

Chapter 3. Summary Refuge and Resource Descriptions

Cape May Refuge

Physical Environment

Climate

Cape May National Wildlife Refuge (Cape May Refuge) is within the New Jersey coastal weather station zone (Sandy Hook, Long Branch, Atlantic City, and Cape May weather stations). The ocean moderates the State's continental climate within the coastal weather zone. The average monthly temperature is 35°F in January, the coldest month of the year, and 75°F in July, the hottest month of the year. The growing season for the Refuge is 255 days. The growing season is the period of the year in which the average temperature is 43°F or more. The average annual precipitation in the coastal zone is 42.6 inches. Precipitation is distributed fairly evenly through the year, with slightly more in July and August, and less in February.

Geology, Topography and Soils

The Cape May Refuge is within the Outer Coastal Plain, which consists of sedimentary deposits dating from the Tertiary Period. Elevations in Cape May County range between sea level and 55 feet above mean sea level. The interior of Cape May County consists of low rolling hills and poorly drained depressions. The ocean side of the County consists of broad tidal marsh areas fronted by barrier islands. There are well developed sand dunes in some places on the ocean barrier islands and along the shore of Delaware Bay in the southwestern part of the County.

The major soil series in the Great Cedar Swamp Division of Cape May Refuge are Barryland and Mullica-Manahawkin Association and Transquaking-Appoquinimink-Misspillion-Pawcatuck Association. The major soils series in the Delaware Bay Division are Barryland and Mullica-Manahawkin Association and Transquaking-Appoquinimink-Misspillion-Pawcatuck Association, Downer-Ingleside-Swainton Association, and Hammonton Association. The soil series on the Two Mile Beach Unit are Transquaking-Appoquinimink-Misspillion-Pawcatuck Association and Urban land-Psamments-Beaches Association.

Hydrology

The Cape May Refuge is located within the New Jersey Coastal Plain with the underling aquifers consisting of the Kirkwood-Cohansey aquifer system and the Atlantic City 800-foot sand. The Cape May Peninsula is surrounded on three sides by salt water and the groundwater recharge areas for the aquifers are not as large as farther north along the coast. Because of these two factors, saltwater intrusion into the Choansey aquifer is a substantial problem in the area. The City of Cape May has constructed a \$5 million desalination plant, because it can no longer extract suitable freshwater from some of its five wells. The plant's capacity is two million gallons of water per day. The estimated operating and maintenance costs are \$500,000 per year.

Cape May Refuge has both tidal and non-tidal surface waters. Non-tidal waters include marshes, bogs, ponds, creeks, and seasonally flooded forests. Tidal waters include ponds, salt and fresh marshes, creeks and old ditches, coves, bays, and inlets. Most of the salt marsh is tidally inundated daily, with the greatest inundation occurring at new and full moons.

The Great Cedar Swamp Division is drained by Cedar Creek and Dennis Creek; the Delaware Bay Division is drained by Bidwell Creek, Dias Creek, Green Creek, and Fishing Creek. These streams display low

runoff, about half the volume of other streams in the State, which indicates a high infiltration rate. The Bidwell's Creek drainage basin has been identified by the County as one of the region's most important groundwater recharge areas. Other major groundwater recharge areas in the County are near Cape May Court House and Cold Spring.

Contaminants

The Service collected sediments, mummichogs, and fiddler crabs at 25 locations in and adjacent to the Cape May Refuge in 1992 to determine baseline contamination. The 25 locations included all major drainages and selected tidal creeks. The Service analyzed the sediments and mummichogs for trace metals, organochlorine pesticides and polychlorinated biphenyls (PCB's); the fiddler crabs were analyzed only for organochlorines (USFWS, 1994b).

The sediment trace metal concentrations were considered to be typical for sediments in southern New Jersey and probably represent site-specific background levels. Although low, the concentrations of arsenic, beryllium, cadmium, chromium, copper, iron, lead, mercury, nickel, and zinc at one or more sample locations exceeded sediment "effects range-low" levels developed by the National Oceanic and Atmospheric Administration, and freshwater sediment "lowest effects" levels developed by the Ontario Ministry of the Environment. Because sediment trace metal concentration levels did not exceed more severe effects levels, the potential for adverse effects on benthic organisms exposed to the contaminants is low to non-existent. The mean trace metal levels found in mummichogs and fiddler crabs were at the low end of ranges typically observed in New Jersey. The maximum trace metal levels found in mummichogs and fiddler crabs appeared to be well below levels of concern for fish and wildlife.

None of the twenty organochlorine tested for were detected in the sediment samples (average detection limit = 0.04 ppm dry weight). The only organochlorine detected in the mummichogs and fiddler crabs were the DDT breakdown products, DDD and DDE. The average combined DDD and DDE concentrations were comparable to background levels for New Jersey. The maximum combined DDD and DDE level found (0.18 ppm wet weight in mummichogs and 1.04 ppm wet weight in fiddler crabs), however, were greater than the background levels. Organochlorine concentration levels in Cape May Refuge area mummichog and fiddler crab populations are low and are not expected to adversely affect the organisms or their immediate predators.

Although low, the concentrations of DDD and DDE did not appear to decline significantly since 1989—the last previous sampling. Although the use of the parent compound DDT ceased in the mid-1960's, it is possible that weathered material continues to enter the estuarine ecosystem as previously contaminated areas are disturbed through dredging or erosion.

Biological Environment

There is an extensive description of the plant and animal communities in the Cape May Refuge area in "Significant Habitats and Habitat Complexes of the New York Bight Watershed" (USFWS, 1997). The most important biological features of the locality include the estuaries associated with Delaware Bay and the Atlantic coast, the transition between southern and northern species assemblages, and the unique and critical role the peninsula plays as a staging area and corridor for bird migration.

Threatened, Endangered, Recovered and Rare Species

There are 12 species in and around Cape May Refuge that are Federally-listed endangered, threatened, recovered, or species of concern, formerly called candidate species (Appendix E). The listed species for which the most information is available are the peregrine falcon and bald eagle. Fall raptor surveys conducted at Cape May Point by the Cape May Bird Observatory since 1976 have demonstrated a dramatic increase in observations of both species. Over the past 10 years, peregrine falcon sightings have undergone a five-fold increase, while bald eagle sightings have doubled.

Migrating and wintering eagles utilize the extensive marshes for hunting, and the wooded swamp and forest edge habitats for roosting. The Dennis Creek Marsh is one of the most heavily used raptor sites in New Jersey. The Great Cedar Swamp is an historic nesting site for bald eagles. Although eagles now only roost in the swamp, the area is a potential nesting site.

A number of the other listed species have been documented on Cape May peninsula. There is a strong potential for their occurrence on lands currently owned by the Refuge, or proposed for acquisition.

Vegetation and Habitat Types

About half of the Refuge land at the Cape May Refuge is wetland and about half is upland. Forests (combining upland and wetland types) represent the largest single habitat type for the Refuge.

Most of the wetlands in the Cape May Refuge are dominated by woody vegetation (swamps) not emergent vegetation (marshes). Salt marsh makes up about 15% of the Refuge land, forested wetlands make up 30%, shrub/scrub wetlands and bogs make up about 4%, and open water makes up less than 1%.

Most of the salt marshes were either impounded earlier in the century to create meadows for salt hay production or grid ditched for mosquito control. Most of the impounded areas have been reopened by tidal action or human intervention.

Forested uplands make up about 42% of the Service-owned property at the Cape May Refuge. Upland forests range from deciduous to coniferous dominated overstory composition, with tree species including: pitch pine (*Pinus rigida*), oaks (e.g., white oak - *Quercus alba*, chestnut oak - *Q. prinus*, black oak - *Q. velutina*, scarlet oak - *Q. coccinea*), black cherry (*Prunus serotina*), and sweet gum (*Liquidambar styraciflua*). Fire played a prominent role in defining the composition and structure of upland plant communities, both historically and prehistorically (Little, 1998). There are still some nearby State lands in the Pine Barrens that receive regular fire treatment (both prescribed and wild), but fire on Refuge lands has been suppressed for decades. Other upland habitats include shrub/scrub uplands which make up about 3%, and grassland/old fields uplands which make up about 3%. Beaches make up less than 1% of the Service-owned property.

Unique to the peninsula and present on the Cape May Refuge is the Cape May lowland swamp, a deciduous forest swamp with an unusually high species diversity and found in headwaters areas.

Wildlife Resources

Migratory Birds: The Cape May Peninsula has long been renowned for its spectacular concentrations of birds during the spring and fall migrations. Because of its unique configuration and geographic location along the Atlantic Flyway, thousands of songbirds, raptors, and woodcock are funneled into Cape May during the fall migration. Facing a 12-mile open water crossing, migrants may rest and feed in the area until favorable winds allow them to either cross Delaware Bay or head back north, up and around the Bay. In addition, the peninsula's extensive marshes attract large numbers of waterfowl, particularly wintering black

ducks, while the bay's narrow beaches attract major assemblages of shorebirds in the spring. Over 360 species of birds can be observed in Cape May County during the year.

The upland shore edge of Delaware Bay is well recognized as a critical fall migratory bird corridor. The wetlands of the Delaware Bay Estuary, which include the Delaware Bay wetlands in the Cape May Refuge, are classified as Wetlands of International Importance under the Ramsar Convention, one of only 17 sites so designated in the United States.

The coastal wetlands of New Jersey, including the Delaware Bay marshes, are of international importance to wintering waterfowl, annually wintering 34% of the entire Atlantic Flyway black duck (*Anas rubripes*) population. During severe winters, black ducks rely heavily on freshwater fringe areas along the upland edges of the marsh, where the relatively constant temperature of the upper reaches of small streams and creeks cause them to remain ice-free when the remainder of the marsh has iced over. These marshes also provide important black duck breeding habitat. Nesting surveys conducted by the New Jersey Division of Fish and Wildlife have found high nest densities in the Delaware Bay Division.

In addition to black duck, Cape May Refuge also supports large numbers of other migrating waterfowl, many of which remain throughout the winter: wood duck (*Aix sponsa*), blue-winged teal (*Anas discors*), green-winged teal (*A. crecca*), American wigeon (*A. americana*), mallard (*A. platyrhynchos*), gadwall (*A. strepera*), northern shoveler (*A. clypeata*), northern pintail (*A. acuta*), canvasback (*Aythya valisineria*), greater scaup (*A. marila*), lesser scaup (*A. affinis*), bufflehead (*Bucephala albeola*), and Canada goose (*Branta canadensis*).

Many marsh and water birds use the Refuge. The most common include great blue heron (*Ardea herodias*), great egret (*Casmerodius albus*), snowy egret (*Egretta thula*), black-crowned night heron (*Nycticorax nycticorax*), glossy ibis (*Plegadis falcinellus*) and cattle egret (*Bubulcus ibis*). Herons and egrets nest on or near the Refuge, frequently foraging in the salt marshes, streams, and ponds.

The Delaware Bay shoreline is a major shorebird staging area in North America, second only to the Copper River Delta in Alaska. Delaware Bay is a hemispherically important shorebird site. Hundreds of thousands of shorebirds, nearly 80% of some populations, stop to rest and feed here during their spring migration from South America to their breeding grounds in the Arctic. The arrival of over 20 species of shorebirds, primarily red knots, ruddy turnstones, sanderlings, and semipalmated sandpipers coincides with the peak horseshoe crab spawning season. Horseshoe crab eggs provide an abundant source of food for these shorebirds to replenish their energy reserves.

There is substantial raptor migration through Cape May Refuge, with large numbers of 15 species observed. Each year since 1976, an average of 75,000 hawks have been recorded by the Cape May Bird Observatory. Because these birds are hesitant to cross wide expanses of water, most species migrate along the length of the Bay coast, utilizing the Bayshore upland edge as a migratory corridor.

Notable raptor species include sharp-shinned hawk, Cooper's hawk (*A. cooperii*), red-tailed hawk, broad-winged hawk, red-shouldered Hawk, northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), and merlin (*F. columbarius*).

Large numbers of owls also migrate through the Cape May Refuge. Typical species include the common barn-owl, northern saw-whet owl (*Aegolius acadicus*), and long-eared owl (*Asio otus*). The thick cedar groves and woodlands of the expansion area are important to wintering populations of owls, including long-eared owl, short-eared owl, and northern saw-whet owl.

American woodcock concentrate in large numbers on the Cape May peninsula during the fall migration. The birds utilize the field/forest edge and old field habitats. Cape Charles, Virginia, is the only other area along the Atlantic coast that concentrates woodcock in comparable numbers.

During the fall migration, nearly 100 species of songbirds pass through the County, utilizing a variety of habitat types. An abundance of songbirds also breeds in the field/forest edge habitat of the cedar swamps and salt marsh. Cape May Refuge also provides nesting habitat for regionally and nationally significant species such as rails, Neotropical migrants, and raptors.

Mammals: Over 30 species of mammals occur on the Refuge, in assemblages characteristic of the Mid-Atlantic coastal communities. Forest species include red fox (*Vulpes vulpes*), grey fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), long-tailed weasel (*Mustela frenata*), short-tailed weasel (*Mustela erminea*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginiana*), white-tailed deer (*Odocoileus virginianus*), grey squirrel (*Sciurus carolinensis*), red squirrel (*Tamiasciurus hudsonicus*), chipmunk (*Tamias striatus*), white-footed mouse (*Peromyscus leucopus*), red-backed vole (*Clethrionomys gapperi*), pine vole (*Microtus pinetorum*), masked shrew (*Sorex cinereus*), short-tailed shrew (*Blarina brevicauda*), eastern mole (*Scalopus aquaticus*), and a variety of bat species. Shrubland and grassland species of mammals include the meadow vole (*Microtis pennsylvanicus*), meadow jumping mouse (*Zapus hudsonius*), woodchuck (*Marmota monax*), eastern cottontail (*Sylvilagus floridanus*), and several of the forest and wetland species. Mammals associated with wetlands include mink (*Mustela vison*), river otter (*Lutra canadensis*), muskrat (*Ondatra zibethicus*), meadow vole, southern bog lemming (*Synaptomys cooperi*), least shrew (*Cryptotis parva*), and marsh rice rat (*Oryzomys palustris*).

Several species of bats occur in forested habitat types during the summer breeding season. Forest openings are common foraging areas for this group. A number of other migrating bat species probably pass through southern New Jersey during migration, while others would use caves for hibernacula (not found locally). Very little research has been done on bats in the vicinity.

Reptiles and Amphibians: The reptiles and amphibians known to occur on the Refuge represent two major assemblages – Pine Barrens and coastal estuarine environment. Important species from the Pine Barrens group include wood turtles (*C. insculpta*), Cope's gray and pine barrens treefrog (*Hyla chrysoscelis* and *H. andersonii*), ambystomid salamanders (*Ambystoma* spp.). An important estuarine ecosystem species is the northern diamondback terrapin (*Malaclemys t. terrapin*).

Fish: The estuarine habitat at Cape May Refuge hosts a wide variety of fish species. Some species, like the mummichog (*Fundulus heteroclitis*), a common prey species for many larger fish and for wading birds, depend on salt marsh as their primary habitat. Other species depend on the estuary for only a portion of their life cycle. Important commercial and recreational finfish and shellfish species that utilize the estuary during a portion of their life cycle include horseshoe crab (*Limulus polyphemus*), weakfish (*Cynoscion regalis*), summer flounder (*Paralichthys dentatus*), bluefish (*Pomatomus saltatrix*), black sea bass (*Centropristis striata*), blue crab (*Callinectes sapidus*), and hardshell clam (*Mercenaria mercenaria*). The horseshoe crab is particularly noteworthy. The Delaware Bay hosts the largest concentration of horseshoe crabs, and many birds depend on horseshoe crab eggs for food. (See **Migratory Birds** above.)

Archaeological and Historical Environment

Prehistoric Period

The Cape May Refuge and the surrounding area was the subject of an archaeological field school sponsored by Rutgers University and Stockton College from 1995 through 1998. Several prehistoric sites were

discovered, most notably a large site or group of sites on a tidal marsh island that is rapidly eroding. In addition to the expected shellfish and mammal remains, a substantial amount of turtle bone from a variety of species was identified here.

There is a proposal to study the paleoecology of the adjacent marshland, to determine the biological resources available at the time the site was occupied. While the field school was not designed specifically as a planning study to identify archaeological sites in the Refuge, its findings show that the highly varied and changing mix of upland and wetland supported Native American populations in the area for an apparently unbroken period covering the last 12,000 years.

Historic Period

Historic period settlement on the Refuge appears to have been limited. Most of the area was marshland, woodland, or farmland, with little recorded settlement on Refuge property, and apparently few landing areas to provide opportunities for maritime sites. A mill location on one of the streams within the Refuge is one of the few recorded sites. There are no standing historic structures on the Refuge, however there is a family cemetery.

Socioeconomic Environment

As is the case along the rest of the New Jersey coast, tourism is the number one industry in Cape May County. Cape May County is ranked as the second best birding hotspot in all of North America (Konrad, 1996). A recent study estimated that the 100,000 birders who annually visit Cape May County bring more than \$31 million into the local economy (Kerlinger, 1997).

There is also a substantial commercial fishing industry in southern New Jersey. Fishing is the second largest industry after tourism in Cape May County. There is an increase in shellfish aquaculture, especially oysters. Bait fish, eel, and horseshoe crabs are also a major component of the industry.

Over the last 20 years, casino development in Atlantic City has spurred a large influx of people to Cape May County. As farther north along the New Jersey coast, this has spurred a rapid construction of housing and support infrastructure (e.g., roads, malls, plazas, and utility towers). The increase in human density and associated uses have caused considerable strains on the ecosystem from the following factors:

1. Habitat loss - direct conversion of natural habitat types to developed types.
2. Habitat fragmentation - conversion of large contiguous tracts of natural habitat types to a mosaic of discontinuous, smaller habitat type relicts; or erecting barriers that cause direct lethal impacts to fish, wildlife and plants (e.g., roads, towers, dams).
3. Habitat degradation - partial deterioration of habitat due to pollution (siltation, nutrients, pesticides, metals), exotic and pest species (phragmites, house cats), incompatible uses (all-terrain vehicles, personal watercraft).
4. Water consumption - reducing subsurface and surface waters due to irrigation, home consumption, and industrial applications.

In addition to these environmental-economic connections, there are others. A study conducted in Minnesota determined that there is a statistically significant positive relationship between the amount of wetland acres in an area and residential property values (Lupi, et al., 1991). The authors were not able to identify which

values were captured (i.e., open space, view, habitat, etc). A study conducted in Maine outlines the economic benefits of open space to local communities (American Farmland Trust, 1992).

Beyond the economic factors in land use planning there are ethical considerations. Is the land a commodity that belongs to us? Or is land a community to which we belong? Are we the masters of the land or are we stewards of the land?

Two Mile Beach Unit

Physical Environment

The "Draft Environmental Assessment for the Closure of Electronic Engineering Center (EECEN)" (USCG, 1996) and the Environmental Baseline Survey Report EECEN (ABB, 1997) contain an extensive description of the Physical, Biological, and Socioeconomic environments of the Electronic Engineering Center.

Originally, the Two Mile Beach Unit (Unit) consisted of 491 acres, 221 of which are above the mean high tide line. Of this acreage, upland habitat makes up 90 acres and wetland habitat the remaining 131. An additional 18 acre parcel of wetland habitat joining the Two Mile Beach Unit was purchased in August 2003 as part of the Unit.

Almost all of Unit is within the 100-year flood plain; the entire Unit is within the 500-year flood plain. The 100-year flood, or intermediate regional tide, would have an elevation of 10.0 feet above mean sea level. The 500-year flood, or standard project tide, would have an elevation of 14.0 feet above mean sea level. The September 1944 hurricane that struck New Jersey had a tide 8.0 feet above mean sea level.

In a 100-year flood, or intermediate regional tide, all of the Unit would be flooded, except for a narrow strip along the top of the barrier dunes. In a 500-year flood, or standard project tide, all of the Unit, including the protective barrier dunes, would be underwater. In either event virtually all the buildings at EECEN would be destroyed or severally damaged (USCG, 1996).

Biological Environment

Threatened, Endangered, Recovered and Rare Species

The piping plover has historically used the beaches as nesting grounds, up to three nesting pairs recorded in a given year. Peregrine falcons stop over before heading for the north coast of South America in the fall, and the American bald eagle has been documented in the area.

Vegetation and Habitat Types

The lands above mean high tide consist of coastal beach and dune habitat and salt marsh habitat.

The beach community is composed of sparse vegetation, including American searocket (*Cakile edentula*), coast-blite goosefoot (*Chenopodium rebrum*) and beach-heather (*Hudsonia tomentosa*). The beach dunes are densely vegetated. The dominant dune vegetation includes beachgrass (*Panicum amarum*), bitter panic grass (*Panicum amarulum*), American beachgrass (*Ammophila breviligulata*), American wormseed (*Chenopodium ambrosioides*), and seaside goldenrod (*Solidago sempervirens*), bayberry (*Myrica pennsylvanica*), and black cherry (*Prunus serotina*). The site is an excellent example of a maritime forest.

Common salt marsh species include saltmarsh cordgrass (*Spartina alterniflora*), saltmarsh camphor-weed (*Pluchea purpurascens*), Carolina sealavender (*Limonium carolinianum*), salt-meadow grass (*Spartina patens*), saltmarsh rush (*Juncus gerardii*), marsh elder (*Iva frutescens*), and common reed (*Phragmites australis*).

Wildlife Resources

Migratory birds: Common species include mallard (*Anas platyrhynchos*), common merganser (*Mergus merganser*), American coot (*Fulica americana*), killdeer (*Charadrius vociferus*), herring gull (*Larus argentatus*), turkey vulture (*Cathartes aura*), northern harrier (*Circus cyaneus*), Cooper's hawk (*Accipiter cooperii*), red-tailed hawk, American kestrel (*Falco sparverius*), mourning dove (*Zenaida macroura*), eastern screech-owl (*Otus asio*), belted kingfisher (*Ceryle alcyon*), northern flicker (*Colaptes auratus*), hairy woodpecker (*Picoides villosus*), downy woodpecker (*Picoides pubescens*), and purple martin (*Progne subis*).

Mammals: Many of the mammal species found in dune and tidal wetlands communities of Cape May County occur on the Unit.

Reptiles and Amphibians: Reptile species common in the area include the eastern box turtle (*Terrapene carolina*), diamond back terrapins, eastern fence lizard (*Sceloporus undulatus*), and common garter snake (*Thamnophis sirtalis*). Amphibian species common in the area include eastern newt (*Notophthalmus viridescens*), grey treefrog (*Hyla versicolor*), and bullfrog (*Rana catesbeiana*).

Fish: Fish occurring at Unit would be grouped into two major types: estuarine and near-shore marine. The estuarine systems have already been described above under Cape May Refuge.

Archaeological and Historical Environment

Prehistoric Period

No archaeological surveys have been done at Unit, but the property has potential for prehistoric archaeological sites, especially in areas of wetland edge environments. Several late prehistoric sites have been found nearby in similar settings.

Historic Period

Although Cape May was settled by the middle of the 17th century, there is no record of historic occupation of this property until 1870, when a lifesaving station was built on or near it. Many remains of shipwrecks have been reported in the area, and there may be some evidence of these in the beachfront portion of the property. There are no standing historic structures on this property. The Coast Guard facility was established in the late 1940's, and its buildings are typical modern construction.

Socioeconomic Environment

See **Socioeconomic Environment** section for Cape May Refuge.