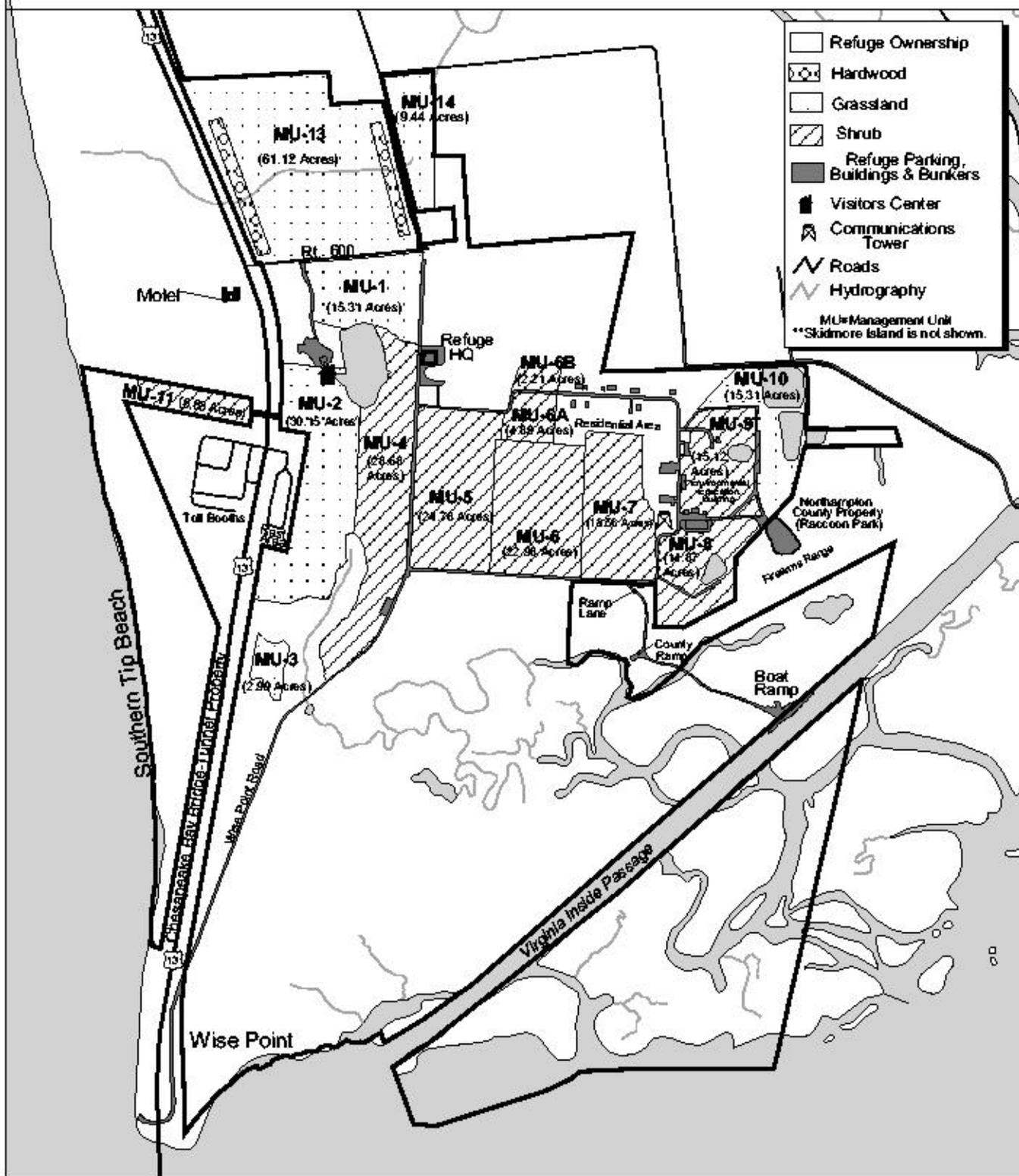
The refuge consists of approximately 185 acres of grassland and shrub/scrub habitat, most of which is concentrated to the south and southwest of refuge headquarters. For management purposes, we have divided this acreage into 14 Management Units (MU's) (see Map 3-1). Much of this land was either previously developed or farmed. The rest of the approximately 935 refuge acres is either forest, beach, marsh, or cleared land with buildings, described in more detail below. Appendix K contains a complete list of vegetative communities.

**Coniferous Forest.**—The two largest forested tracts on the refuge are dominated by loblolly pine. Approximately 118 acres of pine forest are located on Wise Point and 77 acres of pine forest are located along the Chesapeake Bay shoreline, on the refuge's western boundary. Both these forests are exposed to the harsh maritime influences of wind and salt spray; therefore, the vegetative community is unlike the climax vegetation found in more upland areas of the peninsula. The understory is dominated by Japanese honeysuckle, greenbrier, poison ivy, Muscadine grape, fox grape, Virginia creeper, trumpet creeper, and blackberry. A similar species composition can be found in the understory of all the forested acreage on the refuge.

**Mixed Coniferous/Hardwood Forest.**—The largest block of mixed coniferous/hardwood forest is located on the former Wise Point Corporation property. This approximately 53-acre block consists of forested "hammocks" dominated by loblolly pine mixed with oaks, black cherry, sassafras, wax myrtle, greenbrier, poison ivy, Virginia creeper, and some American holly. This forested area mainly occurs on old dredge spoil sites. This forest type consists of loblolly pine and Virginia pine and includes deciduous species such as white oak, southern red oak, black oak, willow oak, sweet gum, black gum, black cherry, red maple, flowering dogwood, yellow poplar, and hickories.

**Deciduous Forest.**—Deciduous forest covers about 60 acres north of the refuge headquarters. This habitat is oak dominant, consisting of white oak, southern red oak, black oak, and willow oak. An additional 40 acres adjacent to the Winslow Bunker are dominated by black cherry, black locust, sassafras, American holly, devil's walking stick, and yaupon holly.

## Habitat Management *Eastern Shore of Virginia Refuge*



**Data Sources:**  
 1:24,000 Hydrography & 1:100,000 Road data provided by USGS with a circa date of 1981 & 1985. All other data provided by USFWS. Projection/Date: UTM Zone 18, NAD 83, March 2000.  
 Map prepared for the Eastern Shore of Virginia MWR & Patuxent Island MWR Comprehensive Conservation Plan by the RS Cartography & Spatial Data Services Section. March 2000.  
 This map is for planning purposes only.





**Wax Myrtle.**  
*USFWS photo*

**Shrub/Scrub.**—There are about 185 acres of shrub/scrub habitat on the Eastern Shore of Virginia Refuge. About 130 acres are located in the central and eastern portions of the refuge in Management Units 4–9. This habitat is expanding via natural succession into the grassland Management Units. Commonly found species include wax myrtle, black raspberry, blackberry, Eastern red cedar, Japanese honeysuckle, multiflora rose, autumn olive, willow, shining sumac, and common nightshade. Another 35 acres of shrub/scrub habitat exist on the former Wise Point Corporation land at the highest elevations of intertidal marsh, where the habitat transitions to upland forest. Vegetation is typically dominated by the salt-tolerant high-tide bush and groundsel bush, grading into wax myrtle and ultimately forest.

Shrub/scrub habitat can also be found on about 20 acres on the southern tip. The dominant species there are wax myrtle, bayberry, shining sumac, groundsel tree, and black needlerush. This habitat is slowly decreasing in acreage due to an adjacent stand of loblolly pine that is encroaching into this habitat area and blocking sunlight.

**Mixed Forb/Grassland.**—There are about 230 acres of mixed forb/grassland habitat, concentrated in Management Units 1, 2, 3, 10, 13, and 14. These grasslands consist of mixed forbs and grasses dominated by horseweed, ragweed, pigweed, goldenrod, common fennel, pokeweed, broomsedge, crab grass, goose grass, and patches of black raspberry and blackberry (Watts 2000). These fields are heavily impacted by non-native fescue grass. Eastern red cedar seedlings commonly sprout throughout these open-habitat areas.

MU 13 has a different composition of mixed forb/grassland. In the spring of 1999, the refuge planted warm season grasses in this management unit. Species planted included big bluestem, Indiangrass, switchgrass, eastern gammagrass, and coastal panicgrass. These drought-tolerant grasses are considered to be a good source of food and cover for both resident and migrating wildlife. During the first two growing seasons, these fields were inundated with weedy species dominated by mustard in the first season and horseweed in the second season.



**Switchgrass.**  
*USFWS photo*

**Salt Marsh.**—The former Wise Point Corporation tract includes about 290 acres of salt marsh along Raccoon Creek and the Virginia Inside Passage. The marsh is dominated by typical Atlantic coast marsh species such as salt marsh cordgrass, salt marsh hay, black needlerush, and scattered high-tide bush. Tidal creeks and mudflats occur throughout the tract and serve as feeding areas for waterfowl, wading birds, and shorebirds.

*Fisherman Island National Wildlife Refuge*

Succession has formed a mosaic of vegetative communities capable of withstanding the harsh environmental conditions present on Fisherman Island Refuge. The variety of habitats combined with the geographic location of the island, accessibility of food, protective shrub and thicket cover, and minimal human disturbance all make this island an important stopover location for migratory birds. Accretion has led to significant increases in beach and foredune habitat on the north/northeast and south/southeast portions of the island with similarly significant increases in salt marsh habitat in the northern section of the island.

**Beach/Foredune.**—This highly dynamic habitat occurs along the south and east perimeter of the island in a relatively narrow zone of 15–30 meters. It is composed of plants able to withstand dry sandy conditions, high amounts of salt spray, and low ground nutrient content (Oertel 1999). Vegetation is primarily composed of grasses such as salt meadow hay, running panic grass, American beach grass, and sand spur. Other plants include Russian thistle, seabeach orach, cocklebur, and searocket (Oertel 1999).

Seabeach knotweed, a globally rare plant, was discovered in August 2000. Forty plants were found on the southeastern end of the island, just east of the largest tidal pond. In addition, two populations of dune ground cherry were discovered, a plant rare to Virginia. Approximately a hundred plants were found on the northeast side of the island and a much larger population was found on the southwest side of the island.



**Beach and Dunes on Fisherman Island NWR.**

*USFWS photo*

**Primary Dune Ridge.**—The primary dune ridge lies landward of the beach/foredune zone along crests of low ridges. Vegetation is usually sparse or clumped and mainly colonized with grasses that have the ability to propagate via rhizomes and can withstand deep sand burial. The predominant species are American beach grass, running panic grass, salt meadow hay, and salt grass. These grasses extend into the primary swale where they tend to be more dense. The primary swales also have sparsely distributed shrubs, mainly wax myrtle and bayberry.

**Secondary Dune Ridge.**—The older secondary dune ridges are inland of the primary dune ridge and consist of a mosaic of species, including the grasses described above, with the addition of seaside goldenrod, switchgrass, prickly pear cactus, groundsel tree, and occasionally Atlantic white cedar. There are a few occurrences of spike grass.

The older secondary dune ridges have stands of woody vegetation such as myrtle, groundsel tree, black needlerush, eastern red cedar, and Atlantic white cedar. This zone also includes pioneers of sassafras, black cherry, willow, cottonwood, and tooth-ache tree. As this vegetation community stabilizes, natural succession leads to the growth of thickets and mature woods.

**Thicket.**—This habitat extends landward of the secondary dune ridges and consists of dense stands of primarily wax myrtle with scattered cherry, sassafras, tooth-ache and groundsel trees, and sumac. This community frequently includes several woody vines such as Virginia creeper, Japanese honeysuckle, and poison ivy. Thicket habitat is found on sites ranging from wet depressions to dry ridges. On wet sites, groundsel tree and marsh elder are significant components of this community.

**Deciduous Forest.**—Nearly all of the forested community is in a large contiguous area west of the Bridge-Tunnel. Cherry and sassafras dominate with scattered sumac, American holly, and tooth-ache tree along with many woody vines. Most of the forested habitat is characterized by a relatively open understory; however, shrubs (primarily myrtles) are gradually shaded out by canopy closure.

Southern beach spurge, a plant rare to Virginia, was discovered in August 2000, on the edge of the forest habitat in the northern interior of the island.

**Low Marsh.**—Frequently called tidal or salt marsh, these areas are subject to bimodal daily inundation. This habitat is characterized by a salt marsh cordgrass and saltwort in slightly higher elevations. There has been an increase in low marsh habitat on Fisherman Island Refuge due to accretion along the protected north and northeastern sides of the island.

**High Marsh/Transition.**—This habitat type encompasses the diverse areas between low marsh and various dune communities. This complex includes high marsh, marsh transition, salt panne, and the dune-marsh boundary. Component communities are sometimes very narrow (often only a few feet wide), discontinuous and ephemeral due to periodic overwash, wind, and natural plant succession. Common plants include salt marsh hay, saltwort, black needlerush, sea oxeye daisy, salt grass, groundsel tree, marsh elder, foxtail, seaside goldenrod, and phragmites. As with the low dune community, these are dynamic areas that are continuously changing.

**Freshwater Marsh.**—This habitat occurs in several small isolated depressions proximate to the Bridge-Tunnel. Species such as salt meadow hay, threesquare, beardgrass, smartweed, and phragmites are found in these areas. Encroachment by the thicket community and phragmites invasion continues to alter the character of this habitat.

## Wildlife Resources

### *Avifauna*



**Indigo bunting, a neotropical migratory bird.**

*USFWS photo*

The southern tip of the Delmarva Peninsula has been identified as an important migratory bird stopover location along the Atlantic coast (Mabey et al. 1993). In the mid-Atlantic region, migratory birds are influenced by three major water bodies—the Delaware Bay, the Chesapeake Bay, and the Atlantic Ocean. The narrow peninsulas created by these water bodies cause a funneling effect on the birds as they fly south. Once the birds reach the southern tip of the Delmarva Peninsula they are faced with crossing the Chesapeake Bay. The Eastern Shore of Virginia and Fisherman Island Refuges, fortuitously located at the southern tip, provide critical stop-over habitats where the birds can rest and feed before resuming their migration.

Birds that breed in northern parts of North America migrate south during the late summer through fall into Central and South America where food supplies are more abundant and weather conditions more favorable for survival. Migration of several hundred to thousands of miles are stressful and hazardous for these birds, forcing them to expend a considerable amount of energy. While migration routes of individual species sometimes vary, it is generally believed that most land birds and raptors have specific migration corridors which are defined by weather patterns and geographic influences. Prevailing winds from the west push birds southeastward as they migrate. Major geographical features such as mountain ranges and coastlines provide a combination of visual navigational references and favorable air currents.

The first southward migration for juvenile birds can be particularly stressful due to lack of previous navigational experience and because juveniles are not as strong as adult birds. For these reasons, juveniles are pushed further eastward during migration to the Atlantic coastline to a much greater extent than adult birds. Indeed, the majority of the birds passing through the lower Delmarva Peninsula during the fall migration are juveniles (Hodnett 1998).



**Little Blue heron.**

*USFWS photo*

In this section, avifauna are separated into five categories: colonial nesting waterbirds, shorebirds, waterfowl, raptors, and land birds. Each category will contain information about the location, habitats, and seasonalities of these species. As a general rule, colonial nesting waterbirds, shorebirds, and waterfowl are more likely to be found on Fisherman Island Refuge, while a large abundance of diverse land bird species are known to exist on Eastern Shore of Virginia Refuge. One notable exception is raptors.

**Colonial Nesting Waterbirds.**—Fisherman Island Refuge supports various colonial and beach nesting waterbirds such as herons, egrets, gulls, terns, ibis, and oystercatchers. Virginia's barrier islands have historically supported large numbers of colonial

nesting waterbirds. In recent years many of these colonies have suffered dramatic losses, from mammalian and avian predation.

The populations of colonial nesting birds on Fisherman Island Refuge, however, have not declined along with the populations on many of Virginia's other barrier islands. The refuge continues to support large royal tern and brown pelican nesting colonies with over 1,600 and 1,000 pairs respectively (2002). Forster's tern, common tern, and sandwich terns commonly nest on Fisherman Island in small numbers of less than 28 nesting pairs per species. Laughing, herring, and great black-backed gulls nest in close proximity to the tern and pelican colonies with over 2,200 pairs of gulls recorded in 2000.

Long-term research on the demographics and distribution of royal terns is currently in progress. Royal tern chicks have been banded at their natal site on Fisherman Island Refuge for 33 years with a total of 69,559 royal tern chicks banded between 1957 and 2000. Annual banding totals approximate chick production. Numbers have fluctuated between a low of 908 and a high of 4,628 between 1980 and 2000.

**Shorebirds.**—Large numbers of shorebirds migrate along the barrier island chain of the Delmarva Peninsula. These birds move northward to their breeding grounds from March through May and travel south to their wintering areas from July through October. Many of these shorebirds stop to rest and feed on Fisherman Island. Common species include black-bellied and semipalmated plover, greater and lesser yellowlegs, spotted sandpiper, whimbrel, ruddy turnstone, red knot, semipalmated, solitary and least sandpiper, dunlin, short-billed dowitcher, and common snipe.



**Greater yellowlegs.**

*USFWS photo*

Marbled godwit populations concentrate on the eastern shore along the mudflats just west of Smith Island. This bird is considered to be one of the less common of the migratory shorebird species. Other shorebird species found on Fisherman Island include the upland sandpiper, buff-breasted sandpiper, and golden plover.

Some of these migrating shorebirds also breed on Fisherman Island. Relatively small numbers of American oystercatcher nests have been found dispersed along the perimeter of the island. Twenty American oystercatcher nests were found in 2000 (Terwilliger 2000). Thirty-four pairs of American oystercatchers were found in 2001 and 2002. Historically, black skimmers nested on Fisherman Island in relatively large numbers throughout the 1970's, but have not been recorded since 1980. Wilson's plover and piping plovers have nested on the island in past years, but have not been recorded nesting since 1992.

Marsh birds such as the Virginia rail, clapper rail, and sora can be found breeding in the cordgrass dominated saltmarsh which comprises approximately 50 percent of Fisherman Island. The clapper rail is a

year-round resident, though some may be migratory.



**Black duck.**  
*USFWS photo*

**Waterfowl.**—The barrier island bays and wetlands of Virginia, such as the ones found on Fisherman Island, are important in the Atlantic Flyway because they provide feeding and resting habitat for waterfowl during the fall and spring migration. This habitat also serves as the wintering grounds for many species of waterfowl. Waterfowl that winter on Fisherman Island include snow goose, Canada goose, green-winged teal, and northern pintail. Tidal ponds are also attractive wintering habitat for red-throated and common loon, and the horned grebe. Black ducks and gadwalls use the marsh and brackish ponds on Fisherman Island Refuge for breeding.

**Raptors.**—Researchers and volunteers from the Center for Conservation Biology at the College of William and Mary and the non-profit Coastal Virginia Wildlife Observatory have conducted raptor banding on the refuges for many years. Sixteen species of raptors (see Appendix L) are annually caught and banded using mist nets and bow traps. Relatively large numbers of sharp-shinned hawks, Cooper's hawks, peregrine falcons, and red-tailed hawks are banded each year. Researchers and volunteers have banded record numbers of merlin on the lower eastern shore over the last few years. Approximately 95 percent of the 857 birds captured on the lower Delmarva Peninsula in 1999 were juvenile or hatch-year birds. This trend is consistent with previous years indicating a divergence in migration routes between adults and juveniles.



**Saw-whet owl.**  
*USFWS photo*

In 1994 the Center for Conservation Biology discovered a significant autumn migration of northern saw-whet owls moving down the lower Delmarva Peninsula. Although saw-whet owls are year-round residents throughout much of their breeding range, some populations migrate to wintering areas at lower latitudes (Weir et al. 1980). During the fall of 1999, a total of 700 saw-whet owls were captured from three sites located on the lower peninsula. Data indicates a bimodal migration pattern down the eastern shore with most hatch-year birds moving through the lower Delmarva in early- to mid-November and a greater proportion of after-hatch-year birds moving through in late November and early December (Paxton and Watts 2000). Two other wintering owl species detected on Eastern Shore of Virginia Refuge are the short-eared and long-eared owls.

Ospreys nest on artificial nest platforms. A pair of peregrine falcons are resident to Fisherman Island Refuge and often nest on the island's hacking tower.



**Swamp sparrow.**

*USFWS photo*

**Migrant Land Birds.**—Many of the land birds found on Virginia’s eastern shore are migrants which pass through the refuge during either the spring or fall seasons. Researchers and others have observed that these land birds spend relatively short time periods (days or weeks) resting and feeding before continuing their journeys. There are two types of migratory birds that visit the refuges—temperate and neotropical. Temperate migrants leave their breeding grounds in the northern latitudes of North America in the fall to spend winters in the more mild mid-Atlantic and southern United States. Neotropical migrants also summer in the United States and Canada, but winter in Central and South America.

The warbler’s taxonomic family, Emberizidae, is the largest family of migrants to visit the lower eastern shore. Warblers use the forested stands and shrub thickets of the Eastern Shore of Virginia and Fisherman Island Refuges for food and cover. Their diet consists mainly of arthropods, fruit, and nectar; but they will also eat mollusks (small snails, slugs) and worms (Dunn and Garrett 1997). Fruit from the Eastern Shore of Virginia Refuge’s bayberry and wax myrtle thickets sustains many warblers during the fall migration, especially the abundant yellow-rumped warbler.

Temperate migrants tend to move through the area at later times than the neotropical migrants and in two general migration waves (Paxton and Watts 2000). Early temperate migrants are comprised of species such as the yellow-rumped warbler, common snipe, eastern meadowlark, and grasshopper sparrow. The later wave of temperate migrants consists primarily of American goldfinch, white-throated sparrow, white-crowned sparrow, chipping sparrow, and orange-crowned warbler. Other sparrow species (i.e., savanna, swamp, song and field) also occur throughout the migration season.

Thrushes observed migrating are the veery, gray-cheeked, Bicknell’s, hermit, wood, and Swainson’s thrush. Migrating swifts and swallows include the chimney swift, rough winged, bank, and cliff swallows. Flycatchers observed migrating through the Eastern Shore of Virginia Refuge are the acadian flycatcher, willow flycatcher, and eastern phoebe.

**Breeding Land Birds.**—A variety of land birds breed in the diverse forest, shrub, and grassland habitats of the Eastern Shore of Virginia Refuge. These breeding land birds include the northern bobwhite, field sparrow, song sparrow, and rufous-sided towhee.

Breeding warbler species include the pine and prairie warblers and the yellow-breasted chat. Other nesting species on the refuge include the indigo bunting, blue grosbeak, yellow-billed cuckoo, and ovenbird.

The swallows and thrushs that breed on the refuges are the purple martin, tree swallow, barn swallow, eastern bluebird and the wood thrush.



**Eastern bluebird.**  
*USFWS photo*

**Winter Resident Land Birds.**—These avian species are temperate migrants that spend part or all of the winter on the Eastern Shore of Virginia Refuge. One of the most studied of these species is the American woodcock. The woodcock is found in high numbers on the lower Delmarva Peninsula during fall migration. Woodcock follow a fall migration pattern in which they concentrate at Cape May, New Jersey, then move southward through the Northampton County area, then on to wintering areas in the coastal plain of the south Atlantic states. The peak woodcock migration on the Delmarva Peninsula lasts from late November to early January. The Eastern Shore of Virginia Refuge provides important woodcock habitat both during migration and for wintering, when woodcock stay during mild winters until they migrate to their breeding grounds in mid-February. Woodcock use low lying woods and shrub areas for food and cover during the day and utilize open grassland fields at night for feeding and roosting. Woodcock will also nest throughout the Delmarva Peninsula where suitable habitats exist. Sparrows and warblers also winter on the refuge.

**Year-Round Resident Land Birds.**—Year-round residents, as their name implies, spend their lives in one general area. Year-round residents on the Eastern Shore of Virginia Refuge include the Carolina wren, northern mockingbird, bald eagle, American kestrel, and killdeer. The wild turkey, which was reintroduced to the lower Delmarva Peninsula, also spends all year on the refuge. Year-round resident woodpeckers include the red-bellied, downy, hairy, and pileated woodpeckers and the Northern flicker.

#### *Predators*

Predation, both mammalian and avian, threatens the colonial waterbird nesting colonies on Fisherman Island Refuge. Evidence of mammalian predation on Fisherman Island Refuge appears limited and significantly lower than other barrier islands in Virginia (Truitt 2000). Red fox is the greatest perceived mammalian threat to the Refuge's colonial seabird nesting colonies.



**Northern flicker**  
*USFWS photo*

Diurnal observations of predation on Fisherman Island Refuge identified no serious problems until the summer of 2003 when raccoons preyed on both the royal terns and brown pelicans. The potential threats from gulls, including predation, competition, and displacement, are our most imminent concerns. Researchers conducted weekly monitoring of bird colonies on the refuge in 2000 to determine the extent of predation and interspecific behavioral patterns between nesting terns and their perceived predators such as raccoon, fox, otters, and gulls. Researchers observed avian predation on tern chicks and eggs by herring and great black-backed gulls, but obtained no conclusive evidence. Adult tern mortality was documented early in the nesting season, but direct evidence of the cause was not determined.

The most serious predator problem on Eastern Shore of Virginia

Refuge is feral cat predation on migratory birds and small mammals. Feral cat predation has been directly observed by refuge residents and researchers and is generally considered to have a significant impact on trust resources.



**Flying squirrel.**  
*Nancy Biegel*

### *Mammals*

Thirty-four mammal species are recorded for the lower Delmarva Peninsula and are also likely to be found on the Eastern Shore of Virginia Refuge. Those mammals include the gray fox, red fox, raccoon, white-tail deer, river otter, American mink, muskrat, eastern cottontail, southern flying squirrel, and northern short-tailed shrew.

Nine species of bats are likely to be found on the Eastern Shore of Virginia Refuge, but additional research is needed to confirm their presence. Those bats species are the big brown bat, silver-haired bat, eastern red bat, hoary bat, yellow bat, little brown myotis, northern myotis, eastern pipistrella, and the evening bat.

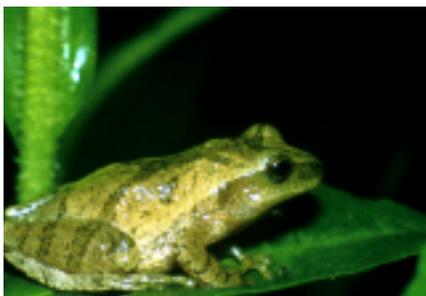
Comprehensive mammal surveys are not available for Fisherman Island Refuge.

### *Reptiles and Amphibians*

Modern herpetofauna on Virginia's eastern shore has been affected by the loss and alteration of natural habitat, such as the effect on freshwater wetlands caused by agricultural practices. Natural sources of surface freshwater in Northampton County are limited in part because of the historical loss of pocosin-like wetlands (Pettry et al. 1979).

Very few amphibians or reptiles have been studied in any depth on the eastern shore (e.g., Dunson 1986, Scott 1986, Hrantiz et al. 1993). None have been studied from the perspective of population size and dynamics, life history traits, or movement ecology.

According to the 2001 Region 5 anuran survey, the frogs and toads that can be found on the Eastern Shore of Virginia Refuge include the northern spring peeper, southern green frog, southern leopard frog, Fowler's toad, and eastern narrow-mouthed toad.



**Spring peeper.**  
*USFWS photo*

The freshwater and estuarine turtles which inhabit Eastern Shore of Virginia Refuge are the eastern painted turtle, spotted turtle, eastern mud turtle, northern red-bellied cooter, eastern box turtle, eastern snapping turtle, and the estuarine northern diamond-backed terrapin.

Four species of salamanders are likely to be found on the refuge, although more research is needed to confirm their presence. Only one species of salamander—the red-backed salamander—is commonly found. Other species include the spotted salamander, marbled salamander, and the red-spotted newt. The Eastern Shore

of Virginia Refuge supports four species of lizards and 11 species of snakes.

Insufficient records have been compiled to make a comprehensive reptile or amphibian species list for Fisherman Island Refuge. Baseline inventories and basic natural history information are needed for herpetofauna on both the Eastern Shore of Virginia and Fisherman Island Refuges.

#### *Invertebrates*



#### **Buckeye.**

*Denny Ariola*

Researchers have conducted butterfly surveys in the area since 1997. Sixty-four species of butterflies and skippers have been confirmed on the Eastern Shore of Virginia Refuge (see Appendix A). In 1999, a researcher from the Coastal Virginia Wildlife Observatory tagged 955 monarch butterflies from both refuges and from nearby roosts in hopes of identifying and protecting the major roosting sites on the lower Delmarva Peninsula. It is estimated that during the height of the 1999 migration, 50,000 monarchs were seen roosting in one evening. The researcher also discovered roosting locations of migrating monarch butterflies on Fisherman Island. Roosts were found on the secondary dunes with estimates ranging from 10,000 to 50,000 individuals. During one evening in early October 1999, an estimated 100,000 individuals were discovered on various trees on the southern portion of Fisherman's Island. The monarch butterfly research project continued in 2000, when 715 butterflies were tagged in the fall.

Baseline inventories for invertebrate species other than lepidopterans on the Eastern Shore of Virginia and Fisherman Island Refuges are not available.

#### *Aquatic Resources*

The shallow estuarine waters surrounding Fisherman Island are highly productive. Algal phytoplankton and detritus produced by the extensive wetlands dominated by saltmarsh cordgrass make up the first order of the food chain. Intermediate levels of the aquatic food chain include a number of zooplankton species and benthic species dominated by annelid worms, mollusks, and crustaceans. Submerged aquatic vegetation around Fisherman Island is limited to a few small patches on the northern end.

Many of the aquatic shellfish resources in the area are used for commercial purposes. Hard clam beds have been planted by commercial aquaculturists throughout suitable habitat along the southern peninsula. Much of the area between Skidmore and Smith Islands is leased by watermen from the State of Virginia for clam beds. Many of the bayside creeks also have planted clam beds wherever the depth is appropriate. Blue crabs are commercially harvested offshore using crab traps. Many crab pots are



**A depiction of a spotted seatrout.**  
*USFWS photo*

concentrated on the north end of Fisherman Island. Oyster grounds are currently being restored by the Virginia Institute of Marine Science, just north of Fisherman Island Refuge.

Finfish of primary importance that use the surrounding waters for spawning, nursery, or feeding areas include black drum, red drum, bluefish, winter flounder, summer flounder, menhaden, spot, Atlantic croaker, grey trout, mullet, spotted seatrout, and stripped bass. The species caught by recreational and commercial fisheries vary seasonally. Peak fishing periods are April through October, with a rockfish season in December.

## Socio-economic Factors

The Eastern Shore of Virginia lies on the southern tip of the Delmarva Peninsula and is made up of two counties—Accomack and Northampton. This section will mainly focus on Northampton County, since that is where the Eastern Shore of Virginia and Fisherman Island Refuges are located. However, information on Accomack County will be provided for the sake of comparison.

Northampton County is 35 miles long and includes about 230,000 acres. In general, the County is not a destination point for most travelers, but rather a stop along their route. This is largely because the Chesapeake Bay separates Northampton from the Hampton Roads area of Virginia, a major metropolitan area with over a million residents. Although the Chesapeake Bay Bridge-Tunnel (Bridge-Tunnel) connects Northampton County to mainland Virginia, the \$20 round trip toll to cross the Bridge-Tunnel has, in the past, prevented many people from visiting the eastern shore. The Bridge-Tunnel Authority, however, recently instituted a commuter toll of \$14 round trip in a 24-hour period for two axle vehicles. This reduction in toll price has had major impacts on the Eastern Shore of Virginia's growth. Many new housing developments have been built in recent years. New hotels, restaurants, and shopping areas are expected in the next few years. A developer is constructing an up-scale golf course community in Cape Charles, located about 10 miles north of the refuge. This community will include up to 3,000 homes and townhouses, a boat marina, hotel, and speciality shops. The first of two golf courses was completed in 2001.

### Population and Employment on the Eastern Shore of Virginia

According to the 2000 Census, the Commonwealth of Virginia's population was 7.1 million, reflecting more than a 14 percent increase over the last 10 years (U.S. Census Bureau 2000). Northampton County, in contrast, had only a 0.2 percent population increase over the last 10 years, bringing its 2000 population to 13,093. One report says Northampton County's population has suffered because agricultural practices have become less labor intensive and more mechanized (Wilbur Smith Associates 1999). Also, several major seafood processing facilities have closed or relocated outside Northampton County. Northampton County's primary industry is agriculture (Adams et al. 1999). Northampton and Accomack County together produce 70 to 75 percent of Virginia's vegetable crops.

While the Eastern Shore is one of the poorest areas in Virginia, its economy boasts a broad range of industries and retains competitive advantage in key traditional and emerging industries (The Louis Berger Group 2000). Few residents commute outside the region for employment. Unemployment is currently low, but given the mix of local industries, employment is highly seasonal and skewed toward

professionals with lower rates of pay.

The total number of full-time, part-time, and proprietorship employment positions grew slightly in both Accomack and Northampton counties from 1990 to 1998 (The Louis Berger Group 2000). Northampton County showed a 3.6 percent gain during that period while Accomack had an increase of less than 1 percent. Overall, the number of jobs on the eastern shore remained relatively steady throughout the last decade, with a slight increase in jobs over the last two years. In contrast, Virginia saw a 15 percent increase in jobs from 1990 to 2000.

Despite the steady number of jobs on the eastern shore over the last 10 years, the area has shown a steady decline in its labor force. Improved economic conditions towards the end of the last decade put the 2000 labor force at just below 1990 levels. A shrinking labor force is common to rural areas with fixed levels of employment opportunities and an outflow of working-age young people searching for a broader range of opportunities (The Louis Berger Group 2000). Furthermore, an influx of retirement-age people has kept the population fixed, but has not contributed to the labor pool. A decline in the labor force and a slight increase in the number of jobs has contributed to low unemployment rates.

The service and retail/wholesale businesses were the biggest employers in Northampton County throughout the 1990s. The government and agriculture sectors also added jobs during this period, offsetting a 50 percent decline in the County's manufacturing sector, which employed 400 people in 1998.

Weekly earnings on the eastern shore vary widely by profession and sector of the economy. The government sector posted the highest average weekly earnings at \$540 a week (The Louis Berger Group 2000).

In 1999, Northampton County had a per capita personal income (PCPI) of \$20,233 (Bureau of Economic Analysis 2000). PCPI is calculated as the total personal income of the residents of an area divided by the population of the area. This figure is often used as an indicator of the quality of consumer markets and of the economic well-being of the residents of an area. Northampton's PCPI ranked 72nd out of 105 counties and independent cities in Virginia. This ranking is 68 percent of the state PCPI average (\$29,794), and 71 percent of the national average (\$28,546). Northampton's 1999 PCPI reflected an increase of 3.5 percent from 1998. In contrast, the state average increased by 5.0 percent in 1999, and the national average increased by 4.5 percent (Bureau of Economic Analysis 2000).

### **Refuge Contributions to the Local Economy**

One way the refuge contributes to the economy of Northampton County is by protecting wildlife habitat, or "open space," in perpetuity. A "Cost of Community Services Study" (COCS) for

Northampton County, Virginia (Adams et al. 1999) documents the benefits of open space. COCS is a case study analysis of the net fiscal impacts of different land uses. It provides a snapshot in time of costs versus revenues based on current land use. These studies are based on real budgets for a specific community. The analysis shows which services private residents receive in return for the taxes they pay to their local community. These studies have shown that open space costs towns less than residential or commercial development. This is because residential and, to a lesser extent, commercial development require services costly to the town such as schools, utilities, and emergency services. Although residential and commercial development increase an area's tax base, expenses incurred by the area for increased services outweigh the taxes generated from residential and commercial uses.

The refuge directly contributes to the local economy through "Refuge Revenue Sharing" payments. The Federal government does not pay property tax on refuge lands, but instead makes annual payments to respective counties based on a maximum of 0.75 percent of the fair market value of refuge lands, as determined by an appraisal every five years. The actual amount distributed each year varies and is based on Congressional appropriations. The amount distributed also changes as new lands are acquired. Table 3-4 depicts the amounts contributed to Northampton County between 1995 and 2002.

**Table 3-4.** *Refuge Revenue Sharing payments from Eastern Shore of Virginia and Fisherman Island Refuges to Northampton County.*

	Number of Acres		Total Paid to Northampton County	
	Eastern Shore of Virginia Refuge	Fisherman Island Refuge	Eastern Shore of Virginia Refuge	Fisherman Island Refuge
<b>1995</b>	725	1,000	\$12,241	\$6,995
<b>1996</b>	725	1,000	\$16,388	\$9,364
<b>1997</b>	745	1,000	\$16,745	\$9,427
<b>1998</b>	745	1,825	\$10,538	\$16,808
<b>1999</b>	745	1,850	\$9,403	\$15,650
<b>2000</b>	745	1,850	\$8,249	\$13,728
<b>2001</b>	745	1,850	\$8,419	\$14,012
<b>2002</b>	745	1,850	\$11,712	\$13,090



**Cedar Waxwing**  
*USFWS photo*

The refuge also contributes to the local economy by generating tourism dollars. Tourism is the largest industry in Virginia. Preliminary domestic traveler spending in 1999 for Virginia is estimated at \$12.36 billion. Traveler spending represents direct spending by all travelers, including meals, lodging, public transportation, auto transportation, shopping, admissions, and entertainment. In 1997, Virginia was ranked 10th in the nation for domestic traveler spending. Combined visitation to 150 of Virginia's attractions, parks, and travel centers, however, was down 0.1 percent through December 2000. Attractions were down 2.4 percent statewide, but State/National park visitation was up 2.2 percent (Virginia Tourism Corporation 2001). Although National Wildlife Refuges are not included in the State/National park category, these figures illustrate a growing popularity in nature-based tourism.

Traveler spending in Northampton County in 1999 was estimated at \$48.4 million. However, Accomack County traveler spending was almost double, at \$98.1 million. There are approximately seven hotels and a dozen restaurants in Northampton County. Recent tourism initiatives, however, have included the promotion of bed-and-breakfast accommodations throughout the eastern shore, especially in Cape Charles. There is also an effort underway to create a cruise ship port-of-call in Cape Charles.

## Public Use

### Access

U.S. Route 13 and the Chesapeake Bay Bridge-Tunnel connect the Eastern Shore of Virginia to the major metropolitan areas of the east coast (see Table 3-5). Route 13 is a four-lane divided highway and a major north-south corridor on the Delmarva Peninsula for truck traffic. The Bridge-Tunnel is 17 miles long. Crossing over and under open waters where the Chesapeake Bay meets the Atlantic Ocean, the Bridge-Tunnel provides a direct link between southeastern Virginia and the Delmarva Peninsula, and cuts 95 miles from the journey between Virginia Beach and locations north of Wilmington, Delaware. The crossing consists of a series of low-level trestles interrupted by two 1-mile long tunnels. Construction of the original bridge began in September 1960 and the bridge opened for traffic in April 1964 (Eastern Shore of Virginia Economic Development Commission 2001). The toll to cross the bridge is \$10 each way, with a \$14 round-trip commuter fee levied in March 2002.

The Eastern Shore Railroad has more than 90 miles of track serving Accomack and Northampton Counties, and a 26-mile car float operation to cross the Chesapeake Bay from Cape Charles to Little Creek (Eastern Shore of Virginia Economic Development Commission 2001). Two carfloats of 18 and 25 car capacity are used over the water route. Commodities currently handled by the railroad include coal, stone, cement, grain, propane gas, paper, chemicals, fertilizer, food stuffs, and brick.

**Table 3-5.** Major metropolitan cities near the Eastern Shore of Virginia Refuge and the driving distance between the cities and the refuge (Eastern Shore of Virginia Economic Development Commission 2000).

City	Miles
Norfolk, VA	35
Richmond, VA	125
Baltimore, MD	140
Washington, D.C.	150
Philadelphia, PA	165
Raleigh, NC	225
New York, NY	290

Commercial air service is available from Norfolk International Airport, with service from several commercial airlines and air freight carriers. Accomack County Airport is located near the geographic center of the Eastern Shore of Virginia. The general aviation airport has a 5,000-foot concrete runway capable of accommodating most jet and prop aircraft.

#### Refuge Visits

Visitation at the Eastern Shore of Virginia Refuge has increased dramatically since 1996. One of the reasons for the increased visitation is because, part-way through 1996, the refuge installed a traffic counter that helped refuge staff obtain a more accurate account of visitation. Before the traffic counter was installed, visitor numbers were largely underestimated (see Table 3-6). Another reason for the increase in visitation since 1996 is the completion of construction of the Visitor Center. Signs on Route 13 directing drivers to the refuge's Visitor Center have increased the visibility of the refuge, as well as the refuge's visitation.

In general, the refuge is not a destination point for most people, but rather a stop along the way to somewhere else. Many visitors to the Washington, D.C. area stop at the refuge on their way north or south. Some visitors are retirees who visit the refuge on their travel between their seasonal homes. Visitors come to the refuge for birdwatching, environmental education, trail walking, photography, and use of the boat ramp. Other visitors include military history buffs and groups of people who use the refuge's conference facilities. Most visits last 20 to 30 minutes. Visitor patterns, however, are expected to change with increased development in the area.

Currently, there is little tourism support in the area, but this could change with the construction of additional hotels, restaurants, and shopping centers. The refuge schedules educational programs for local school children throughout the year. Approximately 1,200 school children visited the Eastern Shore of Virginia Refuge in the 2000 school year.

**Table 3-6.** *Visitors to the Eastern Shore of Virginia Refuge.*

	1995	1996	1997	1998	1999
<b>Refuge Visits</b>	45,000	91,540	150,107	173,151	190,911
<b>Visitor Center Visits</b>	N/A <sup>2</sup>	21,000 <sup>1</sup>	28,463	29,160	30,758

<sup>1</sup> Due to construction, the Visitor Center was only open June through December 1996.

<sup>2</sup> The Visitor Center was closed in 1995 for construction.

### Hunting

The Eastern Shore of Virginia Refuge implemented a hunt program in 1993 as a means of keeping the white-tailed deer population in balance with refuge habitat, while also providing recreation benefits (USFWS 1993b). Approximately 200 acres are divided into five hunt zones that can accommodate a maximum of 23 hunters per day (see Map 3-2). The archery season is currently 12-days long with hunting from Monday through Saturday for two consecutive weeks. The hunt generally starts during the last week in October and ends in early November. Refuge trails and access to the refuge remain open during the archery hunt. The shotgun season lasts seven days with hunting on Wednesdays and Saturdays in November and December. Refuge trails are closed during the firearms hunt days and access through the refuge is by Special Use Permit only. There is no hunting on Fisherman Island Refuge.



**Deer hunter with deer at check station.**

*USFWS photo*

### Fishing

There are no fishing opportunities on either refuge. However, we traditionally allowed access through the refuge to the former Wise Point Corporation property for recreational anglers and commercial watermen. Since the refuge has taken over ownership of that property, access for recreational anglers has been temporarily halted until improvements are made to the boat ramp and parking lot. Since commercial watermen depend on access to the boat ramp for their livelihood, the refuge has continued to allow access for them while boat ramp improvements are underway. There are 20 commercial watermen currently using the boat ramp. Commercial watermen are charged \$1,200 annually for a Special Use Permit (SUP), which supports up to four transferrable subpermits.

**Table 3-7.** Statistics on the number of hunters at the Eastern Shore of Virginia Refuge, their success rates, and the number of deer taken.

	Archery			Shotgun			Total		
	1999	2000	2001	1999	2000	2001	1999	2000	2001
#Hunters	63	49	50	91	62	67	154	111	117
% Successful	26	37	44	10	19	22	18	27	32
Hunter Hours	930	1137	1134	805	795	817	1735	1932	1951
Deer Taken	17	18	22	9	12	15	26	30	37
Hours Per Deer	54.7	63.2	51.6	90	66.3	54.5	66.7	64.4	52.7

### Wildlife Observation and Photography



**Osprey.**  
USFWS photo

The Eastern Shore of Virginia Refuge has a 1.5-mile trail system with two observation platforms, interpretive signs, and a kiosk. The trail starts at the Visitor Center with the Butterfly Trail and links to an interpretive trail that loops through mixed hardwoods past an old graveyard and up to the top of a World War II bunker which offers a panoramic view of refuge marshes, barrier islands, bays, inlets, and the Atlantic Ocean. The trails are open for walking only. The refuge also has an environmental education building, a conference building, and a photography blind that overlooks a freshwater pond. The refuge is open from half an hour before sunrise to half an hour after sunset. Visitors are prohibited from some activities, including metal detecting, picnicking, and collecting plants, animals, or artifacts.

There is an observation window in the Visitor Center overlooking a freshwater pond. The Visitor Center has binoculars and a spotting scope available for visitor use to observe wildlife. Behind the Visitor Center is a butterfly garden which provides opportunities to view and photograph butterflies.

Fisherman Island Refuge is open to the public for guided tours from October 15 through March 30. The island is closed the remainder of the year to protect colonial nesting birds from disturbance. Occasionally tours are given at other times of the year (i.e., International Migratory Bird Day). Visitors to Fisherman Island Refuge observe neotropical birds in the fall and many different species of waterfowl in the winter.

### Environmental Education and Interpretation

The Visitor Center offers exhibits and short videos on the important habitats of the area and wildlife management activities that occur on

the refuges. It also offers an auditorium where wildlife videos are shown.

Most of the elementary school children in Northampton County (approximately 1,000 students) annually receive one to two hours of education on conservation and migratory bird issues. Educational activities follow the State “Standards of Learning.” We also educate about 1,000 children from other schools, summer camps, and other clubs and organizations.

Visitors to Fisherman Island Refuge learn about the essential role the island plays in wildlife protection and its importance to harbor defense during both World Wars.

### **Public Use Opportunities Off-Refuge**

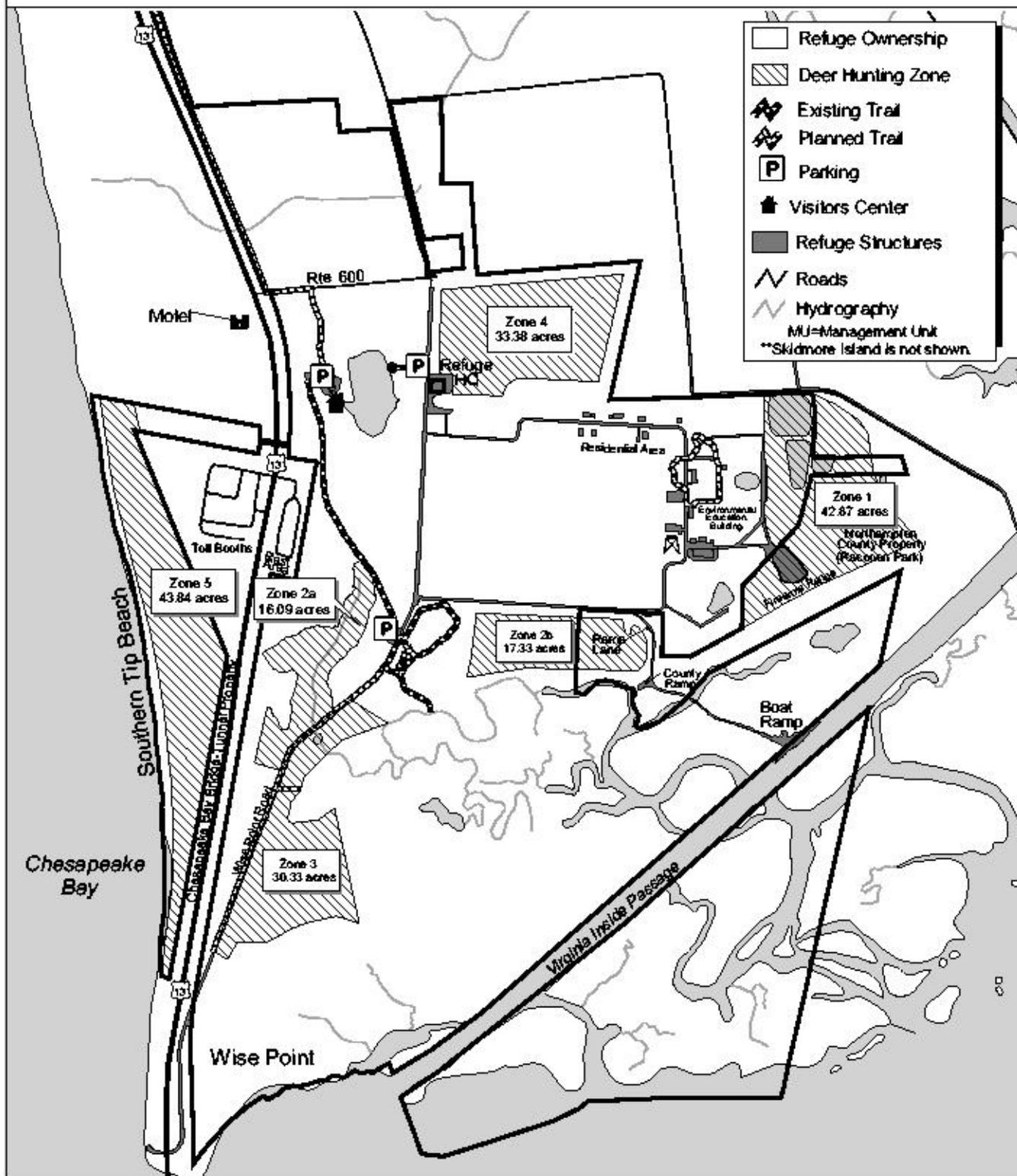
Three miles north of the refuge is Kiptopeke State Park. The 540-acre park is on the Chesapeake Bay and offers camping, swimming, boating, fishing, biking, hiking, picnicking, and interpretive programs.

About 10 miles north of the refuge is Cherrystone Campground, a family camping and recreational vehicle resort. Cherrystone is also on the Chesapeake Bay. The resort is about 300-acres in size and offers cottages, camping cabins, on-site trailer rentals, and tent rentals. Visitors can swim, fish, boat, kayak, shop, and golf.

Approximately 70 miles north is Chincoteague National Wildlife Refuge, Assateague Island National Seashore, the Virginia Space Flight Center (one of only three commercial rocket launch facilities in the United States), small towns filled with historic homes, and hundreds of miles of waterfront on the Chesapeake Bay and Atlantic Ocean.

# Deer Hunting Zones

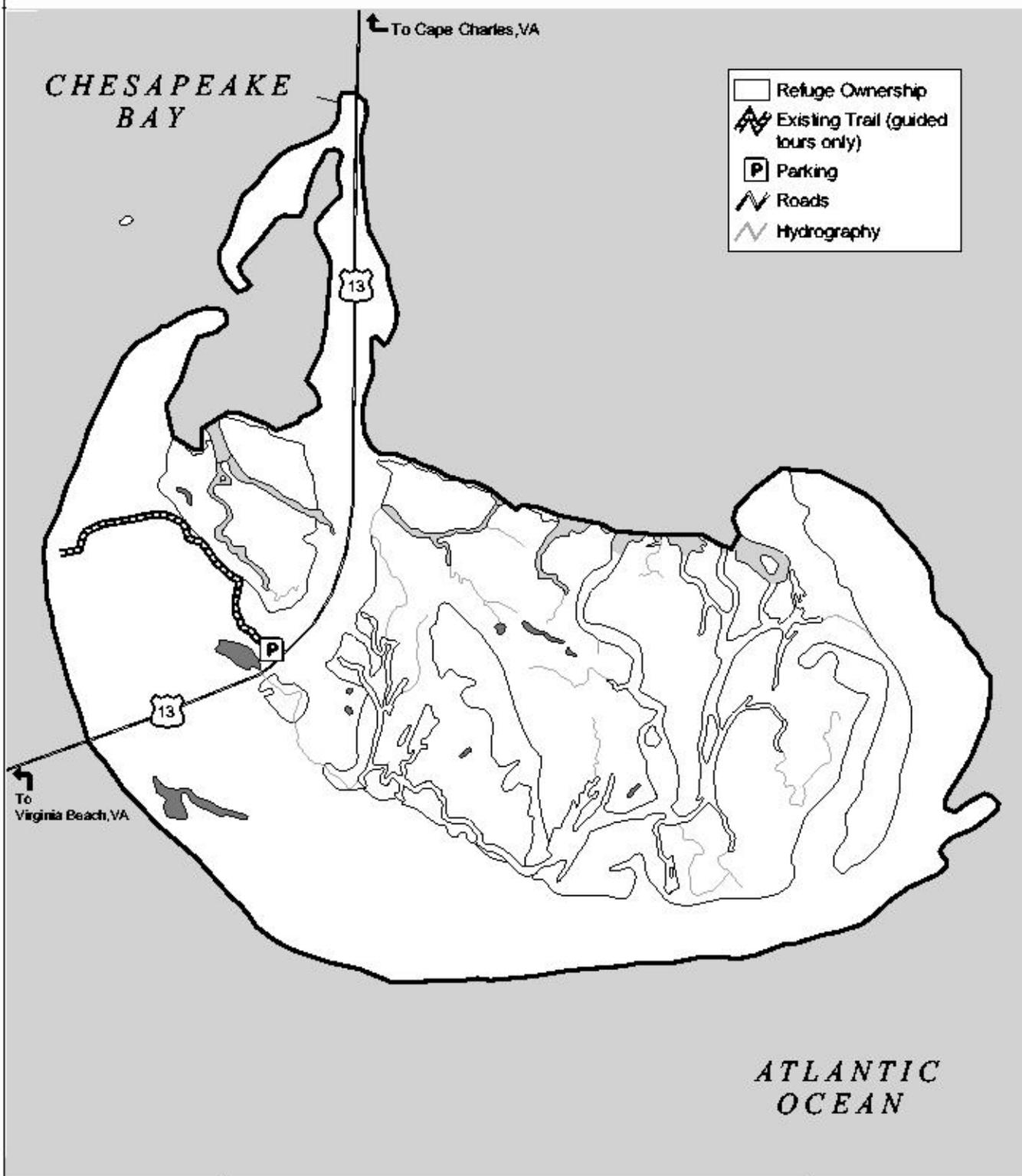
## *Eastern Shore of Virginia Refuge*



**Data Sources:**  
 1:24,000 Hydrography & 1:100,000 Road data provided by USGS with acreage data of 1981 & 1989. All other data provided by USFWS. Projection/Data: UTM Zone 18, NAD 27, Meters.  
 Map prepared for the Eastern Shore of Virginia NWR & Fisheries Island NWR Comprehensive Conservation Plan by the RS Cartography & Spatial Data Services Section, March 2003.  
 This map is for planning purposes only.



## Existing Public Use Opportunities *Fisherman Island Refuge*



**Data Sources:**  
 1:24,000 Hydrography & 1:100,000 Road data provided by USGS with access dates of 1981 & 1989. All other data provided by USFWS. Projection/Datum: UTM Zone 18, NAD 83, Meters.  
 Map prepared for the Eastern Shore of Virginia WWR & Fisherman Island WWR Comprehensive Conservation Plan by the RS Cartography & Spatial Data Services Section - March 2002.  
 This map is for planning purposes only.

0 1000 2000 3000 4000 Feet



0 300 600 900 1200 Meters



## Cultural Resources

A variety of federal laws require the U.S. Fish and Wildlife Service (Service) to identify and preserve important historic structures, archaeological sites, and artifacts. The National Environmental Policy Act (NEPA) mandates consideration of cultural resources in planning federal actions. The National Wildlife Refuge System Improvement Act calls for identification of the archaeological and cultural values of each refuge in the Comprehensive Conservation Plan (CCPs).

Federal agencies are also required, by the National Historic Preservation Act, to locate and protect historic resources (archaeological sites and historic structures eligible for or listed in the National Register of Historic Places, and museum property) on their land or on land affected by their activities. In addition, agencies are required to establish a program for these activities and to carry out their preservation activities in consultation with State Historic Preservation Offices. In Region 5, the Service's Regional Historic Preservation Officer oversees compliance with these laws and consults with the State Historic Preservation Offices in 15 states. In Virginia, this is the Virginia Department of Historic Resources.

According to the National Historic Preservation Act, site preservation depends on the National Register of Historic Places (National Register) eligibility, a measure of the site or structure's quality or importance. Federal agencies are also charged with locating, evaluating, and nominating sites on their land to the National Register. The Service maintains an inventory of discovered archaeological sites and historic structures in the Regional Office, with copies of the site files at each refuge.

We comply with the Archaeological Resource Protection Act, which requires protection of archaeological sites from vandalism and looting, and requires permits for site excavation. The Regional Historic Preservation Officer manages these activities.

We own and care for museum property. Archaeological collections, art, zoological and botanical collections, historical photographs, and historic objects are our most common types of museum property. Each refuge maintains an inventory of museum property. Museum property care on refuges is guided by the Regional Museum Property Coordinator who helps the Service comply with the Native American Grave Protection and Repatriation Act, as well as Federal regulations guiding curation of Federal archaeological collections. The program ensures that Service collections will continue to be available to people for learning and research.

### Eastern Shore of Virginia National Wildlife Refuge

Preservation of cultural resources depends on their eligibility for listing on the National Register of Historic Places. Eastern Shore of Virginia Refuge has had a professional archaeological survey completed to assess the eligibility of its known sites. The Virginia Department of Historic Resources has been consulted with reference to this work. In addition, the refuge has maps of land forms likely to need survey if ground disturbance is necessary.

The end result of this work has proven that the refuge has one National Register eligible farmstead. In addition, there are structural remains of Fort John Custis, part of the Chesapeake Bay Harbor Defenses, which may be eligible for the National Register. Nine other known sites, including two cemeteries, have been evaluated for eligibility for the National Register. None of these sites are eligible.

### Fisherman Island National Wildlife Refuge

#### *Previous Archaeological Work*

Because Fisherman Island consists of modern (post 1820) deposits, the Virginia Department of Historic Resources concurred in 1992 with Espey, Huston and Associates that no archaeological survey was justified on the island unless archival sources suggested historic use of the area. Therefore, the firm's study of the Parallel Crossing Proposal did not include work on Fisherman Island. In 1975, however, a team of museum and military professionals examined structural remains of Fort John Custis on Fisherman Island (Virant 1975). In 1994, Matthew L. Adams and Christopher K. Wiles also visited Fisherman Island and reported on the condition of the Fort John Custis structures (Adams 1994). No archaeological or professional architectural survey has been conducted on Fisherman Island.

Known cultural resources on Fisherman Island consist of four structures remaining from Chesapeake Bay Harbor Defenses for World War II—gun emplacements and the activities related to their support. In addition, one standing cabin is related to hunting and fishing on the island. Sites of cabins from the late 19<sup>th</sup> and early 20<sup>th</sup> century may exist as well. No cultural resources on Fisherman Island have as yet been evaluated for National Register eligibility.