

FEMA Emergency Berm Repair for the Florida Coast

**Biological Opinion
April 3, 2008**

**Prepared by:
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Consultation staff via email to fw4flesregs@fws.gov**

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Acronyms

ABM	Alabama Beach Mouse
Act	Endangered Species Act
AIBM	Anastasia Island Beach Mouse
BIRNM	Buck Island Reef National Monument
BO	Biological Opinion
CAHA	Cape Hatteras National Seashore
CBM	Choctawhatchee Beach Mouse
CBIA	Coastal Barrier Improvement Act
CBRA	Coastal Barrier Resource Act
CCAFS	Cape Canaveral Air Force Station
Corps	U.S. Army Corps of Engineers
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
FWC	Fish and Wildlife Conservation Commission
FWRI	Fish and Wildlife Research Institute
GOM	Gulf of Mexico
GPS	Global Positioning System
GTNERR	Guana Tolomoto Matanzas National Estuarine Research Reserve
HCP	Habitat Conservation Plan
INBS	Index Nesting Beach Survey

ITP	Incidental Take Permit
MHW	Mean High Water
MHWL	Mean High Water Line
MLW	Mean Low Water
NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
ORV	Off Road Vehicles
PBA	Programmatic Biological Assessment
PCE	Primary Constituent Elements
PKBM	Perdido Key Beach Mouse
PKSP	Perdido Key State Park
PSI	Per Square Inch
PHVA	Population and Habitat Viability Analysis
PVA	Population Viability Analysis
RPMs	Reasonable and Prudent Measures
SABM	St. Andrews Beach Mouse
SEBM	Southeastern Beach Mouse
Service	U.S. Fish and Wildlife Service
SNBS	Statewide Nesting Beach Survey
STSSN	Sea Turtle Stranding and Salvage Network
T&Cs	Terms and Conditions
TEDS	Turtle Excluder Devices

USDA United States Department of Agriculture

USVI U.S. Virgin Islands



IN REPLY REFER TO:

United States Department of the Interior

FISH AND WILDLIFE SERVICE

6620 Southpoint Drive, South
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Jacksonville, Florida 32216-0912

April 3, 2008

Mr. Richard Myers
Environmental Liaison Officer
Federal Emergency Management Agency
Florida Long Term Recovery Office
U.S. Department of Homeland Security
36 Skyline Drive
Lake Mary, Florida 32746

Re: Service Federal Activity No: 41910-2007-F-0430
Applicant: Federal Emergency Management
Agency
Date Started: May 30, 2007
Project Title: FEMA Emergency Berm Repair and
Construction
Ecosystem: Florida Coastline
Counties: Nassau, Duval, St. Johns, Flagler,
Volusia, Brevard, Indian River, St. Lucie, Martin,
Palm Beach, Broward, Monroe, Miami-Dade,
Collier, Lee, Charlotte, Sarasota, Manatee, Pinellas,
Pasco, Franklin, Gulf, Bay, Walton, Okaloosa,
Santa Rosa, Escambia.

Dear Mr. Myers:

Enclosed is the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) for Federal Emergency Management Agency (FEMA) emergency berm repair in Florida on nesting loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and Kemp's ridley (*Lepidochelys kempii*) sea turtles, and the southeastern (*Peromyscus polionotus niveiventris*), Anastasia Island (*Peromyscus polionotus phasma*), Choctawhatchee (*Peromyscus polionotus allopheys*), St. Andrews (*Peromyscus polionotus peninsularis*), and Perdido Key (*Peromyscus polionotus trissyllepsis*) beach mice, non-breeding piping plover (*Charadrius melodus*) and designated critical habitat for the Perdido Key beach mouse (PKBM), Choctawhatchee beach mouse (CBM), and St. Andrews beach mouse (SABM) (**Table 1**).

FEMA has determined that the proposed project may affect but is not likely to adversely affect (NLAA) the roseate tern (*Sterna dougallii dougallii*), the beach jacquemontia (*Jacquemontia reclinata*), and the Garbers spurge (*Chamaesyce garberi*) (**Table 2**). Based on our discussions and our review of the project plans and the incorporation of the minimization measures listed in the Programmatic Biological Assessment (PBA) as conditions of the projects where these species are known to exist, we concur that the project is NLAA the above identified species.

Previous FEMA emergency berm repair and construction projects have not occurred or impacted the primary constituent elements within any piping plover critical habitat units in Florida. Given the ephemeral nature of optimal piping plover habitat and the fact that most units are publicly owned, minimal structures occur in these areas and therefore do not meet the criteria necessary for emergency berm placement. Proposed FEMA berm repair and construction projects that occur within piping plover critical habitat are not included in this programmatic BO and will be consulted on individually.

This BO is provided in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). We have assigned Service Federal Activity number 41910-2007-F-0430 for this consultation.

This BO is based on the PBA, and information provided during meetings and discussions with FEMA and the FEMA's representative and information from the Florida Fish and Wildlife Research Institute (FWRI) sea turtle and shorebird nesting databases. A complete administrative record of this consultation is on file in the Service's North Florida, Panama City, and South Florida Ecosystem Field Offices.

Table 1. Status of Federally Listed Species within the Action Area that may be adversely affected by the Berm Construction Activities.

Species common name	Species scientific name	Status
Mammals		
Choctawhatchee beach mouse	<i>Peromyscus polionotus allophrys</i>	Endangered (CH)
Southeastern beach mouse	<i>Peromyscus polionotus niveiventris</i>	Threatened
Anastasia Island beach mouse	<i>Peromyscus polionotus phasma</i>	Endangered
St. Andrews beach mouse	<i>Peromyscus polionotus peninsularis</i>	Endangered (CH)
Perdido Key beach mouse	<i>Peromyscus polionotus trissyllepsis</i>	Endangered (CH)
Birds		
Piping Plover	<i>Charadrius melodus</i>	Threatened
Reptiles		
Green sea turtle	<i>Chelonia mydas</i>	Threatened

Species common name	Species scientific name	Status
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Endangered
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	Endangered
Leatherback sea turtle	<i>Dermochelys coriacea</i>	Endangered
Loggerhead sea turtle	<i>Caretta caretta</i>	Threatened

Table 2. Species and critical habitat evaluated for effects and those where the Service has concurred with a 'not likely to be adversely affected' determination by FEMA.

SPECIES/CRITICAL HABITAT	PRESENT IN ACTION AREA	PRESENT IN ACTION AREA BUT "NOT LIKELY TO BE ADVERSELY AFFECTED"
Roseate Tern	Yes	Yes
Beach jacquemontia	Yes	Yes
Garbers spurge	Yes	Yes

Consultation History

<u>September 1, 2006</u>	The Department of Interior and FEMA entered into a cooperative funding agreement (HSFELA-06-X-0074) to streamline the Act's section 7 consultation process for FEMA funded actions for federally declared disaster response and recovery.
<u>February 21, 2007</u>	The Service met with a representative of FEMA to discuss the PBA for FEMA berms and other activities.
<u>March 7, 2007</u>	The Service discussed via email with a representative of FEMA the activities to be included in the PBA. It was concluded that FEMA would follow up on post- hurricane season 2004 and 2005 emergency consultations for previous activities and any future emergency related activities would be addressed in the PBA.
<u>March 26, 2007</u>	The Service received via email and regular mail a draft of the PBA from FEMA.
<u>March 29, 2007</u>	The Service provided comments via email and regular mail to FEMA on the draft PBA.
<u>April 6, 2007</u>	The Service and a representative of FEMA conducted a conference call to discuss and clarify our comments on the PBA.

<u>April 11, 2007</u>	The Service provided FEMA with a history of previous activities and minimization measures that resulted in a “may affect but not likely to adversely affect” for federally listed species. The Service also provided a list of Reasonable and Prudent Measures and Terms and Conditions that have been included in biological opinions for previous FEMA berm repair.
<u>May 3, 2007</u>	The Service concurred with FEMA on the species to be included in the PBA consultation received on March 26, 2007, based on knowledge of species range.
<u>May 30, 2007</u>	The Service received via regular mail and email from FEMA, a PBA for the proposed work with a letter dated May 17, 2007 and amended on May 30, 2007.
<u>June 4, 2007</u>	The Service provided a letter via regular mail to FEMA acknowledging and concurring with their request for formal section 7 consultation.
<u>September 4, 2007</u>	The Service requested via email from FEMA an extension for submittal of the draft BO. No projected date for submittal was provided.
<u>September 6, 2007</u>	The Service received via email from FEMA a response concurring with our request for the deadline extension for the draft BO.
<u>September 12, 2007</u>	The Service provided via email a projected date of November 12, 2007 for the draft BO.
<u>November 16, 2007</u>	The Service submitted via email the draft BO to FEMA for review.
<u>November 20, 2007</u>	The Service participated in a conference call with FEMA on the draft BO.
<u>November 28, 2007</u>	The Service submitted via email revised Reasonable and Prudent Measures (RPMs) and Terms and Conditions (T&Cs) to FEMA.
<u>November 29, 2007</u>	The Service submitted via email a revised draft BO to FEMA.
<u>December 3-5, 2006</u>	The Service received via email from FEMA comments on the draft BO.
<u>December 6, 2007</u>	The Service submitted via email, revised RPMs and T&Cs.
<u>Dec 2007–Mar 2008</u>	The Service and FEMA discussed and corresponded via email on the RPMs and T&Cs in the draft BOs.
<u>March 5, 2008</u>	The Service received via email from FEMA additional comments on the draft BO and concurrence to finalize the BO.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Emergency berm repair and construction projects covered by this BO are limited to those located landward of waters of the United States (ordinary or mean high water (MHW)) along the Atlantic Ocean and Gulf of Mexico (GOM)). Projects that would involve excavation or filling of waters or wetlands subject to regulatory overview by the U.S. Army Corps of Engineers (Corps) are not covered in this consultation. For this consultation, berms include any small, naturally occurring or man-made sand mounds located seaward of the primary dune (if present) and landward of the normal high tide line. Emergency berm repair is the re-creation of a previously existing beach berm utilizing the same or very similar footprint, elevation and slope, and using similar quality sand that is obtained from upland or other sources. Under FEMA regulations, emergency berm repair may also include creation of new berms. New berms must largely meet the preceding criteria for re-created berms. FEMA considers emergency beach berms as emergency protective measures to protect lives or improved property from waves and flooding. Work is limited to that which would provide protection from a 5-year storm event or would restore the facility to its pre-disaster design, whichever is less.

Construction typically involves placing sand (typically obtained from an upland source) along the path of the berm and shaping it with a bladed, crawler-type tractor. The berm size is limited to no more than six (6) cubic yards of sand per linear foot of berm. Equipment used for berm repair and construction generally includes dump trucks for sand delivery and placement, and small bulldozers (D5) for shaping the berm. Other small bladed tractors may also be used. Trucks entering at one beach access point generally follow the planned berm alignment and after dumping the sand they travel to and along the damp portion of the beach to a single exit point. The duration of construction depends on length of the berm. Normally, this requires less than one week. The most protracted project in Florida resulting from the 2004-05 hurricanes lasted approximately 30 days. Maintenance and repair of the berm, once completed, is not authorized. Prior to 2004-05, shoreline erosion and loss of barrier dunes and berms were addressed most exclusively by local, county, and state governments and by the Corps. In connection with the hurricanes of 2004 and 2005, FEMA has estimated they will provide grants for approximately 340 projects affecting beaches and dunes, of which involve about 40 emergency berm repair affecting approximately 75 miles of improved coastline.

Conservation Measures

The sediment placed on the beach will meet the Florida Department of Environmental Protection's (FDEP) sediment compatibility requirements for beach and nearshore placement (62B-41.007 (2) (j-k)) (<http://www.dep.state.fl.us/legal/Rules/mainrulelist.htm>) listed below:

(j) To protect the environmental functions of Florida's beaches, only beach compatible fill shall be placed on the beach or in any associated dune system. Beach compatible fill is material that maintains the general character and functionality of the material occurring on the beach and in

the adjacent dune and coastal system. Such material shall be predominately of carbonate, quartz or similar material with a particle size distribution ranging between 0.062mm (4.0φ) and 4.76mm (-2.25φ) (classified as sand by either the Unified Soils or the Wentworth classification), shall be similar in color and grain size distribution (sand grain frequency, mean and median grain size and sorting coefficient) to the material in the existing coastal system at the disposal site and shall not contain:

1. Greater than 5 percent^a, by weight, silt, clay or colloids passing the #230 sieve (4.0φ);
2. Greater than 5 percent¹, by weight, fine gravel retained on the #4 sieve (-2.25φ);
3. Coarse gravel, cobbles or material retained on the 3/4 inch sieve in a percentage or size greater than found on the native beach;
4. Construction debris, toxic material or other foreign matter; and
5. Material that results in cementation of the beach.

If rocks or other non-specified materials appear on the surface of the filled beach in excess of 50 percent of background in any 10,000 square foot area, then surface rock shall be removed from those areas. These areas shall also be tested for subsurface rock percentage and remediated as required. If the natural beach exceeds any of the limiting parameters listed above, then the fill material shall not exceed the naturally occurring level for that parameter.

Sea Turtles

1. The FEMA grant applicant will contact the local sea turtle nesting surveyor to conduct daily sea turtle nesting surveys and relocation of sea turtle nests that could be affected by the project construction;
2. For emergency berm construction and repair projects in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward counties, Florida, emergency berm construction and repair will not be allowed during the main part of the nesting season (May 1 through October 31);
3. For some areas in Florida, emergency berm construction and repair projects construction will not be conducted at night during the main part of the nesting season (May 1 through October 31); and
4. The FEMA grant applicant will attend and receive Wildlife Lighting certification from the Florida Fish and Wildlife Conservation Commission (FWC).

Beach Mice

1. No construction, equipment storage, material storage, or heavy equipment access will occur within any existing vegetated dunes; and

^aThis can be 10 percent if the material is dredged from a sand trap or navigational channel.

2. All project lighting will be positioned so that vegetated dunes are not illuminated.

Piping Plover

1. If construction occurs within the period from February through September, shorebird surveys will be conducted in the project area; and
2. Within the project area, the FEMA grant applicant will establish a 300-foot wide buffer zone where piping plover congregate in significant numbers. Any and all construction will be prohibited in the buffer zone.

Nesting Shorebirds

1. If shorebird nesting occurs within the project area, a bulletin board will be placed and maintained in the construction area with the location map of the construction site showing the bird nesting areas and a warning "BIRD NESTING AREAS ARE PROTECTED BY THE FLORIDA THREATENED AND ENDANGERED SPECIES ACT AND THE FEDERAL MIGRATORY BIRD ACT TREATY;" and
2. All tilling will be done outside of shorebird nesting areas (February 15 through August 31);
3. If construction occurs within the period from February through September, shorebird surveys will be conducted in the project area; and
4. Within the project area, the FEMA grant applicant will establish a 300-foot wide buffer zone around any location where shorebirds have been engaged in courtship behavior. Any and all construction will be prohibited in the buffer zone.

Action Area

The Service has described the Action Area for nesting and hatchling sea turtles and beach mice to include the Atlantic Coast of Florida (Key West to Fernandina/ Kings Bay) and the Gulf Coast (Ten Thousand Islands to Alabama State Line) for reasons that will be explained and discussed in the "EFFECTS OF THE ACTION" section of this consultation.

The **Action Area** for piping plovers is all ocean-side and bay-side habitat along the Atlantic Ocean and GOM coastlines in the state of Florida. It begins at the mean low waterline (MLW) and includes intertidal areas, wrack lines, ephemeral ponds, inlets, lagoons and the upper sandy beach with sparse or no vegetation and bay-side sand and mud flats habitat as well as any overwash areas that occur adjacent or connecting the GOM or Atlantic Ocean coastline.

Florida's Dynamic Coastline

Of all the states and provinces in North America, Florida is most intimately linked with the sea. Florida's 1200-mile coastline (exclusive of the Keys) is easily the longest in the coterminous United States. Of the 1200 miles, 745 miles are sandy and mostly in the form of barrier islands. The coastline is dynamic constantly changing as a result of waves, wind, tides, currents, sea level change, and storms. The entire state lies within the coastal plain, with a maximum elevation of about 400 feet, and no part is more than 60 miles from the Atlantic Ocean or GOM.

The east coast of Florida consists of a dynamic shoreline, with a relatively sloped berm, coarse-grained sand, and moderate to high surf (Witherington 1986). The southeast coast of Florida consists of continuous, narrow, sandy barrier islands bordering a narrow continental shelf (Wanless and Maier 2007). The dynamics of the east coast shoreline is due to the occurrence of storm surges and seas from tropical storms that occur mainly during August through early October. More erosion events can also occur during late September through March due to nor'easters. The impacts of these two types of storms may vary from event to event and year to year.

Northwest (panhandle) Florida beaches are considered to be low energy beaches with a gradual offshore slope and low sloped fine grained quartz sand beaches. As along the east coast of Florida, the shoreline dynamics are shaped by tropical storms and hurricanes. Although Gulf beaches may experience winter erosion, they are largely protected from the severe nor'easters.

Coasts with greater tidal ranges are more buffered against storm surges than are those with low tidal ranges, except when the storm strikes during high tide. Mean tidal ranges decrease southward along the Atlantic coast from a mean of 7 feet at the Florida-Georgia line to less than 2 feet in Palm Beach County. The mean tidal range for along the Gulf Coast is less than 3 feet (microtidal) except in the extreme south where it ranges from 3 to 4 feet. Because of its lower elevation and lower wave energy regime, the West Coast of the peninsula is subject to major changes during storm events than is the east coast.

Microtidal coasts have a high vulnerability to sea level rise and barrier islands respond by migrating landward. Migration occurs as a result of overwash from extreme storms which flatten topography and deposit sand on the backside of the island, extending the island landward. These deposition areas become the foundation for the island as it moves landward (Young 2007 pers. communication). Significant widening can occur from a single storm event. Dauphin Island, a barrier island in Alabama, has nearly doubled its pre-Hurricane Ivan width (**Figure 1**).

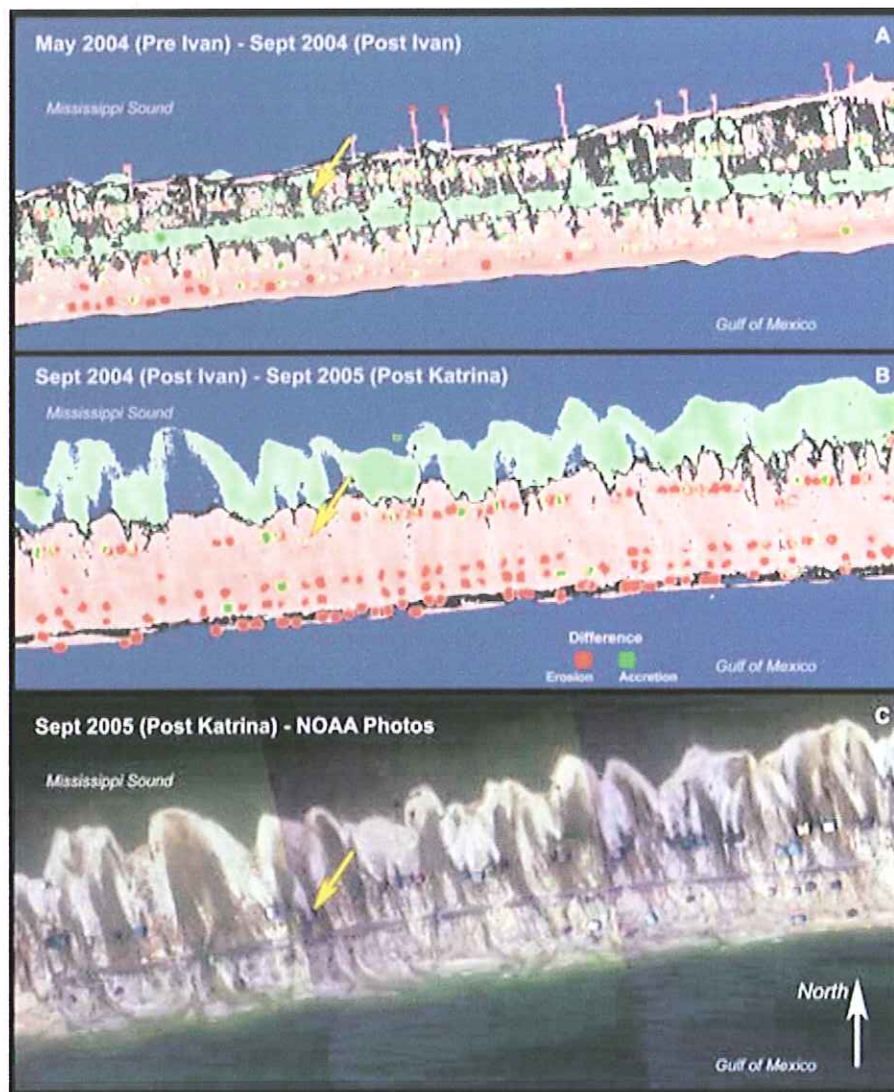


Figure 1. Views of coastal change on Dauphin Island, AL from Hurricanes Ivan and Katrina (USGS 2007).

Sea level has risen globally approximately 7.1 inches in the past century (Douglass 1997). Climate models predict a doubling of the rate of sea level rise over the next 100 years (Pendleton et al. 2004). Recent studies indicate a trend toward increasing hurricane number and intensity (Webster et al. 2005; Emanuel 2005). Barrier islands must be able to move and respond to these conditions. By locking in a barrier island's location with infrastructure, the island loses its ability to migrate to higher elevations which can lead to its eventual collapse (Moore 2007).

Overwash from lesser storms can positively affect island topography. Low natural berms can develop along beach fronts, but generally can be exceeded by overwash from frontal storms. The berm is an accretionary feature at the landward extreme of wave influence. Sediment is transported over the berm crest and is deposited in a nearshore overwash fan and in breach

corridors. Overwash deposition provides source sand for re-establishing dunes. Onshore winds transport the sediment from overwash fans to the dunes, gradually building back dune elevation during storm-free periods.

The interaction between the biology and geomorphology of barrier islands is complex. Just as the barrier island undergoes a process of continual change, so do the ecological communities present. Vegetation zones gradually re-establish following storms, and in turn affect physical processes such as sand accretion, erosion, and overwash. The beachfront, dunes, and overwash areas all provide important habitat components. Many barrier island species are adapted to respond positively to periodic disturbance. As the island widens, new feeding habitat (sand/mud flats) is created for shorebirds such as the piping plover. The beaches provide nesting habitat for sea turtles and roosting/feeding habitat for shorebirds. Early colonizer plants are favored as a food source by beach mice. These barrier island habitats are becoming increasingly rare as our Nation's coastlines rapidly develop.

SEA TURTLES

STATUS OF THE SPECIES/CRITICAL HABITAT

The Service has responsibility for implementing recovery of sea turtles when they come ashore to nest. This BO addresses nesting sea turtles, their nests and eggs, and hatchlings as they emerge from the nest and crawl to the sea. The National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) has jurisdiction over sea turtles in the marine environment.

Five species of sea turtles are analyzed in this BO: the loggerhead, green, leatherback, hawksbill, and the Kemp's ridley.

Loggerhead Sea Turtle

The loggerhead listed as a threatened species on July 28, 1978 (43 FR 32800), inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Loggerheads nest within the continental U.S. from Louisiana to Virginia. Major nesting concentrations in the U.S. are found on the coastal islands of North Carolina, South Carolina, and Georgia, and on the Atlantic and Gulf coasts of Florida (Hopkins and Richardson 1984).

The loggerhead grows to an average weight of about 200 pounds and is characterized by a large head with blunt jaws. Adults and subadults have a reddish-brown carapace. Scales on the top of the head and top of the flippers are also reddish-brown with yellow on the borders. Hatchlings are a dull brown color (NOAA-Fisheries 2002a). The loggerhead feeds on mollusks, crustaceans, fish, and other marine animals.

Major loggerhead nesting beaches are located in the Sultanate of Oman, southeastern U.S., and eastern Australia. The species is widely distributed within its range. It may be found hundreds

of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Coral reefs, rocky places, and ship wrecks are often used as feeding areas. Nesting occurs mainly on open beaches or along narrow bays having suitable sand, and often in association with other species of sea turtles.

No critical habitat has been designated for the loggerhead.

Green Sea Turtle

The green turtle was federally listed as a protected species on July 28, 1978 (43 FR 32800). Breeding populations of the green turtle in Florida and along the Pacific Coast of Mexico are listed as endangered; all other populations are listed as threatened. The green turtle has a worldwide distribution in tropical and subtropical waters. Major green turtle nesting colonies in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Surinam. Within the U.S., green turtles nest in small numbers in the U.S. Virgin Islands and Puerto Rico, and in larger numbers along the east coast of Florida, particularly in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties (NOAA-Fisheries and Service 1991a). Nesting also has been documented along the Gulf coast of Florida from Escambia County through Franklin County in Northwest Florida and from Pinellas County through Collier County in Southwest Florida (FWC statewide nesting database). Green turtles have been known to nest in Georgia, but only on rare occasions (Georgia Department of Natural Resources statewide nesting database). The green turtle also nests sporadically in North Carolina and South Carolina (North Carolina Wildlife Resources Commission statewide nesting database; South Carolina Department of Natural Resources statewide nesting database). Unconfirmed nesting of green turtles in Alabama has also been reported (Bon Secour National Wildlife Refuge nesting reports).

Green turtles are generally found in fairly shallow waters (except when migrating) inside reefs, bays, and inlets. The green turtle is attracted to lagoons and shoals with an abundance of marine grass and algae. Open beaches with a sloping platform and minimal disturbance are required for nesting.

The green turtle grows to a maximum size of about 4 feet and a weight of 440 pounds. It has a heart-shaped shell, small head, and single-clawed flippers. The carapace is smooth and colored gray, green, brown and black. Hatchlings are black on top and white on the bottom (NOAA-Fisheries 2002b). Hatchling green turtles eat a variety of plants and animals, but adults feed almost exclusively on seagrasses and marine algae.

Critical habitat for the green turtle has been designated for the waters surrounding Culebra Island, Puerto Rico, and its outlying keys.

Leatherback Sea Turtle

The leatherback listed as an endangered species on June 2, 1970 (35 FR 8491), is distributed worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans. Non-breeding animals have been recorded as far north as the British Isles and the Maritime Provinces

of Canada and as far south as Argentina and the Cape of Good Hope (Pritchard 1992). Nesting grounds are distributed worldwide, with the Pacific Coast of Mexico supporting the world's largest known concentration of nesting leatherbacks. The largest nesting colony in the wider Caribbean region is found in French Guiana, but nesting occurs frequently, although in lesser numbers, from Costa Rica to Columbia and in Guyana, Surinam, and Trinidad (NOAA-Fisheries and Service 1992; National Research Council 1990a).

The leatherback regularly nests in the U.S. in Puerto Rico, the U.S. Virgin Islands, and along the Atlantic coast of Florida as far north as Georgia (NOAA Fisheries and Service 1992). Leatherback turtles have been known to nest in Georgia, South Carolina, and North Carolina, but only on rare occasions (North Carolina Wildlife Resources Commission; South Carolina Department of Natural Resources; and Georgia Department of Natural Resources statewide nesting databases). Leatherback nesting has also been reported on the northwest coast of Florida (LeBuff 1990; FWC statewide nesting database); and in southwest Florida a false crawl (non-nesting emergence) has been observed on Sanibel Island (LeBuff 1990).

This is the largest, deepest diving, and most migratory and wide ranging of all sea turtle species. The adult leatherback can reach 4 to 8 feet in length and weigh 500 to 2,000 pounds. The carapace is distinguished by a rubber-like texture, about 1.6 inches thick, made primarily of tough, oil-saturated connective tissue. Hatchlings are dorsally mostly black and are covered with tiny scales; the flippers are edged in white, and rows of white scales appear as stripes along the length of the back (NOAA-Fisheries 2002c). Jellyfish are the main staple of its diet, but it is also known to feed on sea urchins, squid, crustaceans, tunicates, fish, blue-green algae, and floating seaweed.

The leatherback nests on shores of the Atlantic, Pacific and Indian Oceans. Non-breeding leatherbacks have been recorded as far north as British Columbia, Newfoundland, the British Isles, and the Maritime Provinces of Canada and as far south as Argentina and the Cape of Good Hope (Pritchard 1992).

Adult females require sandy nesting beaches backed with vegetation and sloped sufficiently so the distance to dry sand is limited. Their preferred beaches have proximity to deep water and generally rough seas.

Marine and terrestrial critical habitat for the leatherback has been designated at Sandy Point on the western end of the island of St. Croix, U.S. Virgin Islands (50 CFR 17.95).

Hawksbill Sea Turtle

The hawksbill was listed as an endangered species on June 2, 1970 (35 FR 8491). The hawksbill is found in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. The species is widely distributed in the Caribbean Sea and western Atlantic Ocean. Within the continental U.S., hawksbill nesting is rare and is restricted to the southeastern coast of Florida (Volusia through Dade Counties) and the Florida Keys (Monroe County) (Meylan 1992; Meylan et al. 1995). However, hawksbill tracks are difficult to differentiate from those of loggerheads and

may not be recognized by surveyors. Therefore, surveys in Florida likely underestimate actual hawksbill nesting numbers (Meylan et al. 1995). In the U.S. Caribbean, hawksbill nesting occurs on beaches throughout Puerto Rico and the U.S. Virgin Islands (NOAA-Fisheries and Service 1993).

Hawksbills typically weigh around 176 pounds or less in the wider Caribbean; hatchlings average about 1.6 inches straight length and range in weight from 0.5 to 0.7 ounces. The carapace is heart shaped in young turtles, and becomes more elongated or egg-shaped with maturity. The top scutes are often richly patterned with irregularly radiating streaks of brown or black on an amber background. The head is elongated and tapers sharply to a point. The lower jaw is V-shaped (NOAA-Fisheries 2002d).

Critical habitat for the hawksbill has been designated for selected beaches and/or waters of Mona, Monito, Culebrita, and Culebra Islands, Puerto Rico.

Kemp's Ridley Sea Turtle

The Kemp's ridley was listed as endangered on December 2, 1970 (35 FR 18320). The range of the Kemp's ridley includes the Gulf coasts of Mexico and the U.S., and the Atlantic coast of North America as far north as Nova Scotia and Newfoundland. Most Kemp's ridleys nest on the coastal beaches of the Mexican states of Tamaulipas and Veracruz, although a small number of Kemp's ridleys nest along the Texas coast (Turtle Expert Working Group 1998; Frey et al. 2007). In addition, rare nesting events have been reported in Florida, Alabama, Georgia, South Carolina, and North Carolina. Hatchlings, after leaving the nesting beach, are believed to become entrained in eddies within the GOM, where they are dispersed within the Gulf and Atlantic by oceanic surface currents until they reach about 7.9 inches in length, at which size they enter coastal shallow water habitats (Ogren 1989). Outside of nesting, adult Kemp's ridleys are believed to spend most of their time in the GOM, while juveniles and subadults also regularly occur along the eastern seaboard of the United States (Service and NOAA-Fisheries 1992).

No critical habitat has been designated for the Kemp's ridley.

Life history

Loggerhead Sea Turtle

The basic life cycle of the loggerhead in the western North Atlantic consists of seven life stages (**Figure 1**) that are based on the size of the sea turtles at different ages (Bolten 2003; Crouse et. al. 1987).

Loggerheads are known to nest from one to seven times within a nesting season (Talbert et al. 1980; Lenarz et al. 1981; Richardson and Richardson 1982; among others); the mean is approximately 4.1 nests (Murphy and Hopkins 1984). The interval between nesting events within a season varies around a mean of about 14 days (Dodd 1988). Mean clutch size varies from about 100 to 126 eggs along the southeastern United States coast (NOAA-Fisheries and

Service 1991b). Nesting migration intervals of 2 to 3 years are most common in loggerheads, but the number can vary from 1 to 7 years (Dodd 1988). Age at sexual maturity is believed to be about 20 to 30 years (Turtle Expert Working Group 1998).

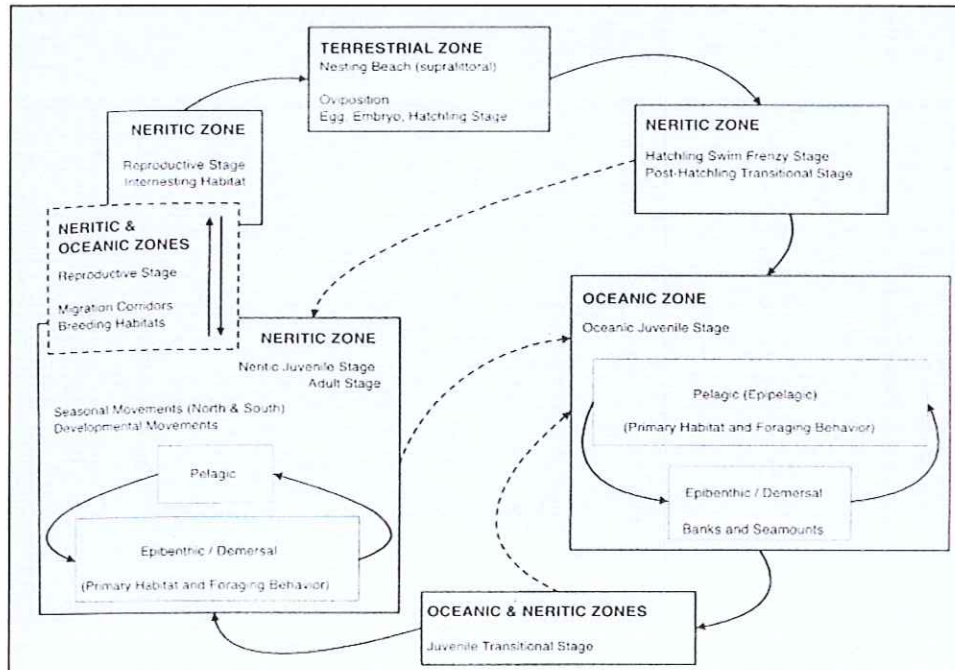


Figure 2. Life history stages of a loggerhead turtle. The boxes represent life stages and the corresponding ecosystems, solid lines represent movements between life stages and ecosystems, and dotted lines are speculative (Bolten 2003).

Green Sea Turtle

Green turtles deposit from one to nine clutches within a nesting season, but the overall average is about 3.3 nests. The interval between nesting events within a season varies around a mean of about 13 days (Hirth 1997). Mean clutch size varies widely among populations. Average clutch size reported for Florida was 136 eggs in 130 clutches (Witherington and Ehrhart 1989). Only occasionally do females produce clutches in successive years. Usually two, three, four or more years intervene between breeding seasons (NOAA-Fisheries and Service 1991a). Age at sexual maturity is believed to be 20 to 50 years (Hirth 1997).

Leatherback Sea Turtle

Leatherbacks nest an average of five to seven times within a nesting season, with an observed maximum of 11 nests (NOAA-Fisheries and Service 1992). The interval between nesting events within a season is about 9 to 10 days. Clutch size averages 80 to 85 yolked eggs, with the addition of usually a few dozen smaller, yolkless eggs, mostly laid toward the end of the clutch (Pritchard 1992). Nesting migration intervals of 2 to 3 years were observed in leatherbacks nesting on the Sandy Point National Wildlife Refuge, St. Croix, U.S. Virgin Islands (McDonald

and Dutton 1996). Leatherbacks are believed to reach sexual maturity in 6 to 10 years (Zug and Parham 1996).

Hawksbill Sea Turtle

Hawksbills nest on average about 4.5 times per season at intervals of approximately 14 days (Corliss et al. 1989). In Florida and the U.S. Caribbean, clutch size is approximately 140 eggs, although several records exist of over 200 eggs per nest (NOAA-Fisheries and Service 1993). On the basis of limited information, nesting migration intervals of 2 to 3 years appear to predominate. Hawksbills are recruited into the reef environment at about 14 inches in length and are believed to begin breeding about 30 years later. However, the time required to reach 14 inches in length is unknown and growth rates vary geographically. As a result, actual age at sexual maturity is unknown.

Kemp's Ridley Sea Turtle

Nesting occurs from April into July during which time the turtles appear off the Tamaulipas and Veracruz coasts of Mexico. Precipitated by strong winds, the females swarm to mass nesting emergences, known as *arribadas* or *arribazones*, to nest during daylight hours. Clutch size averages 100 eggs (Service and NOAA-Fisheries 1992). Some females breed annually and nest an average of 1 to 4 times in a season at intervals of 10 to 28 days. Age at sexual maturity is believed to be between 7 to 15 years (Turtle Expert Working Group 1998).

Population dynamics

Loggerhead Sea Turtle

Approximately 53,000 to 92,000 loggerhead nests are laid per year in the southeastern United States and the GOM, with an estimated total number of nesting females between 32,000 to 56,000 (FWC/FWRI statewide nesting database 2004, Georgia Department of Natural Resources statewide nesting database 2004, South Carolina Department of Natural Resources statewide nesting database 2004, North Carolina Wildlife Resources Commission statewide nesting database 2004). In 1998, 85,988 nests were documented in Florida alone.

From a global perspective, the southeastern U.S. nesting aggregation is of paramount importance to the survival of the species and is second in size only to that which nests on islands in the Arabian Sea off Oman (Ross 1982; Ehrhart 1989; NOAA-Fisheries and Service 1991b). The status of the Oman loggerhead nesting population, reported to be the largest in the world (Ross 1979), is uncertain because of the lack of long-term standardized nesting or foraging ground surveys and its vulnerability to increasing development pressures near major nesting beaches and threats from fisheries interactions on foraging grounds and migration routes (Earl Possardt, Service 2005 pers. communication). The loggerhead nesting aggregations in Oman, the southeastern U.S., and Australia have been estimated to account for about 88 percent of nesting worldwide (NOAA-Fisheries and Service 1991b). About 80 percent of loggerhead nesting in the

southeastern U.S. occurs in six Florida counties (Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward counties) (NOAA-Fisheries and Service 1991b).

Green Sea Turtle

About 150 to 3,000 females are estimated to nest on beaches in the continental U.S. annually (FWC 2007). In the U.S. Pacific, over 90 percent of nesting throughout the Hawaiian archipelago occurs at the French Frigate Shoals, where about 200 to 700 females nest each year (NOAA Fisheries and Service 1998a). Elsewhere in the U.S. Pacific, nesting takes place at scattered locations in the Commonwealth of the Northern Marianas, Guam, and American Samoa. In the western Pacific, the largest green turtle nesting aggregation in the world occurs on Raine Island, Australia, where thousands of females nest nightly in an average nesting season (Limpus et al. 1993). In the Indian Ocean, major nesting beaches occur in Oman where 30,000 females are reported to nest annually (Ross and Barwani 1995).

Leatherback Sea Turtle

Recent estimates of global nesting populations indicate 26,000 to 43,000 nesting females annually (Spotila et al. 1996). The largest nesting populations at present occur in the western Atlantic in French Guiana (4,500 to 7,500 females nesting/year) and Colombia (estimated several thousand nests annually), and in the western Pacific in West Papua (formerly Irian Jaya) and Indonesia (about 600 to 650 females nesting/year). In the United States, small nesting populations occur on the Florida east coast (100 females/year) (FWC 2007), Sandy Point, U.S. Virgin Islands (50 to 190 females/year) (Alexander et al. 2002), and Puerto Rico (30 to 90 females/year).

Hawksbill Sea Turtle

About 15,000 females are estimated to nest each year throughout the world with the Caribbean accounting for 20 to 30 percent of the world's hawksbill population. Only five regional populations remain with more than 1,000 females nesting annually (Seychelles, Mexico, Indonesia, and two in Australia) (Meylan and Donnelly 1999). Mexico is now the most important region for hawksbills in the Caribbean with about 3,000 nests/year (Meylan 1999). Other significant but smaller populations in the Caribbean still occur in Martinique, Jamaica, Guatemala, Nicaragua, Grenada, Dominican Republic, Turks and Caicos Islands, Cuba, Puerto Rico, and U.S. Virgin Islands. In the U.S. Caribbean, about 150 to 500 nests per year are laid on Mona Island, Puerto Rico and 70 to 130 nests/year are laid on Buck Island Reef National Monument, U.S. Virgin Islands. In the U.S. Pacific, hawksbills nest only on main island beaches in Hawaii, primarily along the east coast of the island of Hawaii. Hawksbill nesting has also been documented in American Samoa and Guam (NOAA-Fisheries and Service 1998b).

Kemp's Ridley Sea Turtle

The 40,000 nesting females estimated from a single mass nesting emergence in 1947 reflected a much larger total number of nesting turtles in that year than exists today (Carr 1963; Hildebrand

1963). However, nesting in Mexico has been steadily increasing in recent years -- from 702 nests in 1985 to over 10,000 nests in 2005 (Service 2005a). Despite protection for the nests, turtles have been and continue to be lost to incidental catch by shrimp trawls (Service and NOAA-Fisheries 1992).

Status and Distribution

Loggerhead Sea Turtle

Genetic research involving analysis of mitochondrial DNA has identified five different loggerhead subpopulations/nesting aggregations in the western North Atlantic: (1) the Northern Subpopulation occurring from North Carolina to around Cape Canaveral, Florida (about 29° N.); (2) South Florida Subpopulation occurring from about 29° N. on Florida's east coast to Sarasota on Florida's west coast; (3) Dry Tortugas, Florida, Subpopulation, (4) Northwest Florida Subpopulation occurring at Eglin Air Force Base and the beaches near Panama City; and (5) Yucatán Subpopulation occurring on the eastern Yucatán Peninsula, Mexico (Bowen 1994; 1995; Bowen et al. 1993; Encalada et al. 1998; Pearce 2001). These data indicate that gene flow between these five regions is very low. If nesting females are extirpated from one of these regions, regional dispersal will not be sufficient to replenish the depleted nesting subpopulation.

The Northern Subpopulation has declined substantially since the early 1970s. Recent estimates of loggerhead nesting trends from standardized daily beach surveys showed significant declines ranging from 1.5 percent to 2.0 percent annually (Mark Dodd, Georgia Department of Natural Resources 2005 pers. communication). Nest totals from aerial surveys conducted by the South Carolina Department of Natural Resources showed a 3.3 percent annual decline in nesting since 1980. Overall, there is strong statistical evidence to suggest the Northern Subpopulation has sustained a long-term decline.

Data from all beaches where nesting activity has been recorded indicate that the South Florida Subpopulation has shown significant increases over the last 25 years. However, an analysis of nesting data from the Florida INBS Program from 1989 to 2002 (a period encompassing index surveys that are more consistent and more accurate than surveys in previous years), has shown no detectable trend and, more recently (1998 through 2002), has shown evidence of a declining trend (Blair Witherington, FWC 2004 pers. communication). Given inherent annual fluctuations in nesting and the short time period over which the decline has been noted, caution is warranted in interpreting the decrease in terms of nesting trends.

A near census of the Florida Panhandle Subpopulation undertaken from 1989 to 2002 reveals a mean of 1,028 nests per year, which equates to about 251 females nesting per year (FWC 2007). However, preliminary analysis for nine years (1997 to 2006) of INBS data for the Florida Panhandle subpopulation shows a declining trend (Blair Witherington, FWC 2007 pers. communication).

A near census of the Dry Tortugas Subpopulation undertaken from 1995 to 2001, reveals a mean of 213 nests per year, which equates to about 50 females nesting per year (FWC 2007). The

trend data for the Dry Tortugas Subpopulation are from beaches that were not included in Florida's INBS program prior to 2004, but have moderately good monitoring consistency. There are 7 continuous years (1995 to 2001) of data for this Subpopulation, but the time series is too short to detect a trend (Blair Witherington, FWC 2005 pers. communication).

Nesting surveys in the Yucatán Subpopulation has been too irregular to date to allow for a meaningful trend analysis (Turtle Expert Working Group 1998, 2000).

Recovery criteria

The southeastern U.S. loggerhead population can be considered for delisting where, over a period of 25 years, the following conditions are met:

1. The adult female population in Florida is increasing and in North Carolina, South Carolina, and Georgia, it has returned to pre-listing levels (NC - 800, SC - 10,000, and GA - 2,000 nests per season). The above conditions shall be met with the data from standardized surveys which would continue for at least five years after delisting.
2. At least 25 percent (348 miles) of all available nesting beaches (1,400 miles) are in public ownership, distributed over the entire nesting range and encompassing at least 50 percent of the nesting activity in each state.
3. All priority one tasks identified in the recovery plan have been successfully implemented.

Green Sea Turtle

Total population estimates for the green turtle are unavailable, and trends based on nesting data are difficult to assess because of large annual fluctuations in numbers of nesting females. For instance, in Florida, where the majority of green turtle nesting in the southeastern U.S. occurs, estimates range from 150 to 2,750 females nesting annually (FWC 2007). Populations in Surinam and Tortuguero, Costa Rica, may be stable, but there is insufficient data for other areas to confirm a trend.

Recovery criteria

The U.S. population of green turtles can be considered for delisting when, over a period of 25 years, the following conditions are met:

1. The level of nesting in Florida has increased to an average of 5,000 nests per year for at least six years. Nesting data shall be based on standardized surveys.
2. At least 25 percent (65 miles) of all available nesting beaches (260 miles) are in public ownership and encompass at least 50 percent of the nesting activity.

3. A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.
4. All priority one tasks identified in the recovery plan have been successfully implemented.

Leatherback Sea Turtle

Declines in leatherback nesting have occurred over the last two decades along the Pacific coasts of Mexico and Costa Rica. The Mexican leatherback nesting population, once considered to be the world's largest leatherback nesting population (historically estimated to be 65 percent of worldwide population), is now less than one percent of its estimated size in 1980. Spotila et al. (1996) estimated the number of leatherback sea turtles nesting on 28 beaches throughout the world from the literature and from communications with investigators studying those beaches. The estimated worldwide population of leatherbacks in 1995 was about 34,500 females on these beaches with a lower limit of about 26,200 and an upper limit of about 42,900. This is less than one third the 1980 estimate of 115,000. Leatherbacks are rare in the Indian Ocean and in very low numbers in the western Pacific Ocean. The largest population is in the western Atlantic. Using an age-based demographic model, Spotila et al. (1996) determined that leatherback populations in the Indian Ocean and western Pacific Ocean cannot withstand even moderate levels of adult mortality and that even the Atlantic populations are being exploited at a rate that cannot be sustained. They concluded that leatherbacks are on the road to extinction and further population declines can be expected unless action is taken to reduce adult mortality and increase survival of eggs and hatchlings.

Recovery criteria

The U.S. population of leatherbacks can be considered for delisting when the following conditions are met:

1. The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico, St. Croix, U.S. Virgin Island, and along the east coast of Florida.
2. Nesting habitat encompassing at least 75 percent of nesting activity in U.S. Virgin Islands, Puerto Rico, and Florida is in public ownership.
3. All priority one tasks identified in the recovery plan have been successfully implemented.

Hawksbill Sea Turtle

The hawksbill has experienced global population declines of 80 percent or more during the past century and continued declines are projected (Meylan and Donnelly 1999). Most populations are

declining, depleted, or remnants of larger aggregations. Hawksbills were previously abundant, as evidenced by high-density nesting at a few remaining sites and by trade statistics.

Recovery criteria

The U.S. population of hawksbills can be considered for delisting when the following conditions are met:

1. The adult female population is increasing, as evidenced by a statistically significant trend in the annual numbers of nests on at least five index beaches, including Mona Island and Buck Island Reef National Monument (BIRNM).
2. Habitat for at least 50 percent of the nesting activity that occurs in the U.S. Virgin Islands (USVI) and Puerto Rico is protected in perpetuity.
3. Numbers of adults, subadults, and juveniles are increasing, as evidenced by a statistically significant trend on at least five key foraging areas within Puerto Rico, USVI, and Florida.
4. All priority one tasks have been successfully implemented.

Kemp's Ridley Sea Turtle

Today, under strict protection, the population appears to be in the early stages of recovery. The recent nesting increase can be attributed to full protection of nesting females and their nests in Mexico resulting from a bi-national effort between Mexico and the U.S. to prevent the extinction of the Kemp's ridley, and the requirement to use Turtle Excluder Devices (TEDs) in shrimp trawls both in the United States and Mexico.

The Mexico government also prohibits harvesting and is working to increase the population through more intensive law enforcement, by fencing nest areas to diminish natural predation, and by relocating most nests into corrals to prevent poaching and predation. While relocation of nests into corrals is currently a necessary management measure, this relocation and concentration of eggs into a "safe" area is of concern since it makes the eggs more susceptible to reduced viability.

Recovery criteria

The goal of the Recovery Plan is for the species to be reduced from endangered to threatened status. The Recovery Team members feel that the criteria for a complete removal of this species from the endangered species list need not be considered now, but rather left for future revisions of the plan. Complete removal from the Federal list would certainly necessitate that some other instrument of protection, similar to the Marine Mammal Protection Act, be in place and be international in scope. Kemp's ridley can be considered for downlisting to threatened when the following four criteria are met:

1. Protection of the known nesting habitat and the water adjacent to the nesting beach (concentrating on the Ranch Nuevo area) and continuation of the bi-national project.
2. Elimination of the mortality from incidental catch from commercial shrimping in the U.S. and Mexico through the use of TEDs and full compliance with the regulations requiring TED use.
3. Attainment of a population of at least 10,000 females nesting in a season.
4. All priority one recovery tasks in the recovery plan are successfully implemented.

Common threats to sea turtles

Loggerhead Sea Turtle

Anthropogenic (human) factors that impact hatchlings and adult female turtles on land, or the success of nesting and hatching include: beach erosion, armoring and nourishment; artificial lighting; beach cleaning; increased human presence; recreational beach equipment; beach driving; coastal construction and fishing piers; exotic dune and beach vegetation; and poaching. An increased human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs, and an increased presence of native species (*e.g.*, raccoons, armadillos, and opossums), which raid and feed on turtle eggs. Although sea turtle nesting beaches are protected along large expanses of the western North Atlantic coast, other areas along these coasts have limited or no protection.

Loggerhead turtles are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration and transportation; marine pollution; underwater explosions; hopper dredging, offshore artificial lighting; power plant entrainment and/or impingement; entanglement in debris; ingestion of marine debris; marina and dock construction and operation; boat collisions; poaching and fishery interactions. In the oceanic environment, loggerheads are exposed to a series of longline fisheries that include the U.S. Atlantic tuna and swordfish longline fisheries, an Azorean longline fleet, a Spanish longline fleet, and various fleets in the Mediterranean Sea (Aguilar et al. 1995; Bolten et al 1994; Crouse 1999). There is particular concern about the extensive incidental take of juvenile loggerheads in the eastern Atlantic by longline fishing vessels. In the neritic environment in waters off the coastal U.S., loggerheads are exposed to a suite of fisheries in federal and state waters including trawl, purse seine, hook and line, gillnet, pound net, longline, dredge, and trap fisheries.

Green Sea Turtle

A major factor contributing to the green turtle's decline worldwide is commercial harvest for eggs and food. Fibropapillomatosis, a disease of sea turtles characterized by the development of multiple tumors on the skin and internal organs, is also a mortality factor and has seriously

impacted green turtle populations in Florida, Hawaii, and other parts of the world. The tumors interfere with swimming, eating, breathing, vision, and reproduction, and turtles with heavy tumor burdens may die. Other threats include loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and incidental take from channel dredging and commercial fishing operations.

Leatherback Sea Turtles

The crash of the Pacific leatherback population is believed primarily to be the result of exploitation by humans for the eggs and meat, as well as incidental take in numerous commercial fisheries of the Pacific. Other factors threatening leatherbacks globally include loss or degradation of nesting habitat from coastal development; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; and watercraft strikes.

Hawksbill Sea Turtle

The decline of this species is primarily due to human exploitation for tortoiseshell. While the legal hawksbill shell trade ended when Japan agreed to stop importing shell in 1993, a significant illegal trade continues. It is believed that individual hawksbill populations around the world will continue to disappear under the current regime of exploitation for eggs, meat, and tortoiseshell, loss of nesting and foraging habitat, incidental capture in fishing gear, ingestion of and entanglement in marine debris, oil pollution, and boat collisions. Hawksbills are closely associated with coral reefs, one of the most endangered of all marine ecosystem types.

Kemp's Ridley Sea Turtle

The decline of this species was primarily due to human activities, including the direct harvest of adults and eggs and incidental capture in commercial fishing operations. Nest relocation has assisted in increasing the population of this species; however, egg relocation has its own host of problems due to movement-induced mortality, disease vectors, catastrophic events like hurricanes, and marine predators once the predators learn where to concentrate their efforts.

All Sea Turtles

Coastal Development

Loss of nesting habitat related to coastal development has had the greatest impact on nesting sea turtles in Florida. Beachfront development not only causes the loss of suitable nesting habitat, but can result in the disruption of powerful coastal processes accelerating erosion and interrupting the natural shoreline migration (National Research Council 1990b). This may in turn cause the need to protect upland structures and infrastructure by armoring, groin placement,

beach emergency berm construction and repair, and beach nourishment which cause changes in, additional loss or impact to the remaining sea turtle habitat.

Hurricanes

Hurricanes were probably responsible for maintaining coastal beach habitat upon which sea turtles depend through repeated cycles of destruction, alteration, and recovery of beach and dune habitat. Hurricanes generally produce damaging winds, storm tides and surges, and rain and can result in severe erosion of the beach and dune systems. Overwash and blowouts are common on barrier islands. Hurricanes and other storms can result in the direct or indirect loss of sea turtle nests, either by erosion or washing away of the nests by wave action or inundation or “drowning” of the eggs or hatchlings developing within the nest or indirectly by loss of nesting habitat. Depending on their frequency, storms can affect sea turtles on either a short-term basis (nests lost for one season and/or temporary loss of nesting habitat) or long term, if frequent (habitat unable to recover). How hurricanes affect sea turtle nesting also depends on its characteristics (winds, storm surge, rainfall), the time of year (within or outside of the nesting season), and where the northeast edge of the hurricane crosses land.

Because of the limited remaining nesting habitat, frequent or successive severe weather events could threaten the ability of certain sea turtle populations to survive and recover. Sea turtles evolved under natural coastal environmental events such as hurricanes. The extensive amount of pre-development coastal beach and dune habitat allowed sea turtles to survive even the most severe hurricane events. It is only within the last 20 to 30 years that the combination of habitat loss to beachfront development and destruction of remaining habitat by hurricanes has increased the threat to sea turtle survival and recovery. On developed beaches, typically little space remains for sandy beaches to become re-established after periodic storms. While the beach itself moves landward during such storms, reconstruction or persistence of structures at their pre-storm locations can result in a major loss of nesting habitat.

The 2004 hurricane season was the most active storm season in Florida since weather records began in 1851. Hurricanes Charley, Frances, Ivan, and Jeanne, along with Tropical Storm Bonnie, damaged the beach and dune system, upland structures and properties, and infrastructure in the majority of Florida’s coastal counties. The cumulative impact of these storms exacerbated erosion conditions throughout the state.

The 2005 hurricane season was a record breaking season with 27 named storms. Florida was impacted by Hurricanes Dennis, Katrina, Ophelia, Rita, and Wilma, and Tropical Storms Arlene and Tammy. The cumulative impact of these storms exacerbated erosion conditions in south and northwest Florida.

Erosion

The designation of a Critically Eroded Beach is a planning requirement of the State's Beach Erosion Control Funding Assistance Program. A segment of beach shall first be designated as critically eroded in order to be eligible for State funding. A critically eroded area is a segment of

the shoreline where natural processes or human activity have caused or contributed to erosion and recession of the beach or dune system to such a degree that upland development, recreational interests, wildlife habitat, or important cultural resources are threatened or lost. Critically eroded areas may also include peripheral segments or gaps between identified critically eroded areas which, although they may be stable or slightly erosional now, their inclusion is necessary for continuity of management of the coastal system or for the design integrity of adjacent beach management projects (FDEP 2007). It is important to note, that for an erosion problem area to be critical, there shall exist a threat to or loss of one of four specific interests – upland development, recreation, wildlife habitat, or important cultural resources. The total of critically eroded beaches statewide in Florida for 2007 is 388 miles of 497 miles of shoreline. Seventy-eight (78) percent of the State’s shoreline is considered to be critically eroded.

Beachfront Lighting

Artificial beachfront lighting may cause disorientation (loss of bearings) and misorientation (incorrect orientation) of sea turtle hatchlings. Visual signs are the primary sea-finding mechanism for hatchlings (Mrosovsky and Carr 1967; Mrosovsky and Shettleworth 1968; Dickerson and Nelson 1989; Witherington and Bjørndal 1991). Artificial beachfront lighting is a documented cause of hatchling disorientation and misorientation on nesting beaches (Philibosian 1976; Mann 1977; FWC 2008). The emergence from the nest and crawl to the sea is one of the most critical periods of a sea turtle’s life. Hatchlings that do not make it to the sea quickly become food for ghost crabs, birds, and other predators or become dehydrated and may never reach the sea. Some types of beachfront lighting attract hatchlings away from the sea while some lights cause adult turtles to avoid stretches of brightly illuminated beach. Research has documented significant reduction in sea turtle nesting activity on beaches illuminated with artificial lights (Witherington 1992). During the 2006 sea turtle nesting season in Florida, over 71,000 turtle hatchlings were disoriented (**Table 3**). Exterior and interior lighting associated with condominiums had the greatest impact causing disorientation/misorientation of 86 percent. Other causes included urban sky glow and street lights (http://www.myfwc.com/seaturtle/Lighting/Light_Disorient.htm).

Table 3. Documented Disorientations along the Florida coast (FWC 2008).

Year	Total Number of Hatchling Disorientation Events	Total Number of Hatchlings Involved in Disorientation Events	Total Number of Adult Disorientation Events
2001	743	28,674	19
2002	896	43,226	37
2003	1,446	79,357	18
2004	888	46,487	24
2005	976	41,521	50
2006	1,521	71,798	40

Predation

Depredation of sea turtle eggs and hatchlings by natural and introduced species occurs on almost all nesting beaches. Depredation by a variety of predators can considerably decrease sea turtle nest hatching success. The most common predators in the southeastern United States are ghost crabs (*Ocypode quadrata*), raccoons (*Procyon lotor*), feral hogs (*Sus scrofa*), foxes (*Urocyon cinereoargenteus* and *Vulpes vulpes*), coyotes (*Canis latrans*), armadillos (*Dasypus novemcinctus*), cats (*Felis catus*), and fire ants (*Solenopsis* spp.) (Dodd 1988; Stancyk 1995). Raccoons are particularly destructive on the Atlantic coast and may take up to 96 percent of all nests deposited on a beach (Davis and Whiting 1977; Hopkins and Murphy 1980; Stancyk et al. 1980; Talbert et al. 1980; Schroeder 1981; Labisky et al. 1986). As nesting habitat dwindles, it is essential that nest production be naturally maximized so the turtles may continue to exist in the wild.

In response to increasing depredation of sea turtle nests by coyote, fox, hog, and raccoon, multi-agency cooperative effort have been initiated and are ongoing throughout Florida, in particular on public lands.

Driving on the Beach

The operation of motor vehicles on the beach affects sea turtle nesting by: interrupting a female turtle approaching the beach; headlights disorienting or misorienting emergent hatchlings; vehicles running over hatchlings attempting to reach the ocean; and vehicle tracks traversing the beach which interfere with hatchlings crawling to the ocean. Apparently, hatchlings become diverted not because they cannot physically climb out of the rut (Hughes and Caine 1994), but because the sides of the track cast a shadow and the hatchlings lose their line of sight to the ocean horizon (Mann 1977). The extended period of travel required to negotiate tire tracks and ruts may increase the susceptibility of hatchlings to dehydration and depredation during migration to the ocean (Hosier et al. 1981). Driving directly above or over incubating egg clutches or on the beach can cause sand compaction which may result in adverse impacts on nest site selection, digging behavior, clutch viability, and emergence by hatchlings, decreasing nest success and directly killing pre-emergent hatchlings (Mann 1977; Nelson and Dickerson 1987; Nelson 1988).

The physical changes and loss of plant cover caused by vehicles on dunes can lead to various degrees of instability, and therefore encourage dune migration. As vehicles move either up or down a slope, sand is displaced downward, lowering the trail. Since the vehicles also inhibit plant growth, and open the area to wind erosion, dunes may become unstable, and begin to migrate. Unvegetated sand dunes may continue to migrate across stable areas as long as vehicle traffic continues. Vehicular traffic through dune breaches, or low dunes on an eroding beach may cause accelerated rate of overwash and beach erosion (Godfrey et al. 1978). If driving is required, the area where the least amount of impact occurs is the beach between the low and high tide water lines. Vegetation on the dunes can quickly re-establish provided the mechanical impact is removed.

In 1985, the Florida Legislature severely restricted vehicular driving on Florida's beaches, except that which is necessary for cleanup, repair, or public safety. This legislation also allowed an exception for five counties to continue to allow vehicular access on coastal beaches due to the availability of less than 50 percent of its peak user demand for off-beach parking. The counties affected by this exception are Volusia, St. Johns, Gulf, Nassau, and Flagler counties, as well as limited vehicular access on Walton County beaches for boat launching.

Sea Turtle Strandings

NOAA-Fisheries leads the Sea Turtle Stranding and Salvage network (STSSN). In Florida, strandings are documented by the FWRI staff biologists and by a network of permitted participants located around the state. Since the start of the program in 1980, loggerhead strandings (dead or debilitated turtles) documented by the Florida STSSN have increased significantly from 1989 to 2005 with the two highest yearly totals occurring in 2003 and 2005.

Analysis of the species/critical habitat likely to be affected

The threatened loggerhead, the endangered green, the endangered leatherback, the endangered hawksbill, and the endangered Kemp's ridley are currently listed because of their low and declining population sizes caused by over harvest and habitat loss with continuing anthropogenic threats from commercial fishing, disease, and degradation of remaining habitat. The proposed action has the potential to adversely affect nesting females of these species, their nests, and hatchlings within the proposed material excavation area. Other projects, which include beach nourishment, military missions, coastal development that have affected the conservation of sea turtles in northwest Florida are included in the Service's evaluation of the species current status (**Appendix A**).

ENVIRONMENTAL BASELINE

Status of the species/critical habitat within the action area

In accordance with the Act, the Service completes consultations with federal agencies (including ourselves) for actions that may adversely affect sea turtles. In Florida consultations have included military missions and operations, beach nourishment and other shoreline protection, and actions related to protection of coastal development (**Appendix A**).

Loggerhead Sea Turtle

An updated analysis by FWRI reveals a continuing decline in loggerhead nest numbers around the State of Florida. Loggerhead nest counts decreased approximately 50 percent from 1998 to 2007 (http://research.myfwc.com/features/view_article.asp?id=27537). Nest numbers dropped in 2001 and 2002 to below 70,000, in 2003 below 60,000, in 2004 below 50,000, and in 2005 just above 50,000 and in 2006 below 50,000 nests.

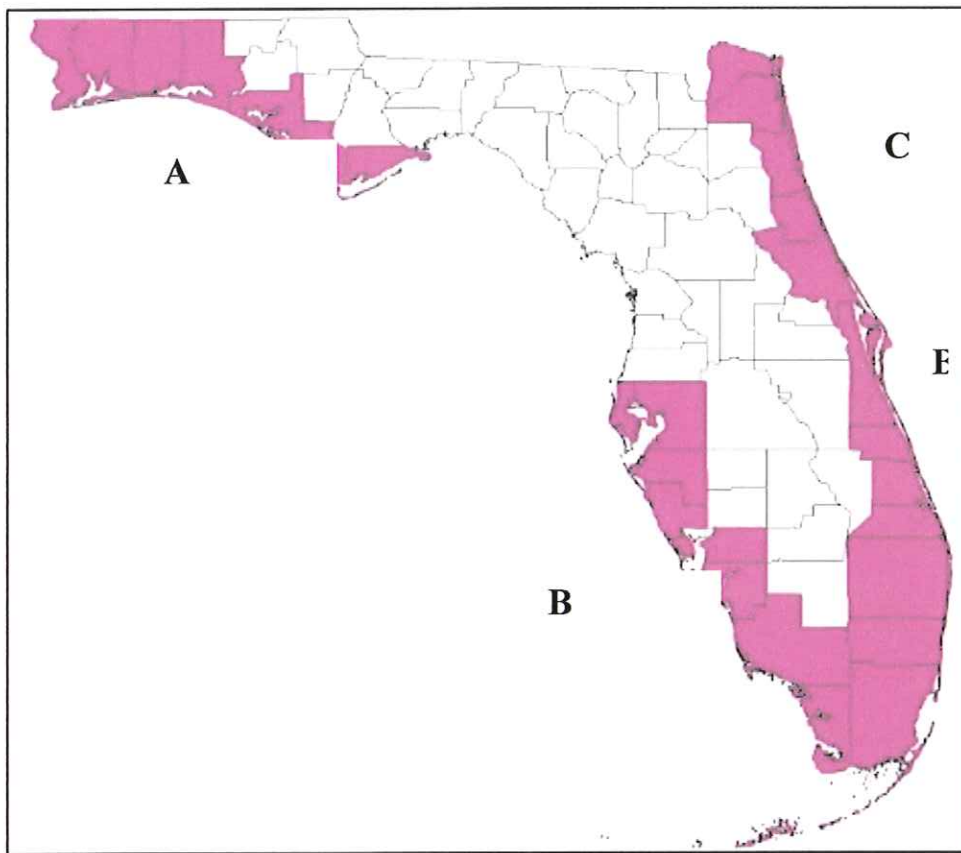


Figure 3. Distribution of loggerhead nesting in Florida.

There are five loggerhead nesting subpopulations. Three of the five nesting subpopulations are in the nesting range of the proposed Action Area.

Subpopulations	Nesting Range
A	Escambia to Franklin counties
B	Pinellas to South Brevard counties
C	North Brevard to Nassau counties

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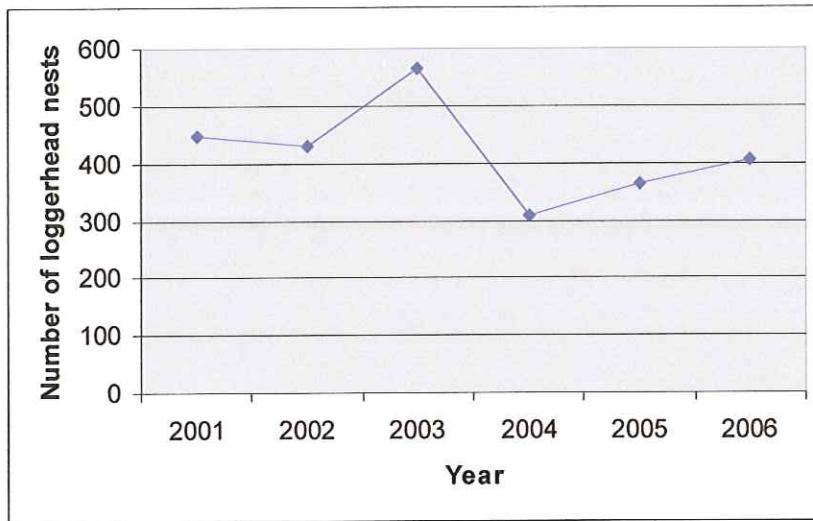


Figure 4. Number of nests in loggerhead subpopulation A from 2001 to 2006 in Florida according to SNBS.

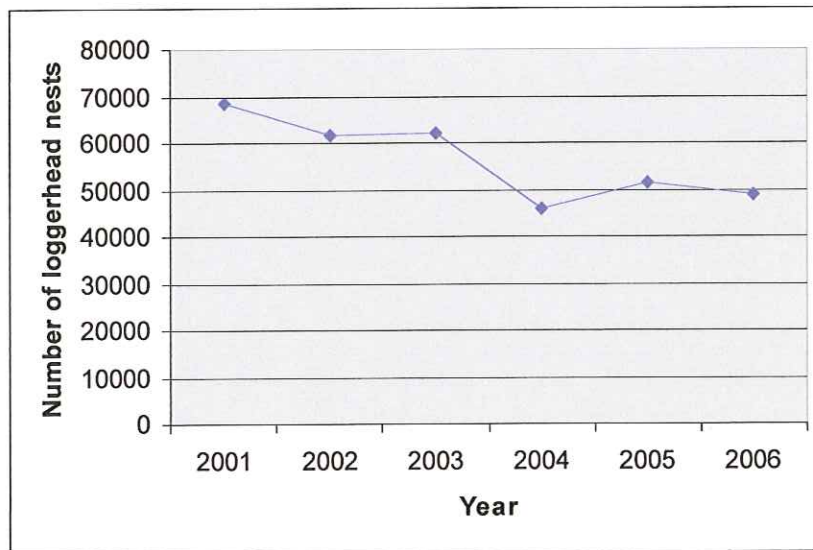


Figure 5. Number of nests in loggerhead subpopulation B from 2001 to 2006 in Florida according to SNBS.

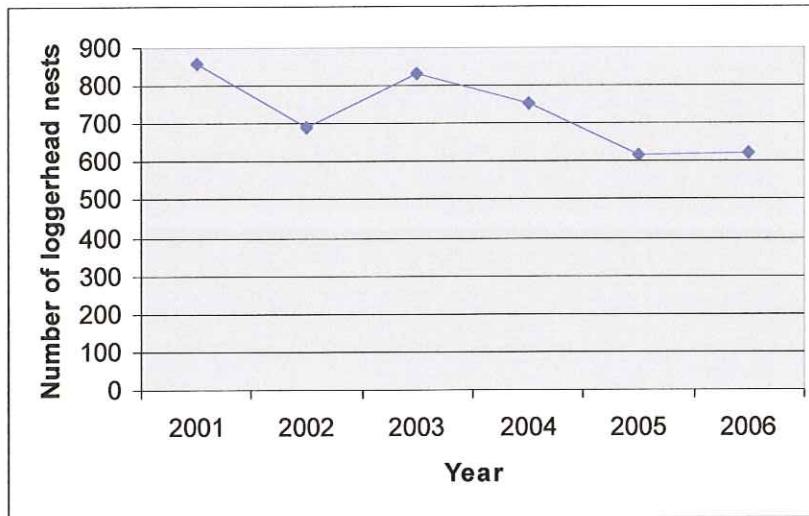


Figure 6. Number of nests in loggerhead subpopulation C from 2001 to 2006 in Florida according to SNBS.

Green Sea Turtle

Green nest numbers are increasing in Florida with a record number of nests being recorded during the 2007 season (FWC/FWRI 2007, http://research.myfwc.com/features/view_article.asp?id=27537).

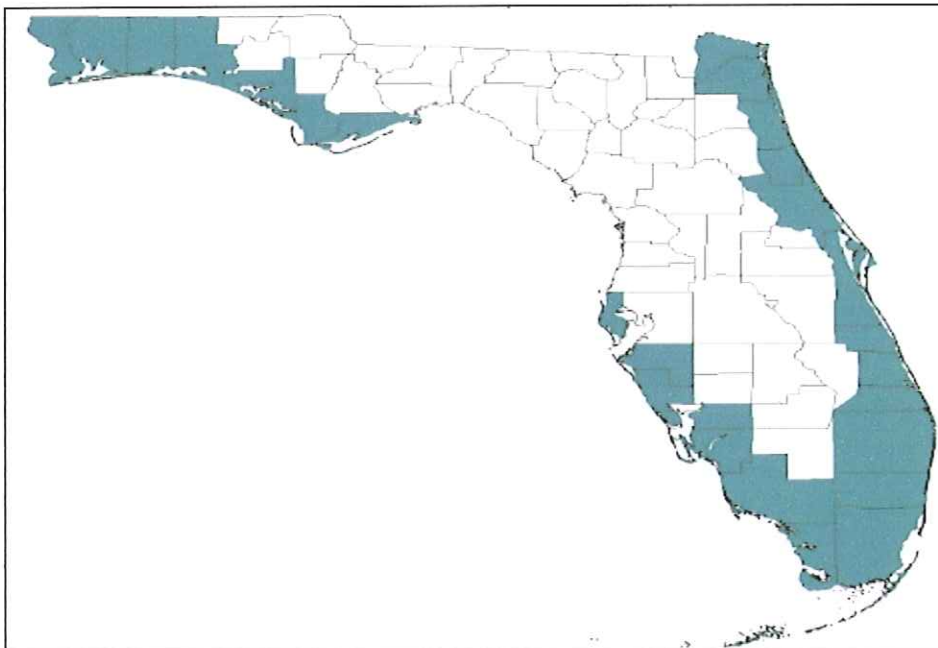


Figure 7. Distribution of green turtle nesting in Florida.

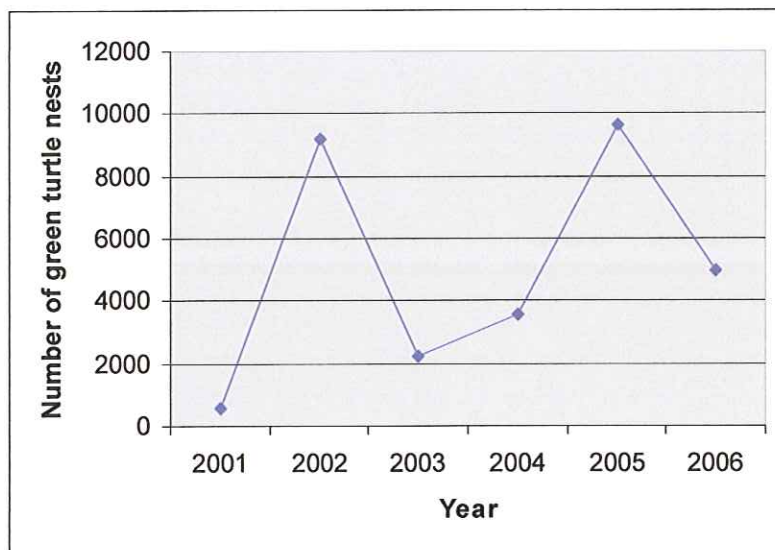


Figure 8. Number of green nests from 2001 to 2006 in Florida, according to SNBS.

Leatherback Sea Turtle

Leatherback nest numbers are increasing in Florida with a record number of leatherback nests being recorded during the 2007 season (FWC/FWRI 2007, http://research.myfwc.com/features/view_article.asp?id=27537).

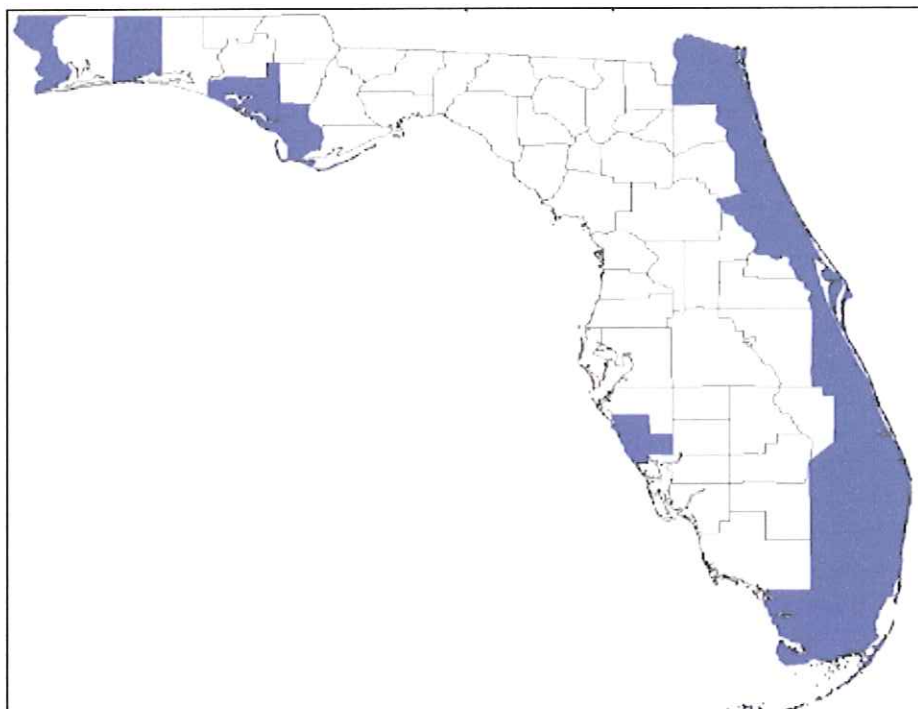


Figure 9. Distribution of leatherback turtle nesting in Florida.

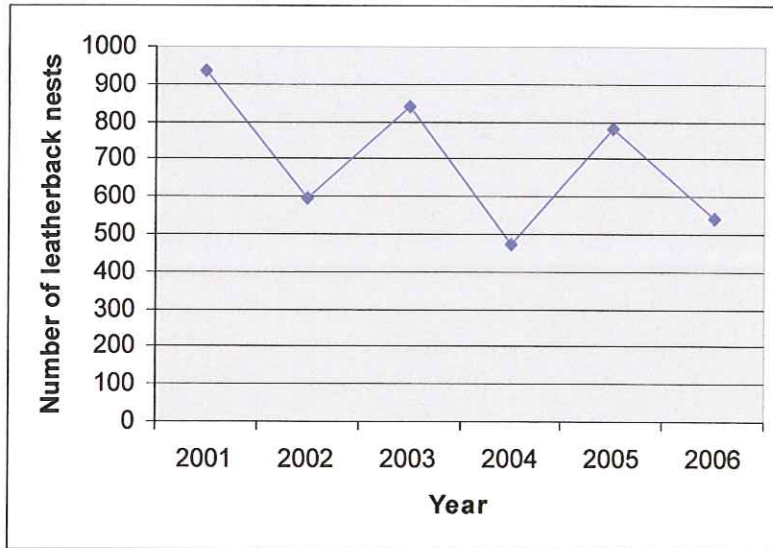


Figure 10. Number of leatherback nests in Florida 2000-2006 according to SNBS.

Hawksbill Sea Turtle

Thirty-eight hawksbill nests have been documented in Florida since 1979 in Broward, Manatee, Martin, Miami-Dade, Monroe, Palm Beach, and Volusia counties (FWC/FWRI statewide nesting database 2006).

Kemp's Ridley Sea Turtle

Twenty-six Kemp's ridley nests have now been documented in Florida in Brevard, Escambia, Gulf, Lee, Martin, Palm Beach, Pinellas, Santa Rosa, Sarasota, and Volusia counties (FWC 2007).

Factors affecting species habitat within the Action Area

The beaches along the coast of Florida are part of the State INBS. For the past 18 years, the Index Nesting Beach Survey (INBS) has coordinated a detailed monitoring program in addition to the Statewide Nesting Beach Survey (SNBS). Of the 190 SNBS surveyed areas, 33 participate in the INBS program (30 percent of the total beaches). The INBS program was established with a set of standardized data-collection criteria to measure seasonal nesting, and to allow accurate comparisons between both beaches and years. The reliability of these comparisons results from the uniformity of beach-survey effort in space and time, from the spatial and temporal detail of surveys (or, the space and time of the surveys), and from the specialized annual training of beach surveyors. Under the core INBS program, 178 miles of nesting beach have been divided into zones, known as core index zones, averaging one-half ($\frac{1}{2}$) mile in length. These beaches are monitored daily during beginning May 15 and ending August 31. On all index beaches, researchers record nests and nesting attempts by species, the location of the nest, and date.

Nest hatching surveys may continue into mid-November depending on nest incubation. Surveys begin at sunrise. Turtle crawls are identified as a true nesting crawl or false crawl. Nests are marked with stakes and some are surrounded with surveyor flagging tape, and if needed screened to prevent predation. The marked nests are monitored throughout the incubation period for storm damage, predation, hatching activity and hatching and emerging success. All monitoring is conducted in accordance with guidelines provided by the FWC.

Loggerhead Sea Turtle

The loggerhead nesting and hatching season is as follows:

Table 4. Loggerhead nesting and hatching season for Florida.

BEACH	COUNTIES	SEA TURTLE NESTING SEASON THROUGH HATCHING SEASON ¹
Northern Gulf of Mexico beaches	Escambia through Pasco	May 1 through October 31
Southern Gulf of Mexico beaches	Pinellas through Monroe Counties	April 1 through November 30
Southern Florida Atlantic beaches	Brevard through Dade	March 1 through November 30
Northern Florida Atlantic beaches	Nassau through Volusia	April 15 through November 30

¹Incubation ranges from about 45 to 95 days.

Hurricane Effects on Loggerhead Nesting

A common question is whether the 2004 and 2005 hurricanes seasons contributed to low nest numbers. Although Florida has been subject to numerous hurricanes in recent years, these storm events cannot account for the decline observed in the number of loggerhead nests on Florida beaches. The hurricanes have a very limited effect on nesting activity of adult female turtles. Because loggerheads that hatch on Florida beaches require some 20 to 30 years to reach maturity, storm impacts would not manifest themselves for many years. Moreover, hurricane impacts to nests tend to be localized and often occur after the main hatching season for the loggerhead is over.

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Green Sea Turtle

The green nesting and hatching season is as follows:

Table 5. Green sea turtle nesting and hatching season for Florida.

BEACH	COUNTIES	SEA TURTLE NESTING SEASON THROUGH HATCHING SEASON ¹
Northern Gulf of Mexico beaches	Escambia through Pasco	May 15 through October 31
Southern Gulf of Mexico beaches	Pinellas through Monroe Counties	May 15 through October 31
Southern Florida Atlantic beaches	Brevard through Dade	May 1 through November 30
Northern Florida Atlantic beaches	Nassau through Volusia	May 15 through November 15

¹Incubation ranges from about 45 to 75 days.

Leatherback Sea Turtle

The leatherback sea turtle nesting and hatching season is as follows:

Table 6. Leatherback sea turtle nesting and hatching season for Florida.

BEACH	COUNTIES	SEA TURTLE NESTING SEASON THROUGH HATCHING SEASON ¹
Northern Gulf of Mexico beaches	Escambia through Pasco	May 1 through September 30
Southern Florida Atlantic beaches	Brevard through Dade	February 15 through November 30
Northern Florida Atlantic beaches	Nassau through Volusia	April 15 through September 30

¹Incubation ranges from about 55 to 75 days.

Hawksbill Sea Turtle

The hawksbill sea turtle nesting and hatching season is as follows:

Table 7. Hawksbill sea turtle nesting and hatching season for Florida.

BEACH	COUNTIES	SEA TURTLE NESTING SEASON THROUGH HATCHING SEASON ¹
Southern tip of Florida	Monroe	June 1 through December 31
Southern Florida Atlantic beaches	Brevard through Dade	June 1 through December 31
Northeast Florida	Volusia	June 1 through December 31

¹Incubation lasts about 60 days.

Other activities have affected the conservation of sea turtles and required consultation with the Service. These are located within and outside of the Action Area and are important in the Service's overall evaluation of the current status of each subspecies. Consultations that have occurred within Florida are listed in **Appendix A**.

EFFECTS OF THE ACTION

Factors to be considered

The proposed project will occur within habitat that is used by sea turtles for nesting and may be constructed during a portion of the sea turtle nesting season. Long-term and permanent impacts from the emergency beach berm repair, construction and placement could include a change in the nest incubation environment from the berm material. Short-term and temporary impacts to sea turtle nesting activities could result from berm work occurring on the nesting beach during the active nesting or hatching period, changes in the physical characteristics of the beach from the placement of the berm material and change the nest incubation environment from the material.

Proximity of action: The emergency beach berm activities would occur within and adjacent to nesting habitat for sea turtles and dune habitats that ensure the stability and integrity of the nesting beach. Specifically, the project would potentially impact nesting and hatchling loggerhead, green, leatherback, hawksbill, and Kemp's ridley sea turtles.

Distribution: The emergency beach berm activities that may impact nesting and hatchling sea turtles would occur along GOM and Atlantic Ocean coasts.

Timing: The timing of the emergency beach berm could directly and indirectly impact nesting and hatchling sea turtles when conducted between April 15 and November 30.

Nature of the effect: The effects of the emergency berm construction and repair activities may change the nesting behavior of adult female sea turtles or diminish the nesting success, change the behavior of hatchling sea turtles, and result in nests or hatching events being missed during the daily survey of the Action Area. Any decrease in productivity and/or survival rates would contribute to the vulnerability of the Florida subpopulations of loggerhead sea turtles.

Duration: The emergency berm construction and repair will be done only in emergency situations. The berms are constructed to withstand 5-year storms. Thus, they are not expected to remain on the beach for very long. Time to complete the project construction may vary depending on the project length, weather, and other factors (contractor and equipment availability, regulatory permitting). However, it is anticipated for most projects work could take from a week to 30 days to complete. The direct effects will be sporadic depending on the erosion conditions of the specific shoreline and short-term in duration. Indirect effects from the activity may continue to impact nesting and hatchling sea turtles in subsequent nesting seasons if the berm material remains in place.

Disturbance frequency: The three Florida loggerhead sea turtle nesting subpopulations, greens, leatherback, hawksbill, and Kemp's ridleys may experience decreased nesting success, hatching success and hatchling emergence that could result from the emergency berm construction and repair activities being conducted at night during one nesting season or during the earlier or latter parts of two nesting seasons.

Disturbance intensity and severity: Depending on the need (number of disasters) and the timing of the emergency berm construction and repair activities during sea turtle nesting season, effects to the loggerhead, green, leatherback, hawksbill, and Kemp's ridley sea turtle populations of Florida, and potentially the U.S. populations could be important.

Analyses for effects of the action

Repair and replacement of a beach berm may have similar impacts as a beach nourishment to sea turtles because the action may occur during the sea turtle nesting season, sandy material is being placed in sea turtle nesting habitat, and the material may migrate and be redistributed along the beach. Thus, most of the following discussions concerning impacts of beach berm construction will use findings from beach nourishment research, studies, and the Service's experience from previous nourishment and berm replacement projects.

Beneficial effects

The need for a beach berm replacement is a result of a natural disaster when the wet and dry beach has been eroded and the elevation lowered. It is likely that post disaster beaches may not provide optimal habitat for sea turtle nests. Placement of sand on a beach may increase sea turtle nesting habitat quality if the placed sand is highly compatible (*i.e.*, grain size, shape, color, etc.) with naturally occurring beach sediments in the area, and compaction and escarpment remediation measures are incorporated into the project. In addition, placement of a berm that is designed and constructed to mimic the pre-disaster beach system while the beach is naturally restoring, may benefit sea turtles in the interim.

Direct effects

Direct effects are those direct or immediate effects of a project on the species or its habitat. Placement of sand on a beach in and of itself may not provide suitable nesting habitat for sea turtles. Although, the placement of a beach berm may enhance the quality of nesting habitat immediately post disaster; significant negative impacts to sea turtles may result if protective measures are not incorporated during project construction. Placement of sand during the nesting season, particularly on or near high density nesting beaches, can cause increased loss of eggs and hatchlings and, along with other mortality sources, may significantly impact the long-term survival of the species if not completed correctly. For instance, projects conducted during the nesting and hatching season could result in the loss of sea turtle nests by burial or crushing of nests or hatchlings. While a nest monitoring and egg relocation program would reduce these impacts, nests may be inadvertently missed (when crawls are obscured by rainfall, wind, and/or tides) or misidentified as false crawls during daily patrols. Even under the best of conditions,

about 7 percent of the nests can be misidentified as false crawls by experienced sea turtle nest surveyors (Schroeder 1994).

1. *Nest relocation*

Following disasters and once the beach is deemed safe, the sea turtle surveyors commence nesting surveys. There may be a short period of time when the beaches are not surveyed and nests are missed. Aerial photography following Hurricane Dennis in 2005 showed sea turtle crawls within 48 hours of the storm's passage. Besides the potential for missing nests during surveys and a nest relocation program, there is a potential for eggs to be damaged by nest movement or relocation, particularly if eggs are not relocated within 12 hours of deposition (Limpus et al. 1979). Nest relocation can have adverse impacts on incubation temperature (and hence sex ratios), gas exchange parameters, hydric environment of nests, hatching success, and hatchling emergence (Limpus et al. 1979; Ackerman 1980; Parmenter 1980; Spotila et al. 1983; McGehee 1990). Relocating nests into sands deficient in oxygen or moisture can result in mortality, morbidity, and reduced behavioral competence of hatchlings. Water availability is known to influence the incubation environment of the embryos and hatchlings of turtles with flexible-shelled eggs, which has been shown to affect nitrogen excretion (Packard et al. 1984), mobilization of calcium (Packard and Packard 1986), mobilization of yolk nutrients (Packard et al. 1985), hatchling size (Packard et al. 1981; McGehee 1990), energy reserves in the yolk at hatching (Packard et al. 1988), and locomotory ability of hatchlings (Miller et al. 1987).

In a 1994 Florida study comparing loggerhead hatching and emergence success of relocated nests with *in situ* nests, Moody (1998) found that hatching success was lower in relocated nests at 9 of 12 beaches evaluated. In addition, emergence success was lower in relocated nests at 10 of 12 beaches surveyed in 1993 and 1994.

2. *Equipment*

The use of heavy machinery on the beach during a construction project may also have adverse effects on sea turtles. Equipment left on the nesting beach overnight can create barriers to nesting females emerging from the surf and crawling up the beach, causing a higher incidence of false crawls and unnecessary energy expenditure.

3. *Artificial lighting*

Visual cues are the primary sea-finding mechanism for hatchling sea turtles (Mrosovsky and Carr 1967; Mrosovsky and Shettleworth 1968; Dickerson and Nelson 1989; Witherington and Bjorndal 1991). When artificial lighting is present on or near the beach, it can misdirect hatchlings once they emerge from their nests and prevent them from reaching the ocean (Philibosian 1976; Mann 1977; FWC sea turtle disorientation database). In addition, a significant reduction in sea turtle nesting activity has been documented on beaches illuminated with artificial lights (Witherington 1992). Therefore, construction lights along a project beach and on the dredging vessel may deter females from coming ashore to nest, misdirect females trying to return to the surf after a nesting event, and misdirect emergent hatchlings from adjacent non-project beaches. Construction of the beach berms is only to occur during daylight hours.

Thus, lighting associated with berm construction is not expected to impact nesting or hatchling sea turtles.

Indirect effects

Indirect effects are those effects that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Effects from the proposed project may continue to affect sea turtle nesting on the project beach and adjacent beaches in future years.

Many of the direct effects of emergency berm construction and repair may persist over time and become indirect impacts. These indirect effects include increased susceptibility of relocated nests to catastrophic events, the consequences of potential increased beachfront development, changes in the physical characteristics of the beach, the formation of escarpments, and future sand migration.

1. Increased susceptibility to catastrophic events

Relocation of sea turtle nests from the berm construction area may concentrate eggs in an area making them more susceptible to future disaster events. Hatchlings released from concentrated areas also may be subject to greater predation rates from both land and marine predators, because the predators learn where to concentrate their efforts (Glenn 1998; Wyneken et al. 1998).

2. Increased beachfront development

Pilkey and Dixon (1996) state that beach replenishment frequently leads to more development in greater density within shorefront communities that are then left with a future of further replenishment or more drastic stabilization measures. Dean (1999) also notes that the very existence of a beach nourishment project can encourage more development in coastal areas. Following completion of a beach nourishment project in Miami during 1982, investment in new and updated facilities substantially increased tourism there (National Research Council 1995). Increased building density immediately adjacent to the beach often accommodated more beach users than the replaced older buildings. This may also be the issue for the replacement of berms on the beach. Property owners may be provided a false sense of security in regard to protection of their property. Overall, shoreline management creates an upward spiral of initial protective measures resulting in increased and more expensive development, which leads to the need for more and larger protective measures. Increased shoreline development may adversely affect sea turtle nesting success. Greater development may support larger populations of mammalian predators, such as foxes and raccoons, than undeveloped areas (National Research Council 1990a), and can also result in greater adverse effects due to artificial lighting, as discussed above.

3. Changes in the physical environment

Replacing a beach berm may result in changes in sand density (compaction), beach shear resistance (hardness), beach moisture content, beach slope, sand color, sand grain size, sand grain shape, and sand grain mineral content if the placed sand is dissimilar from the original beach sand (Nelson and Dickerson 1988a). These changes could result in adverse impacts on

nest site selection, digging behavior, clutch viability, and emergence by hatchlings (Nelson and Dickerson 1987; Nelson 1988). The beach berm material is required to meet the State of Florida's beach sand compatibility requirements under 62B-41.007, Florida Administrative Code (FAC), for beach placement.

Beach compaction and unnatural beach profiles that may result from beach berm replacement activities could negatively impact sea turtles regardless of the timing of projects. Very fine sand and/or the use of heavy machinery can cause sand compaction on the beaches (Nelson et al. 1987; Nelson and Dickerson 1988a). Significant reductions in nesting success (*i.e.*, false crawls occurred more frequently) have been documented on severely compacted nourished beaches (Fletemeyer 1980; Raymond 1984; Nelson and Dickerson 1987; Nelson et al. 1987), and increased false crawls may result in increased physiological stress to nesting females. Sand compaction may increase the length of time required for female sea turtles to excavate nests and also cause increased physiological stress to the animals (Nelson and Dickerson 1988b). Nelson and Dickerson (1988c) concluded that, in general, beaches nourished from offshore borrow sites are harder than natural beaches, and while some may soften over time through erosion and accretion of sand, others may remain hard for 10 years or more. The sand used for the beach berm repair or replacement may be dredged from offshore or obtained from an upland source.

These impacts can be minimized by using suitable sand and by tilling compacted sand after project completion. The level of compaction of a beach can be assessed by measuring sand compaction using a cone penetrometer (Nelson 1987). Tilling of a nourished beach with a root rake may reduce the sand compaction to levels comparable to unnourished beaches. However, a pilot study by Nelson and Dickerson (1988c) showed that a tilled nourished beach will remain uncompacted for up to 1 year. Multi-year beach compaction monitoring and, if necessary, tilling, would ensure that project impacts on sea turtles are minimized. While the berms are considered as temporary (withstand 5-year storms) the material may remain on the beach over a year or more.

A change in sediment color on a beach could change the natural incubation temperatures of nests in an area, which, in turn, could alter natural sex ratios. To provide the most suitable sediment for nesting sea turtles, the color of the nourished sediments shall resemble the natural beach sand in the area. Natural reworking of sediments and bleaching from exposure to the sun would help to lighten dark nourishment sediments; however, the timeframe for sediment mixing and bleaching to occur could be critical to a successful sea turtle nesting season. Meeting the State of Florida criteria for beach quality sand would ensure that the material color is compatible to pre-disaster conditions on the beach.

4. *Escarpment formation*

On nourished beaches, steep escarpments may develop along their water line interface as they adjust from an unnatural construction profile to a more natural beach profile (Coastal Engineering Research Center 1984; Nelson et al. 1987). These escarpments can hamper or prevent access to nesting sites (Nelson and Blihovde 1998). Researchers have shown that female turtles coming ashore to nest can be discouraged by the formation of an escarpment, leading to situations where they choose marginal or unsuitable nesting areas to deposit eggs (*e.g.*, in front

of the escarpments, which often results in failure of nests due to prolonged tidal inundation). Designing the berm to reduce the seaward slope would provide a more natural slope for sea turtle approach and decrease the time needed for the shoreline profile to equilibrate. This impact can also be minimized by leveling any escarpments prior to the nesting season.

Species' response to a proposed action

The following summary illustrates sea turtle responses to and recovery from a nourishment project. A significantly larger proportion of turtles emerging on nourished beaches abandoned their nesting attempts than turtles emerging on natural or pre-nourished beaches. This reduction in nesting success is most pronounced during the first year following project construction and is most likely the result of changes in physical beach characteristics associated with the nourishment project (*e.g.*, beach profile, sediment grain size, beach compaction, frequency and extent of escarpments). During the first post-construction year, the time required for turtles to excavate an egg chamber on untilled, hard-packed sands increases significantly relative to natural and background conditions. However, tilling is effective in reducing sediment compaction to levels that did not significantly prolong digging times. As natural processes reduced compaction levels on nourished beaches during the second post-construction year, digging times returned to background levels (Ernest and Martin 1999; Crain et al. 1995; Trindell et al. 2000).

During the first post-construction year, nests on nourished beaches are deposited significantly seaward of the toe of the dune and significantly landward of the tide line than nests on natural beaches. As the width of nourished beaches decreased during the second year, nest placement diminishes. More nests are washed out on the wide, flat nourished beaches than on the narrower steeply sloped natural beaches. This phenomenon may persist through the second post-construction year resulting from the placement of nests near the seaward edge of the beach berm where dramatic profile changes occurred, caused by erosion and scarping, as the beach equilibrated to a more natural contour.

The principal effect of nourishment on sea turtle reproduction is a reduction in nesting success during the first year following project construction. Although most studies have attributed this phenomenon to an increase in beach compaction and escarpment formation, Ernest and Martin (1999) indicated that changes in beach profile may be more important. Regardless, as a nourished beach is reworked by natural processes in subsequent years and adjusts from an unnatural construction profile to a more natural beach profile, beach compaction and the frequency of escarpment formation decline, and nesting and nesting success return to levels found on natural beaches. Because of the similarities of beach nourishment and beach berm construction we anticipate similar impacts to occur from the repair and replacement of beach berms following a disaster.

BEACH MICE

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/critical habitat description

The formal taxonomic classification of beach mouse subspecies follows the geographic variation in pelage and skeletal measurements documented by Bowen (1968). This peer-reviewed, published classification was also accepted by Hall (1981). The taxonomic validity of the beach mouse subspecies came into question when three of the Gulf Coast subspecies, PKBM, ABM, and CBM were proposed for listing (1984-1985). Two unpublished letters (Dawson 1983; Griswold undated) were submitted to the Service for consideration in response to the proposed listing. The conclusion reached by these authors was that three of the eight beach mouse subspecies did not differ sufficiently from inland populations to warrant their recognition as subspecies. Close consideration of the Dawson and Griswold unpublished papers by Service biologists determined that neither paper constituted completed studies. Furthermore, Dawson clearly expressed the need for further taxonomic studies to adequately answer the questions concerning subspecific taxonomy of beach mice. To date, Bowen's (1968) work is the latest published comprehensive review of beach mice and is the taxonomy on which the Service continues to rely.

Since the listing of the beach mice, further research concerning the taxonomic validity of the subspecific classification of beach mice has been initiated and/or conducted. Preliminary results from these studies support the separation of beach mice from inland forms, and support the currently accepted taxonomy (Bowen 1968) (*i.e.*, each beach mouse group represents a unique and isolated subspecies). Recent research using mitochondrial DNA data illustrates that Gulf Coast beach mouse subspecies form a well-supported and independent evolutionary cluster within the global population of the mainland or inland old field mice (Van Zant and Wooten 2006 pers. communication).

The old-field mouse (*Peromyscus polionotus*) is different in form and structure as well as being genetically diverse throughout its range in the southeastern United States (Bowen 1968; Selander et al. 1971). Currently there are sixteen recognized subspecies of old-field mice (Hall 1981). Eight subspecies of the old-field mouse occupy coastal rather than inland habitat and are referred to as beach mice (Bowen 1968). Two existing subspecies of beach mouse and one extinct subspecies are known from the Atlantic coast of Florida and five subspecies of the beach mice live along the Gulf coast of Alabama and northwestern Florida.

Rivers and various inlets bisect the Gulf and Atlantic beaches and naturally isolate habitats in which the beach mice live. The outer coastline and barrier islands are typically separated from the mainland by lagoons, swamps, tidal marshes, and flatwood areas with hardpan soil conditions. However, these dispersal barriers are not absolute; sections of sand peninsulas may from time to time be cut off by storms and shift over time due to wind and current action. Human development has also fragmented the ranges of the subspecies, and as a consequence of

coastal development and the dynamic nature of the coastal environment, beach mouse populations are generally comprised of various disjunct populations.

Atlantic Coast Beach Mice

The Southeastern Beach Mouse (SEBM) was listed as a threatened species under the Act in 1989 (54 FR 20598). Critical habitat was not designated for this subspecies. SEBM is also listed as threatened by the State of Florida. The original distribution of the SEBM was from Ponce Inlet, Volusia County, southward to Hollywood, Broward County, and possibly as far south as Miami in Dade County. It is currently restricted to Volusia, Brevard, and Indian River counties. Formerly, this subspecies occurred along about 175 miles of Florida's southeast coast; it now occupies about 50 miles, a significant reduction in range (**Figure 11**).

This subspecies uses both beach dunes and inland areas of scrub vegetation. The most seaward vegetation typically consists of sea oats (*Uniola paniculata*), dune panic grass (*Panicum amarulum*), railroad vine (*Ipomoea pes-caprae*), beach morning glory (*Ipomoea stolonifera*), and camphor weed (*Heterotheca subaxillaris*). Further landward, vegetation is more diverse, including beach tea (*Croton punctatus*), prickly pear cactus (*Opuntia humifusa*), saw palmetto (*Serenoa repens*), wax myrtle (*Myrica cerifera*), and sea grape (*Coccoloba uvifera*).

The Anastasia Island beach mouse (AIBM) was listed as endangered under the Act in 1989 (54 FR 20598). Critical habitat was not designated for the subspecies. AIBM is also listed as endangered species by the State of Florida. The distribution of the AIBM has declined significantly, particularly in the northern part of its range. Historically, it was reported to occur from the vicinity of the Duval-St. Johns County line southward to Matanzas Inlet, St. Johns County, Florida (Humphrey and Frank 1992a). It currently occurs only on Anastasia Island, primarily at the north (Anastasia State Park) and south (Fort Matanzas National Monument) ends of the island, although beach mice still occur at low densities in remnant dunes along the entire length of the island (Service 1993). The original distribution consisted of about 50 linear miles of beach; current populations occupy about 14 linear miles of beach with possibly only 3 miles supporting viable populations (Service 1993) (**Figure 12**).

In 1992 to 1993, the Service funded the reintroduction of AIBM to Guana Tolomoto Matanzas National Estuarine Research Reserve (GTMNERR) in St. Johns County where historical habitat for the subspecies existed (Service 1993). GMTNERR-Guana River is 9 miles north of the existing population of beach mice at Anastasia State Park. Fifty-five mice (27 females and 28 males) were trapped at Fort Matanzas National Monument and Anastasia State Park from September 24, to November 12, 1992, and placed in soft-release enclosures at the State Park on September 27, and November 12, 1992. During follow-up trapping conducted in February 1993, beach mice occupied the entire 4.2 miles length of the park; 34 were captured and it was estimated that the population totaled 220. The reintroduction has been successful thus far, despite several hurricanes and northeasterly storms that have caused beach erosion. Due to the limited dune habitat at the park it is not known if it will be able to maintain a stable population.

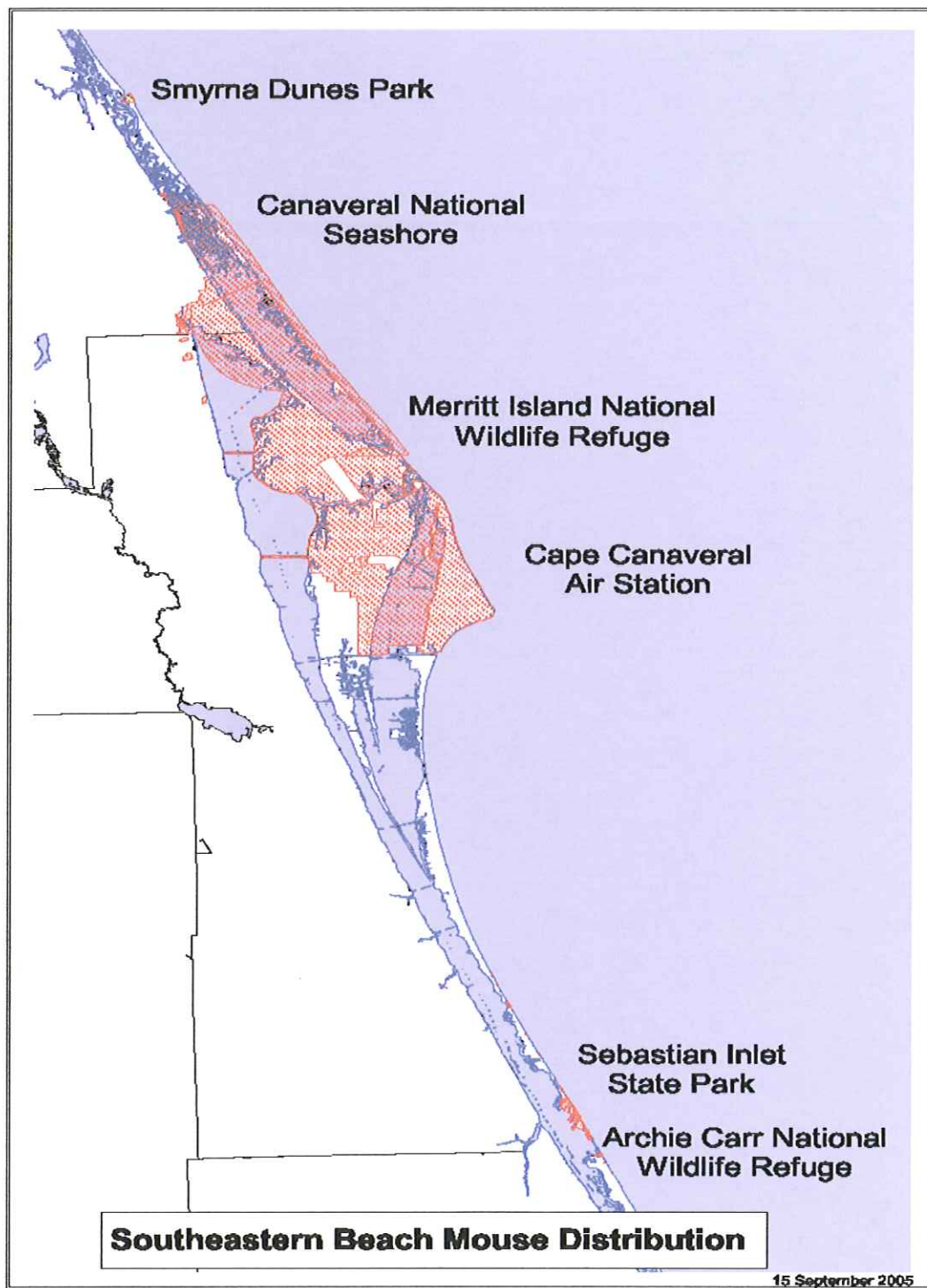


Figure 11. The distribution of the southeastern beach mouse.

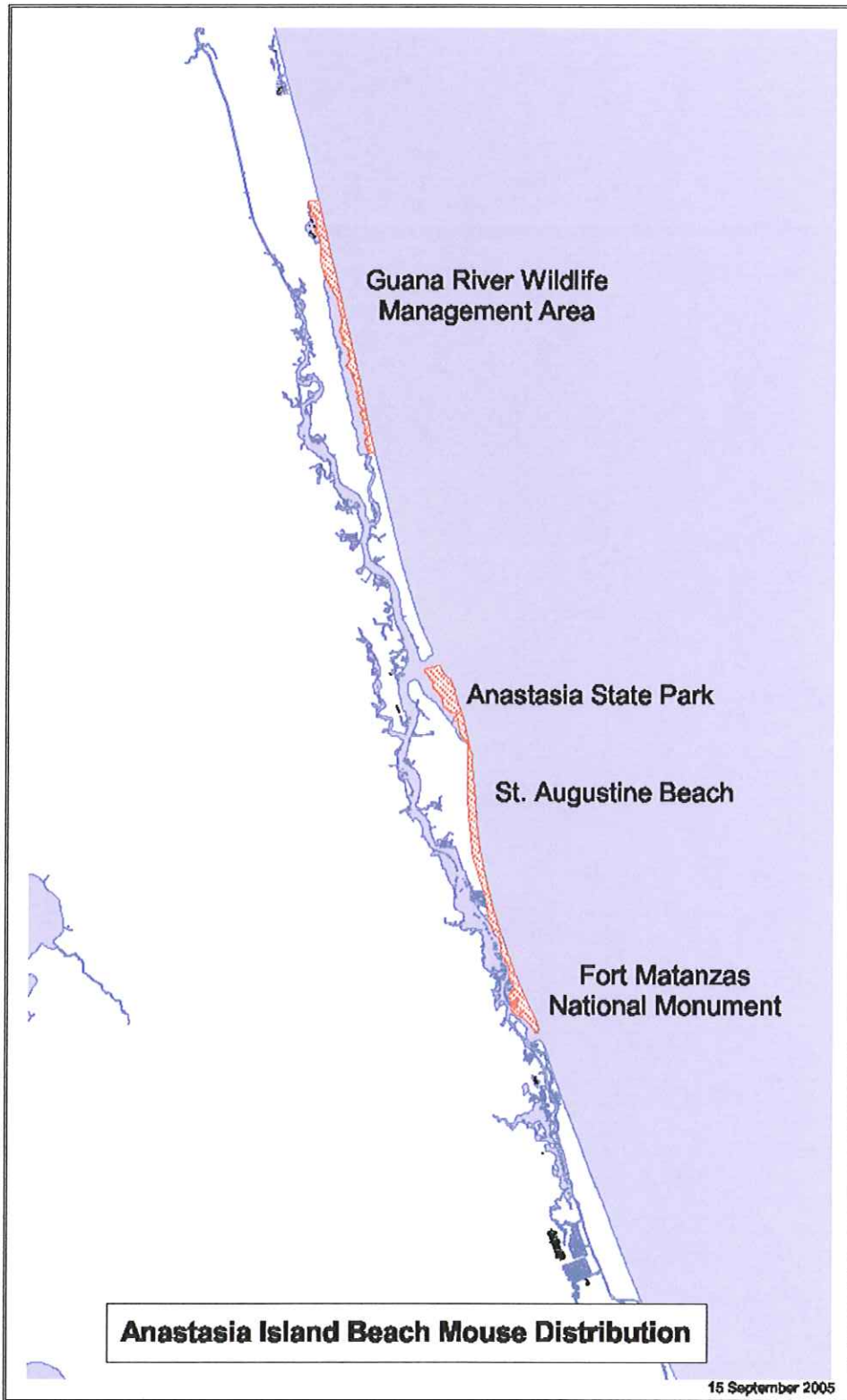


Figure 12. The distribution of the Anastasia Island beach mouse.

Gulf Coast Beach Mice

The CBM and the PKBM were listed with the Alabama beach mouse (ABM), *Peromyscus polionotus ammobates*, as endangered species under the Act in 1985 (50 FR 23872). The SABM was listed under the Act in 1998 (63 FR 70053). CBM, SABM, and PKBM are also listed as endangered species by the State of Florida. Critical habitat was designated for the CBM and PKBM at the time of listing; however, critical habitat was revised in 2006 (71 FR 60238). Critical habitat was also designated for the SABM in the 2006 (71 FR 60238).

The historic range of the CBM extended 53 miles between the Destin Pass, Choctawhatchee Bay in Okaloosa County and East Pass in St. Andrew Bay, Bay County in Florida. PKBM historically ranged along the entire length of Perdido Key for 16.9 miles in Alabama and Florida, between Perdido Bay, Alabama (Perdido Pass) and Pensacola Bay, Florida (Bowen 1968). The historic range of the SABM extended 38 miles between Money Bayou in Gulf County, and Crooked Island at the East Pass of St. Andrews Bay, Bay County, Florida including the St. Joseph Peninsula and the coastal mainland adjacent to St. Joseph Bay, in Florida (**Figure 13**).

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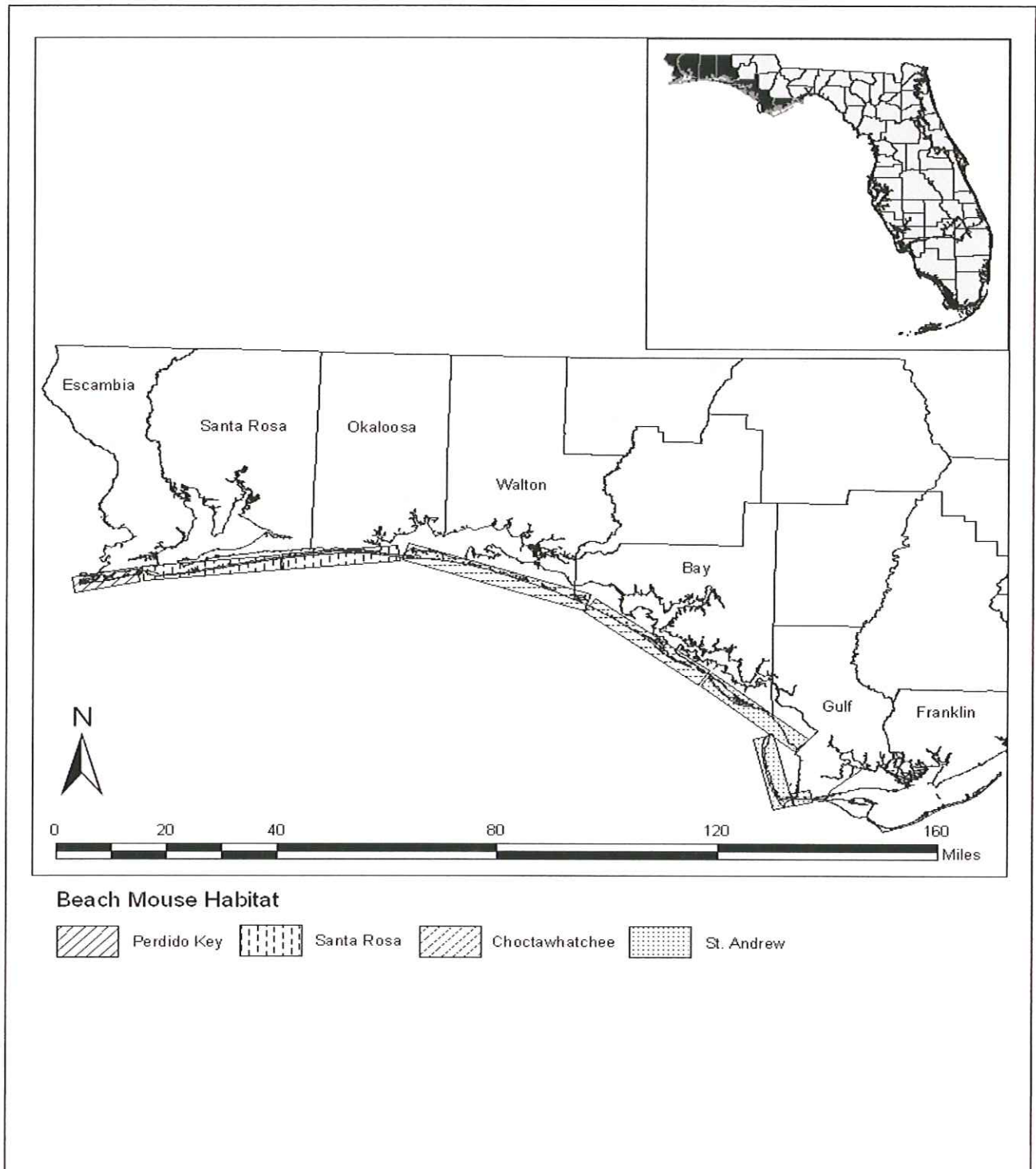


Figure 13. Historic range of Gulf Coast beach mouse subspecies.

Critical habitat

Since the listing of the PKBM and CBM in 1985, research has refined previous knowledge of Gulf Coast beach mouse habitat requirements and factors that influence their use of habitat. The findings most pertinent to the revision of critical habitat and determination (prudence) to revise the critical habitat designation involved the role of scrub dune habitat. Coastal dune habitat is generally categorized as: primary dunes (characterized by sea oats and other grasses), secondary dunes, similar to primary dunes, but also frequently include such plants as woody goldenrod (*Chrysoma pauciflosculosa*), false rosemary (*Conradina canescens*), and interior or scrub dunes (often dominated by scrub oaks (*Quercus geminata* spp.) and yaupon holly (*Ilex vomitoria*)). Contrary to the early belief that beach mice were restricted to (Howell 1909; 1921; Ivey 1949), or preferred the frontal dunes (Blair 1951; Pournelle and Barrington 1953; Bowen 1968), more recent research has shown that scrub habitat serves an invaluable role in the persistence of beach mouse populations (Swilling et al. 1998; Sneckenberger 2001). Beach mice occupy scrub dunes on a permanent basis and studies have found no detectable differences between scrub and frontal dunes in beach mouse body mass, home range size, dispersal, reproduction, survival, food quality, and burrow site availability (Swilling et al. 1998; Swilling 2000; Sneckenberger 2001). While seasonally abundant, the availability of food resources in the primary and secondary dunes fluctuates (Sneckenberger 2001). In contrast, the scrub habitat provides a more stable level of food resources, which becomes crucial when food is scarce or nonexistent in the primary and secondary dunes. This suggests that access to primary, secondary and scrub dune habitat is essential to beach mice at the individual level.

Based on the current knowledge of the life history, biology, and ecology of the subspecies and the requirements of the habitat to sustain the essential life history functions of the species, the primary constituent elements (PCE) of critical habitat for Gulf Coast beach mice consist of:

1. A contiguous mosaic of primary, secondary and scrub vegetation and dune structure, with a balanced level of competition and predation and few or no competitive or predaceous nonnative species present, that collectively provide foraging opportunities, cover, and burrow sites.
2. Primary and secondary dunes, generally dominated by sea oats, that, despite occasional temporary impacts and reconfiguration from tropical storms and hurricanes provide abundant food resources, burrow sites, and protection from predators.
3. Scrub dunes, generally dominated by scrub oaks, that provide food resources and burrow sites, and provide elevated refugia during and after intense flooding due to rainfall and/or hurricane induced storm surge.
4. Functional, unobstructed habitat connections that facilitate genetic exchange, dispersal, natural exploratory movements, and recolonization of locally extirpated areas.

5. A natural light regime within the coastal dune ecosystem, compatible with the nocturnal activity of beach mice, necessary for normal behavior, growth and viability of all life stages.

Thirteen coastal dune areas (units) in southern Alabama and the panhandle of Florida have been determined to be essential to the conservation of PKBM, CBM, and SABM and are designated as critical habitat (**Figures 14 through 16**). These 13 units include five units for PKBM, five units for CBM, and three units for the SABM. These units total 6,194 acres of coastal dunes, and include 1,300 acres for the PKBM in Escambia County, Florida and Baldwin County, Alabama (**Table 8**); 2,404 acres for the CBM, in Okaloosa, Walton, and Bay counties, Florida (**Table 9**); and 2,490 acres for the SABM in Bay and Gulf counties, Florida (**Table 10**).

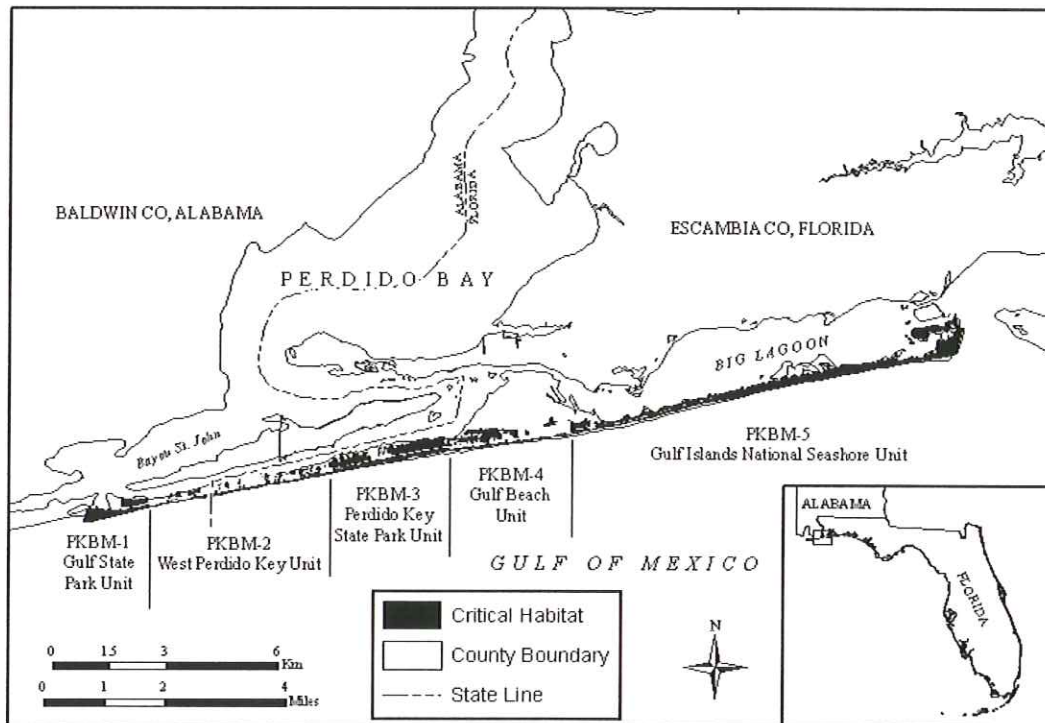


Figure 14. Critical habitat units designated for the Perdido Key beach mouse.

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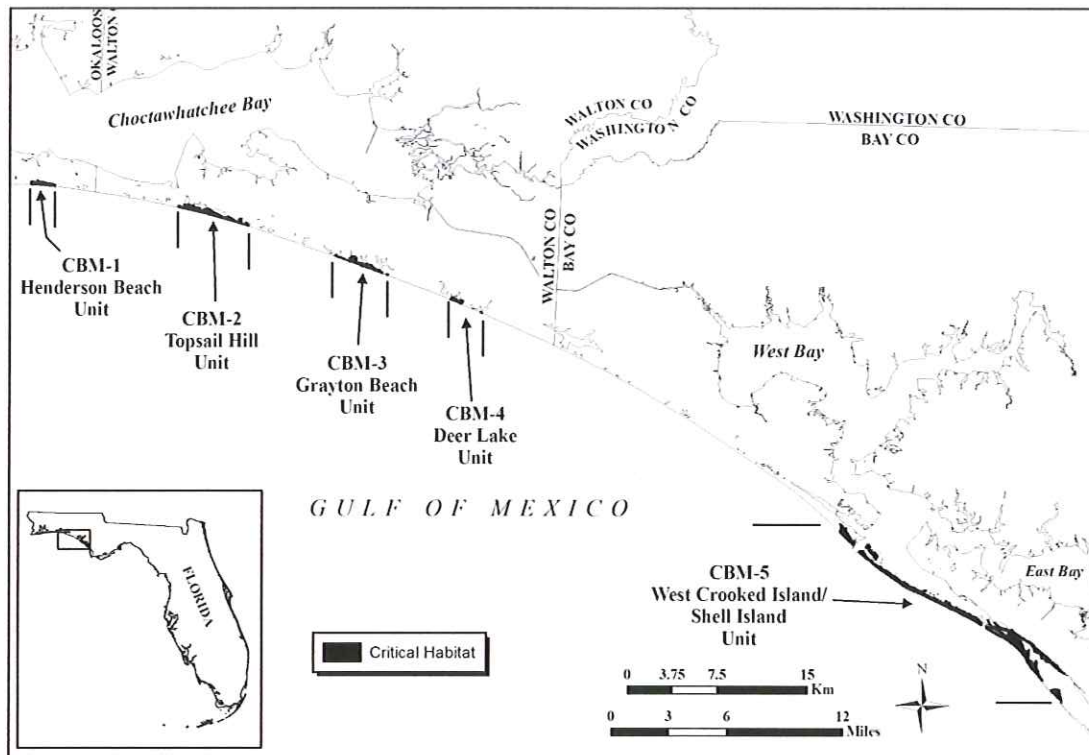


Figure 15. Critical habitat units designated for the Choctawhatchee beach mouse.

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Figure 16. Critical habitat units designated for the St. Andrew beach mouse.

Table 8. Critical habitat units designated for the Perdido Key beach mouse.

Perdido Key Beach Mouse Critical Habitat Units	Federal Acres	State Acres	Local and Private Acres	Total Acres
1. Gulf State Park Unit	0	115	0	115
2. West Perdido Key Unit	0	0	147	147
3. Perdido Key State Park Unit	0	238	0	238
4. Gulf Beach Unit	0	0	162	162
5. Gulf Islands National Seashore Unit	638	0	0	638
Total	638	353	309	1300

Table 9. Critical habitat units designated for the Choctawhatchee beach mouse.

Choctawhatchee Beach Mouse Critical Habitat Units	Federal Acres	State Acres	Local and Private Acres	Total Acres
1. Henderson Beach Unit	0	96	0	96
2. Topsail Hill Unit	0	277	31	308
3. Grayton Beach Unit	0	162	17	179
4. Deer Lake Unit	0	40	9	49
5. W. Crooked Island/Shell Island Unit	1333	408	30	1771
Total	1333	982	87	2404

Table 10. Critical habitat units designated for the St. Andrew beach mouse.

St. Andrew Beach Mouse Critical Habitat Units	Federal Acres	State Acres	Local and Private Acres	Total Acres
1. East Crooked Island Unit	649	0	177	826
2. Palm Point Unit	0	0	162	162
3. St. Joseph Peninsula Unit	0	1280	222	1502
Total	649	1280	561	2490

The Gulf State Park Unit (PKBM-1) consists of 115 acres in southern Baldwin County, Alabama, on the westernmost region of Perdido Key. This unit encompasses essential features of beach mouse habitat within the boundary of Gulf State Park from the west tip of Perdido Key at Perdido Pass east to approximately 1.0 mile west of where the Alabama–Florida State line bisects Perdido Key and the area from the mean high water line (MHWL) north to the seaward extent of the maritime forest. This unit was occupied by the species at the time of listing. PKBM were known to inhabit this unit during surveys in 1979 and 1982, and by 1986 this was the only known existing population of the subspecies (Humphrey and Barbour 1981; Holler et al. 1989). This population was a core population and was the donor site for the reestablishment of PKBM into Gulf Islands National Seashore in 1986. This project ultimately saved PKBM from extinction as the population at Gulf State Park was considered extirpated in 1998 due to tropical storms and predators (Auburn University 1999).

Beach mouse habitat in this unit consists of primary, secondary, and scrub dune habitat. Because scrub habitat is separated from the frontal dunes by a highway in some areas, the population inhabiting this unit can be especially vulnerable to hurricane impacts, and therefore further linkage to scrub habitat and/or habitat management would improve connectivity. This unit is managed by the Alabama Department of Conservation and Natural Resources and provides PCEs 2, 3, 4, and 5. Threats specific to this unit that may require special management considerations include artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, and/or a decrease in

habitat quality. This unit, which contains interior scrub habitat as well as primary and secondary dunes, serves as an expansion of the original critical habitat designation (50 FR 23872).

The West Perdido Key Unit (PKBM-2) consists of 114 acres in southern Escambia County, Florida, and 33 acres in southern Baldwin County, Alabama. This unit encompasses essential features of beach mouse habitat from approximately 1.0 mile west of where the Alabama-Florida State line bisects Perdido Key east to 2.0 miles east of the State line and areas from the MHWL north to the seaward extent of human development or maritime forest. This unit consists of private lands and ultimately includes essential features of beach mouse habitat between Perdido Key State Park (PKBM-3) and Gulf State Park (PKBM-1). Beach mouse habitat in this unit consists of primary, secondary, and scrub dune habitat and provides PCEs 2, 3, and 4.

Habitat fragmentation and other threats specific to this unit are mainly due to development. Consequently, threats to this unit that may require special management considerations include habitat fragmentation and habitat loss, artificial lighting, presence of feral cats as well as other predators at unnatural levels, excessive foot traffic and soil compaction, and damage to dune vegetation and structure. At the time of listing, it was not known that beach mice occupied this area. While no trapping has been conducted on these private lands to confirm absence for sections 7 and 10 permitting, sign of beach mouse presence was confirmed in 2005 through observations of beach mouse burrows and tracks (Sneckenberger, Service 2005 pers. communication), and this unit is adjacent to contiguous, occupied beach mouse habitat (PKBM-3). Therefore, this unit is considered currently occupied. This unit provides essential connectivity between two core population areas (Perdido Key State Park and Gulf State Park), provides habitat for expansion, natural movements, and recolonization, and is therefore essential to the conservation of the species. Specifically, this unit may have historically provided for the recolonization of Gulf State Park (PKBM-1) and/or may facilitate similar recolonization in the future as the habitat recovers from recent hurricane events.

The Perdido Key State Park Unit (PKBM-3) consists of 238 acres in southern Escambia County, Florida. This unit encompasses essential features of beach mouse habitat within the boundary of Perdido Key State Park from approximately 2.0 miles east of the Alabama-Florida State line to 4.0 miles east of the State line and the area from the MHWL north to the seaward extent of the maritime forest. Beach mouse habitat in this unit consists of primary, secondary and scrub dune habitat. Trapping efforts in this area were limited in the past. In 2000, a relocation program began to reestablish mice at Perdido Key State Park. This project is considered a success and the population occupying this unit now considered a core population. This unit provides PCEs 2, 3, 4, and 5 and is essential to the conservation of the species. Improving and/or restoring habitat connections would increase habitat quality and provide more functional connectivity for dispersal, exploratory movements, and population expansion. The Florida Park Service manages this unit. Threats specific to this unit that may require special management considerations include artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, and/or a decrease in habitat quality. This unit, which contains interior scrub habitat as well as primary and secondary dunes, serves as an expansion of the original critical habitat designation (50 FR 23872).

The Gulf Beach Unit (PKBM-4) consists of 162 acres in southern Escambia County, Florida. This unit includes essential features of beach mouse habitat between Gulf Islands National Seashore and Perdido Key State Park from approximately 4.0 miles east of the Alabama–Florida State line to 6.0 miles east of the State line and areas from the MHWL north to the seaward extent of human development or maritime forest. This unit consists of private lands. Beach mouse habitat in this unit consists of primary, secondary, and scrub dune habitat. Habitat fragmentation and other threats specific to this unit are mainly due to development. Consequently, threats to this unit that may require special management considerations include habitat fragmentation and habitat loss, artificial lighting, presence of feral cats as well as other predators at unnatural levels, excessive foot traffic and soil compaction, and damage to dune vegetation and structure. While not known as occupied habitat at the time of listing, presence of beach mice has recently been confirmed within the unit as a result of trapping efforts in conjunction with permitting (Lynn 2004b). This unit provides PCEs 2, 3, and 4 and is essential to the conservation of the species. This unit includes high-elevation scrub habitat and serves as a refuge during storm events and as an important repopulation source if storms extirpate or greatly reduce local populations. This unit currently provides essential connectivity between two populations (PKBM-3 and PKBM-5) and provides essential habitat for expansion, natural movements, and recolonization (PCE 4).

The Gulf Islands National Seashore Unit (PKBM-5) consists of 638 acres in southern Escambia County, Florida, on the easternmost region of Perdido Key. This unit encompasses essential features of beach mouse habitat within the boundary of Gulf Islands National Seashore–Perdido Key Area (also referred to as Johnson Beach) from approximately 6.0 miles east of the Alabama–Florida State line to the eastern tip of Perdido Key at Pensacola Bay and the area from the MHWL north to the seaward extent of the maritime forest. Beach mouse habitat in this unit consists mainly of primary and secondary dune habitat, but provides the longest contiguous expanse of frontal dune habitat within the historic range of the PKBM. PKBM were known to inhabit this unit in 1979, though the population was impacted by Hurricane Frederic (1979) and no beach mice were captured during surveys in 1982 and 1986 (Humphrey and Barbour 1981; Holler et al. 1989) therefore, the unit was unoccupied at the time of listing. In 1986, PKBM were reestablished at this unit as a part of Service recovery efforts. This reestablishment project was identified as the most urgent recovery need for the mouse (Service 1987; Holler et al. 1989). The project is considered a success, as the population inhabiting this unit is considered a core population. In 2000 and 2001, PKBM captured from this site served as donors to re-establish beach mice at Perdido Key State Park (PKBM-3).

PKBM-5, in its entirety, possesses all five PCEs and is essential to the conservation of the species. However, most of this unit consists of frontal dunes, making the population inhabiting this unit particularly threatened by storm events. Threats specific to this unit that may require special management considerations include artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, and/or a decrease in habitat quality. The National Park Service–Gulf Islands National Seashore manages this unit. This unit was included in the initial critical habitat designation (50 FR 23872).

The Henderson Beach unit (CBM-1) consists of 96 acres in Okaloosa County, Florida. This unit encompasses essential features of beach mouse habitat within the boundary of Henderson Beach State Park from 0.5 mi east of the intersection of Highway 98 and Scenic Highway 98 to 0.25 mi west of Matthew Boulevard and the area from the MHWL north to the seaward extent of the maritime forest. This westernmost unit provides primary, secondary, and scrub dune habitat (PCEs 2 and 3). This unit is within the historic range of the subspecies; however, it was not known to be occupied at the time of listing and current occupancy is unknown because no recent efforts have been made to document beach mouse presence or absence. Because this unit includes protected, high-elevation scrub habitat, it may serve as a refuge during storm events and as an important source population if storms extirpate or greatly reduce local populations or populations to the east.

This unit is managed by the Florida Park Service and is essential to the conservation of the species. Threats specific to this unit that may require special management considerations include habitat fragmentation, Park development, artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, or other decrease in habitat quality.

The Topsail Hill Unit (CBM-2) consists of 308 acres in Walton County, Florida. This unit encompasses essential features of beach mouse habitat within the boundary of Topsail Hill Preserve State Park, as well as adjacent private lands from 0.1 mi east of the Gulf Pines subdivision to 0.6 mi west of the inlet of Oyster Lake and the area from the MHWL north to the seaward extent of human development or maritime forest. This unit provides primary, secondary, and scrub dune habitat and possesses all five PCEs. Its large, contiguous, high-quality habitat allows for natural movements and population expansion. CBM were confirmed present in the unit in 1979 (Humphrey 1992), were present at the time of listing, and are still present. Beach mice have been captured on Stallworth County Park and Stallworth Preserve subdivision, a private development within the unit, east of the Park (Service 2003a). The population of CBM inhabiting this unit appears to harbor unique genetic variation and displays a relatively high degree of genetic divergence considering the close proximity of this population to other populations (Wooten and Holler 1999).

This unit has portions with different ownership, purposes, and mandates. Threats specific to this unit that may require special management considerations include Park and residential development, artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, or other decrease in habitat quality.

Lands containing the features essential to the conservation of the CBM within the area covered under the HCP for the Stallworth County Preserve (4 acres) are excluded from critical habitat designation under section 4(b)(2) of the Act.

The Grayton Beach Unit (CBM-3) consists of 179 acres in Walton County, Florida. This unit encompasses essential features of beach mouse habitat within the boundary of Grayton Beach State Park, as well as adjacent private lands and inholdings, from 0.3 mi west of the inlet of Alligator Lake east to 0.8 mi west of Seagrove Beach and the area from the MHWL north to the

seaward extent of human development or maritime forest. This unit provides primary, secondary, and scrub dune habitat (PCEs 2 and 3), habitat connectivity (PCE 4) and is essential to the conservation of the species. This unit also provides a relatively natural light regime (PCE 5). Beach mice were not detected in the unit in 1979 (Holler 1992a); however, they were found to be present in 1995 after Hurricane Opal (Moyers et al. 1999). While it seems likely that beach mice were present at the time of listing (and may have been present, but not detected, in 1979), we do not have data to confirm this assumption. Therefore, we consider this unit to be unoccupied at the time of listing. A program to strengthen and reestablish the population began in 1989 and yielded a persistent population at the State Park. Recent evidence of beach mice on State Park land was documented in 2004 (Service 2004). Beach mice are also known to currently occupy the private lands immediately east of the park.

This unit has portions with different ownership, purposes, and mandates. Threats specific to this unit that may require special management considerations include hurricane impacts that may require dune restoration and revegetation, excessive open, unvegetated habitat due to recreational use or storm impacts that may require revegetation, Park development, artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, or other decrease in habitat quality.

Lands containing the features essential to the conservation of the Choctawhatchee beach mouse within the area covered under the Habitat Conservation Plan for the Watercolor development (4 acres) are excluded from critical habitat designation under section 4(b)(2) of the Act.

The Deer Lake Unit (CBM-4) consists of 49 acres in Walton County, Florida. This unit encompasses essential features of beach mouse habitat within the boundary of Deer Lake State Park as well as adjacent private lands from approximately 1 mi east of the Camp Creek Lake inlet west to approximately 0.5 mi west of the inlet of Deer Lake and the area from the MHWL north to the seaward extent of maritime forest or human development. This unit provides primary, secondary, and scrub dune habitat (PCEs 2 and 3), habitat connectivity to adjacent lands (PCE 4), and is essential to the conservation of the species. This unit also provides a relatively natural light regime (PCE 5). Because live-trapping efforts in this area have been limited to incidental trapping, and beach mice were not detected in 1998 (Auburn University 1999), we consider this unit to be unoccupied at the time of listing. Choctawhatchee beach mice were translocated from Topsail Hill Preserve State Park to private lands adjacent to this unit in 2003 and 2005 (Service 2003b, 2005a, 2005b, 2005c, 2005d). Tracking within the adjacent State park lands have indicated expansion of the population into the park.

This unit has portions with different ownership, purposes, and mandates. Threats specific to this unit that may require special management considerations include artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, or other decrease in habitat quality.

Lands containing the features essential to the conservation of the CBM within the area covered under the HCP for Watersound (71 acres) are excluded from critical habitat designation under section 4(b)(2) of the Act (see Application of Section 4(a)(3) and Exclusions Under Section

4(b)(2) of the Act section below). This excluded area is 0.5 mi west of the Camp Creek Lake inlet to 0.5 mi east of the Camp Creek Lake inlet.

The West Crooked Island/ Shell Island Unit (CBM-5) consists of 1,771 acres in Bay County, Florida. This unit encompasses essential features of beach mouse habitat within the boundaries of St. Andrew State Park mainland from 0.1 mi east of Venture Boulevard east to the entrance channel of St. Andrew Sound, Shell Island east of the entrance of St. Andrew Sound east to East Pass, and West Crooked Island southwest of East Bay and east of the entrance channel of St. Andrew Sound, and areas from the MHWL north to the seaward extent of the maritime forest. Shell Island consists of State lands, Tyndall AFB lands, and small private inholdings. CBM were known to inhabit the majority of Shell Island in 1987 (Holler 1992b) and were again confirmed present in 1998 (Auburn University 1999), 2002, and 2003 (Lynn 2003a, 2003b). Because beach mice inhabited nearly the entire suitable habitat on the island less than two years prior to listing and were reconfirmed after listing, we consider this area to be occupied at the time of listing. The West Crooked Island population is the result of a natural expansion of the Shell Island population after the two islands became connected in 1998 and 1999, a result of Hurricanes Opal and Georges (Service 2003b). Shell Island was connected to the mainland prior to the 1930s when a navigation inlet severed the connection on the western end. Beach mice were documented at St. Andrew State Park mainland as late as the 1960s (Bowen 1968), though no records of survey efforts exist again until Humphrey and Barbour (1981) and Meyers (1983) at which time beach mice were not detected. Therefore, it seems likely that this area was not occupied at the time of listing. Current beach mouse population levels at this site are unknown, and live-trapping to document the absence of mice has not been conducted. Similar to the original designation, this Park was designated as critical habitat because it has features essential to the CBM. It is also within the historic range of the mouse. This unit supports the easternmost population of CBM, with the next known population 22 miles to the west.

This unit provides primary, secondary, and scrub dune habitat and possesses all five PCEs. Portions of this unit are managed by the Florida Park Service, while the remaining areas are federally (Tyndall AFB) and privately owned. Threats specific to this unit that may require special management considerations include artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high residential or recreational use that may result in soil compaction, damage to dunes, or other decrease in habitat quality.

The East Crooked Island Unit (SABM-1) consists of 826 acres in Bay County, Florida. This unit encompasses essential features of beach mouse habitat on East Crooked Island from the entrance of St. Andrew Sound to 1 mi west of Mexico Beach, and the area from the MHWL to the seaward extent of the maritime forest (not including Raffield Peninsula). Beach mouse habitat in this unit consists of primary, secondary, and scrub dune habitat and possesses all five PCEs. St. Andrew beach mice were known to inhabit the unit in 1986 and 1989 (James 1992), though the population was presumably extirpated after 1989 due to impacts from hurricanes. The East Crooked Island population was reestablished with donors from St. Joseph State Park in 1997. This unit was occupied at the time of listing. Recent live-trapping confirms present occupation of mice (Moyers and Shea 2002; Lynn 2002a; Slaby 2005). This unit maintains connectivity along the island and this unit is essential to provide a donor population following storm events.

The majority of this unit is federally owned (Tyndall AFB), while the remaining habitat is privately owned. Threats specific to this unit that may require special management considerations include artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational and military use that may result in soil compaction, damage to dunes, or other decrease in habitat quality.

The Palm Point Unit (SABM-2) consists of 162 acres of private lands in Gulf County, Florida. This unit encompasses habitat from Palm Point 1.25 mi northwest of the inlet of the Gulf County Canal to the southeastern boundary of St. Joe Beach and the area from the MHWL to the seaward extent of the maritime forest. St. Andrew beach mice were documented in the area by Bowen (1968) and were considered to have been present in this unit at the time of listing. Since St. Andrew beach mouse habitat is limited to only two other areas, protecting this mainland site located within the species' historic range is needed for the subspecies' long-term persistence. As other viable opportunities are limited or nonexistent, this unit is essential to reduce the threats of stochastic events to this subspecies. Furthermore, as this unit is on the mainland, it is somewhat buffered from the effects of storm events. This area provides frontal and scrub dune habitat (PCEs 2 and 3), but may provide limited connectivity between habitats. Threats specific to this unit that may require special management considerations include habitat fragmentation, habitat loss, artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high residential use that may result in soil compaction, damage to dunes, or other decrease in habitat quality.

The St. Joseph Peninsula Unit (SABM-3) consists of 1,502 acres in Gulf County, Florida. This unit encompasses essential features of beach mouse habitat within the boundary of St. Joseph Peninsula State Park (Park) as well as south of the Park to the peninsula's constriction north of Cape San Blas (also known as the "stumphole" region) and area from the MHWL to the seaward extent of the maritime forest. Beach mouse habitat in this unit consists of primary, secondary, and scrub dune habitat, and provides a relatively contiguous expanse of habitat within the historic range of the St. Andrew beach mouse. This unit possesses all five PCEs and was occupied at the time of listing. St. Andrew beach mice were known to inhabit this unit in 1986 and 1987 (James 1992), 1989, 1992, 1993, and 1994, 1995), and 2005, (Gore 1994; Moyers et al. 1999; Slaby 2005). In addition, recent tracking efforts suggest that mice continue to occupy private lands south of the Park (Slaby 2005). The Park alone does not provide sufficient habitat to allow for population expansion along the peninsula, which may be necessary for a population anchored by the tip of a historically dynamic peninsula. A continuous presence of beach mice along the peninsula is the species' best defense against local and complete extinctions due to storm events. The population of SABM inhabiting this unit appears to possess unique genetic variation, and displays greater than expected genetic divergence from other populations (Wooten and Holler 1999).

The Florida Park Service manages portions of this unit, while the remaining area is privately owned. Threats specific to this unit that may require special management considerations include artificial lighting, habitat fragmentation and habitat loss, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, or other decrease in habitat quality. The population inhabiting this unit may

also be particularly susceptible to hurricanes due to its location within St. Joseph Bay (the peninsula is a thin barrier peninsula with a north–south orientation).

Life history (All subspecies of beach mice)

Beach mice are differentiated from the inland subspecies by the variety of fur (pelage) patterns on the head, shoulders, and rump. The overall dorsal coloration, in coastal subspecies, is lighter in color and less extensive than on those of the inland subspecies (Sumner 1926; Bowen 1968). Similarly, beach mouse subspecies can be differentiated from each other by pelage pattern and coloration.

The SEBM averages 5.47 inches in total length (range of 10 individuals = 5.03 inches, with a 2.04-inch tail length (Osgood 1909; Stout 1992). Females are slightly larger than males. These beach mice are slightly darker in appearance than some other subspecies of beach mice, but paler than inland populations of *P. polionotus* (Osgood 1909). SEBM have pale, buffy coloration from the back of their head to their tail, and their underparts are white. The white hairs extend up on their flanks, high on their jaw, and within 0.07 to 0.12 inches of their eyes (Stout 1992). There are no white spots above the eyes as with AIBM (Osgood 1909). Their tail is also buffy above and white below. Juvenile SEBM are more grayish in coloration than adults; otherwise they are similar in appearance (Osgood 1909).

The AIBM averages 5.45 inches in total length (range of 10 individuals); with 2.05 inches mean tail length (James 1992). This subspecies has a very pale, buff-colored head and back with extensive white coloration underneath the sides (Howell 1939). Bowen (1968) noted two distinct rump color pigmentations, one tapered and the other a squared pattern, which extended to the thighs.

The SABM has head and body lengths averaging 2.95 inches, and tail mean lengths averaging 2.05 inches (James 1992). This subspecies has a very pale, buff-colored head and back with extensive white coloration underneath and along the sides (Howell 1939). Bowen (1968) noted two distinct rump color pigmentations, one tapered and the other a squared pattern, which extended to the thighs.

The PKBM is slightly smaller than the other Gulf coast beach mouse subspecies (Bowen 1968). Head and body length ranges from 2.7 to 3.3 inches (Holler 1992b). The pigmentation of PKBM is gray to gray-brown with the underparts white and coloration on the head is less pronounced. The line between pigmented and unpigmented pelage runs dorsally posterior above the eyes and behind the ears. Pigmentation patterns on the rump are either squared or squared superimposed on a tapered pattern (Bowen 1968). There is no tail stripe.

CBM have head and body lengths ranging from 2.7 to 3.5 inches (Holler 1992a). This beach mouse is distinctly more orange-brown to yellow-brown than the other Gulf coast beach mouse subspecies (Bowen 1968). Pigmentation on the head either extends along the dorsal surface of the nose to the tip, or ends posterior to the eyes leaving the cheeks white. A dorsal tail stripe is either present or absent.

Behavior

Peromyscus polionotus is the only member of the genus that digs an extensive burrow. Beach mice are semifossorial, using their complex burrows as a place to rest during the day and between nightly foraging bouts, escape from predators, have and care for young, and hold limited food caches. Burrows of *P. polionotus* generally consist of an entrance tunnel, nest chamber, and escape tunnel. Burrow entrances are usually placed on the sloping side of a dune at the base of a shrub or clump of grass. The nest chamber is formed at the end of the level portion of the entrance tunnel at a depth of 23.6 to 35.4 inches, and the escape tunnel rises from the nest chamber to within 9.8 inches of the surface (Blair 1951). Nests of beach mice are constructed in the nest chamber of their burrows, a spherical cavity about 1.5 to 2.5 inches in diameter. The nest comprises about one fourth of the size of the cavity and is composed of sea oat roots, stems, leaves and the chaffy parts of the panicles (Ivey 1949). Beach mice have been found to select burrow sites based on a suite of biotic and abiotic features including dune slope, soil compaction, vegetative cover, and height above sea level (Lynn 2000a; Sneckenberger 2001). A shortage of potential burrow sites is considered to be a possible limiting resource.

Reproduction and Demography

Studies on *Peromyscus* species in peninsular Florida suggest that these species may achieve greater densities and undergo more significant population fluctuations than their temperate relatives, partially because of their extended reproductive season (Bigler and Jenkins 1975). Subtropical beach mice can reproduce throughout the year; however their peak reproductive activity is generally during late summer, fall, and early winter. Extine (1980) reported peak reproductive activity for SEBM on Merritt Island during August and September, based on external characteristics of the adults. This peak in the timing and intensity of reproductive activity was also correlated to the subsequent peak in the proportion of juveniles in the population in early winter (Extine 1980). Peak breeding season for Gulf Coast beach mice is autumn and winter, declining in spring, and falling to low levels in summer (Rave and Holler 1992).

Sex ratios in beach mouse populations are generally 1:1 (Extine 1980; Rave and Holler 1992). Beach mice are believed to be generally monogamous (Smith 1966; Foltz 1981; Lynn 2000a). While a majority of individuals appear to pair for life, paired males may sire extra litters with unpaired females. Beach mice are considered sexually mature at 55 days of age; however some are capable of breeding earlier (Weston 2007). Gestation averages 28 to 30 days (Weston 2007) and the average litter size is four pups (Fleming and Holler 1990). Littering intervals may be as short as 26 days (Bowen 1968). Peak breeding season for beach mice is autumn and winter, declining in spring, and falling to low levels in summer (Blair 1951). However, pregnant and lactating beach mice have been observed in all seasons (Moyers et al. 1999).

Apparent survival rate estimates (products of true survival and site fidelity) of beach mice along the Gulf Coasts of Florida and Alabama have demonstrated that their average life span is about nine months (Swilling 2000). Other research indicated that 63 percent of Alabama beach mice lived (or remained in the trapping area) for four months or less, 37 percent lived five months or

greater and 2 percent lived 12 to 20 months (Rave and Holler 1992). Less than half (44 percent) of beach mice captured for the first time were recaptured the next season (Holler et al. 1997). Greater than ten percent of mice were recaptured three seasons after first capture; and four to eight percent were recaptured more than one year after initial capture. Beach mice held in captivity have lived three years or more (Blair 1951; Holler 1995).

Habitat and Movement

Beach mice inhabit coastal dune ecosystems on the Atlantic and Gulf Coasts of Florida and the Gulf Coast of Alabama. The dune habitat is generally categorized as: primary dunes (characterized by sea and other grasses), secondary dunes (similar to primary dunes, but also frequently include such plants as woody goldenrod, false rosemary, and interior or scrub dunes (often dominated by scrub oaks and yaupon holly. While seasonally abundant, the availability of food resources in the primary and secondary dunes fluctuates (Sneckenberger 2001). In contrast, the scrub habitat provides a more stable level of food resources, which becomes crucial when food is scarce or nonexistent in the primary and secondary dunes. This suggests that access to primary, secondary and scrub dune habitat is essential to beach mice at the individual level.

The sea oat zone of primary dunes is considered essential habitat of beach mice on the Atlantic Coast (Humphrey and Barbour 1981; Humphrey et al. 1987; Stout 1992). The SEBM has also been reported from sandy areas of adjoining coastal strand/scrub vegetation (Extine 1980; Extine and Stout 1987), which refers to a transition zone between the fore dune and the inland plant community (Johnson and Barbour 1990). Beach mouse habitat is heterogeneous, and distributed in patches that occur both parallel and perpendicular to the shoreline (Extine and Stout 1987). Because this habitat occurs in a narrow band along Florida's coast, structure and composition of the vegetative communities that form the habitat can change dramatically over distances of several feet.

Primary dune vegetation described from SEBM habitat includes sea oats, dune panic grass, railroad vine, beach morning glory, salt meadow cordgrass (*Spartina patens*), lamb's quarters (*Chenopodium album*), saltgrass (*Distichlis spicata*), and camphor weed (Extine 1980). Coastal strand and inland vegetation is more diverse, and can include beach tea, prickly pear cactus, saw palmetto, wax myrtle, rosemary, sea grape, oaks and sand pine (Extine and Stout 1987). Extine (1980) observed this subspecies as far as 0.62 mile inland on Merritt Island; he concluded that the dune scrub communities he found them in represent only marginal habitat for the SEBM. SEBM have been documented in coastal scrub more than a mile from the beach habitat at Kennedy Space Center/Merritt Island NWR and Cape Canaveral Air Force Station (CCAFS) (Stout, University of Central Florida 2004 pers. communication). Extine (1980) and Extine and Stout (1987) reported that the SEBM showed a preference for areas with clumps of palmetto, sea grape, and expanses of open sand.

Essential habitat of the AIBM is characterized by patches of bare, loose, sandy soil (Humphrey and Frank 1992a). Although they are mainly found in the sea oat zone of the primary zone, they will occur in sandy areas with broomsedge (*Andropogon* sp.) (Service 1993). Ivy (1949) reported AIBM to occur in woody vegetation as far as 500 feet inland. Pournelle and Barrington (1953) found this subspecies in scrub as far as 1800 feet from the dunes. Because this habitat

occurs in a narrow band along Florida's coast, structure and composition of the vegetative communities that form the habitat can change dramatically over distances of only a few feet. Much of the habitat within the range of the AIBM has been converted to condominiums and housing developments. The majority of the high quality habitat, densely occupied by beach mice, remains along the length of both Anastasia State Park and Fort Matanzas National Monument, at either end of Anastasia Island.

Two main types of movement have been identified for small mammals: within home-range activity and long-range dispersal. Such movements are influenced by a suite of factors, such as availability of mates, predation risk, and habitat quality. Movement and home range studies have been conducted for most beach mouse subspecies, but are limited to natural habitat (*i.e.*, research has been conducted on public lands within contiguous beach mouse habitat, not within a development or in a fragmented landscape). Novak's (1997) study of the home range of CBM on Shell Island indicated males had a mean home range of 1.0 plus or minus (\pm) 4.1 acres and females had a mean home range of 0.81 ± 2.18 acres. Lynn (2000a) found male and female radio-tagged ABM had a mean home range of 1.68 ± 0.27 acres and 1.73 ± 0.40 acres, respectively. Swilling et al. (1998) observed one radio-collared ABM to travel over 328 feet during nightly forays after hurricane Opal to obtain acorns from the scrub dunes. Using radio telemetry, Lynn (2000a) documented an ABM that traveled one mile within a 30-minute period. Moyers and Shea (2002) trapped a male and female CBM that moved about 637 feet and 2,720 feet in one night, respectively. Gore and Schaefer (1993) documented a marked Santa Rosa beach mouse crossing SR 399, a two-lane highway. Lynn and Kovatch (2004) through mark and recapture trapping documented PKBM that crossed SR 292, a two-lane highway and right-of-way (100-feet wide).

Sneckenberger (2001) found significant seasonal differences in the movement of ABM, and suggested that this was a result of seasonal fluctuations in food availability, food quality, and nutritional needs. Smith (2003) found that Santa Rosa beach mice demonstrated an increase in movement as habitat isolation increased suggesting that longer travel distances were needed to obtain necessary resources. Smith also found that Santa Rosa beach mice had a preference for vegetation cover and connectivity, which is likely a behavioral response to increased predation risk in open areas. Thus, while beach mice are able and do travel great distances the travel pathways should have vegetated cover and no large gaps or open areas. Previous connectivity research suggests critical thresholds exist for species persistence in fragmented landscapes (With and Crist 1995). As fragmentation increases and connectivity is lost, species' ability to move through and between habitats is reduced in a nonlinear fashion.

Foraging

Beach mice are nocturnal and forage for food throughout the dune system. Beach mice feed primarily upon seeds and fruits, and appear to forage based on availability and have shown no preferences for particular seeds or fruits (Moyers 1996). Beach mice also eat small invertebrates, especially during late spring and early summer when seeds are scarce (Ehrhart 1978; Moyers 1996). Research suggests that the availability of food resources fluctuates seasonally in Gulf Coast coastal dune habitat, specifically that the frontal dunes appear to have more species of high quality foods, but these sources are primarily grasses and annuals that produce large quantities of

small seeds in a short period of time. Foods available in the scrub consist of larger seeds and fruits that are produced throughout a greater length of time and linger in the landscape (Sneckenberger 2001). Nutritional analysis of foods available in each habitat revealed that seeds of plant species in both habitats provide a similar range of nutritional quality.

Population dynamics

Population size

Estimating animal abundance or population size is an important and challenging scientific issue in wildlife biology (Otis et al. 1978; Pollock et al. 1990). A number of different census methods are available to estimate wildlife populations, each with particular benefits and biases. Beach mouse surveys involve live trapping mark-recapture studies, which is a common method with small mammals. A five-night minimum trapping period has been standard practice since 1987 for Gulf Coast beach mice. Data from such surveys have been analyzed using various methods with differing degrees of accuracy and bias, as number of individuals captured, minimum number known alive, number captured per 100 trap nights (**Table 11**), or a mathematically modeled statistical population estimate (program CAPTURE, Otis et al. 1978). As the referenced trapping events were not designed similarly or using a standardized sampling techniques, data should not compared between subspecies or trapping events, nor should densities (mice per 100 trap nights) be inferred beyond the trapping area during that trapping session.

Table 11. Beach mouse trapping sessions and population density estimates.

Subspecies	Location	Reference	Dates of trapping	Number of mice per 100 trap nights	Range (mice per 100 trap nights)
PKBM	Florida Point, Gulf State Park	Moyers et al. (1999)	1995 – 1999	2.37	0.00 – 8.33
PKBM	GINS- Perdido Key Area	Moyers et al. (1999)	1995 – 1999	1.12	0.00 – 3.50
PKBM	Perdido Key State Park	Lynn and Kovatch (2004)	2002	3.0	0.9 – 4.0
PKBM	Perdido Key State Park	Lynn and Kovatch (2004)	2003	4.5	3.19 – 6.25
PKBM	GINS - Perdido Key Area	Lynn and Kovatch (2004)	2002	10.5	5.5 – 19.2
PKBM	GINS - Perdido Key Area	Lynn and Kovatch (2004)	2003	4.38	3.93 – 4.75
PKBM	Perdido Key State Park	FWC/Loggins (2006)	2005	0.3	0.3
PKBM	GINS - Perdido Key Area	FWC/Loggins (2006)	2005	5.5	5.5
PKBM	Perdido Key State Park	FWC/Loggins (2006)	2006	0.6	0.6

Subspecies	Location	Reference	Dates of trapping	Number of mice per 100 trap nights	Range (mice per 100 trap nights)
CBM	Shell Island	Humphrey and Barbour (1981)	1979	8.60	NA
CBM	Shell Island	Meyers (1983)	1982	3.20	NA
CBM	Shell Island	Moyers et al. (1999)	1996	9.11	5.33 - 15.33
CBM	Topsail Hill Preserve State Park	Moyers et al. (1999)	1995 - 1998	0.68	0.23 - 2.21
CBM	Grayton Beach State Park - central unit	Moyers et al. (1999)	1995 - 1998	1.87	0.67 - 2.13
CBM	Shell Island		2002	1.06	NA
CBM	West Crooked Island Tyndall AFB	Lynn (2002a)	2002	0.72	0.13 - 1.86
CBM	Topsail Hill Preserve	Lynn (2002b, c)	2002	0.89	0.7 - 1.08
CBM	WaterSound	St. Joe Company (2004)	2003	1.66	1.66
CBM	WaterColor	St. Joe Company (2004)	2003	0	NA
CBM	WaterColor	St. Joe Company (2005)	2004	0	NA
CBM	WaterSound	St. Joe Company (2005)	2004	0	NA
CBM	Topsail Hill Preserve	US FWS (2005a, b, c)	2005	2.35	0.9 – 4.5
CBM	WaterColor	St. Joe Company (2006)	2005	0	NA
CBM	WaterSound	St. Joe Company (2006)	2005	0	NA
CBM	Topsail Hill Preserve	US FWS (2006a)	2006	1.75	1.75
CBM	Topsail Hill Preserve	US FWS (2006a)	2006	0	NA
CBM	WaterSound	St. Joe Company (2006)	2006	4.7	4.5 - 4.8
SABM	St. Joe Peninsula State Park	Moyers et al. (1999)	1997 - 1998	3.56	3.36 - 3.69
SABM	East Crooked Island, Tyndall AFB	Moyers et al. (1999)	1998	3.44	2.13 - 4.75
SABM	East Crooked Island, Tyndall AFB	Lynn (2000b)	2000	6.55	
SABM	East Crooked Island, Tyndall AFB	Lynn (2002e)	2002	6.83	
SABM	St. Michael's Landing	Moyers and Shea (2002)	2001	5.02	0.30 - 9.73
SABM	St. Michael's Landing	St. Joe Company (2005)	2001	3.7	0.26 - 7.1
SABM	St. Michael's Landing	St. Joe Company (2005)	2002	5.9	5.9
SABM	Bonfire Beach	St. Joe Company (2005)	2005	6.13	4.3 – 8.0

Population densities of beach mice typically reach peak numbers in the late autumn into spring (Rave and Holler 1992; Holler et al. 1997). Peak breeding period occurs in fall and winter, apparently coinciding with the increased availability of seeds and fruits from the previous growing season. Seasonal and annual variation in size of individual populations may be great (Rave and Holler 1992; Holler et al. 1997). Food supplementation studies showed that old field mouse populations increased when foods were abundant; thus, populations of old field mice appear to be food-limited (Smith 1971; Galindo-Leal and Krebs 1998). Similar studies have not been conducted with beach mouse populations.

Gulf Coast Beach Mice

In 1979, Humphrey and Barbour (1981) estimated about 515 CBM existed on Topsail Hill and Shell Island. That estimate was used during the Federal listing of the CBM in 1985. Population estimates using CAPTURE on Shell Island from February 1993 to March 1994, ranged from 105 to 338 CBM on a 23-acre study area (Novak 1997). Just prior to Hurricane Opal in 1995, it was estimated that Shell Island supported 800 to 1,200 CBM (Gore, FWC 1999 pers. communication). Three years following Hurricane Opal in June 1998, one trapping effort at six different sites on Shell Island resulted in a cumulative population estimate of 195 CBM (164 CBM captured) (Moyers et al. 1999). The east portion of the island was trapped from 2000 to 2003. Population estimates ranged between 24 and 67 CBM (Lynn 2004a). At Topsail Hill Preserve State Park, trapping conducted in March 2003 and March 2005 yielded a population estimate of 190 to 250 CBM (Service 2003a, 2003d; Sneckenberger 2005), during which a total of 26 mice were translocated to the WaterSound development adjacent to Deer Lake State Park. Trapping in 2006 has yielded too few captures to calculate a population estimate. Population estimates from trapping at Grayton Beach State Park (main unit) from 1995 to 2000, ranged from 25 to 116 CBM (Moyers et al. 1999; Van Zant 2000). The central unit was trapped for 3 nights in August 2002; however, no mice were captured (Lynn 2002d). Limited tracking surveys were accomplished in 2003 and 2004 and beach mouse tracks were observed (Kovatch 2003; Toothacker 2004). The western area, although it provides CBM habitat, has not been documented as occupied by CBM (Moyers et al. 1999; Van Zant 2000). The population estimates for the WaterColor development for the two years prior to and one year following development ranged from 3 to 7 CBM (The St. Joe Company 1999). CBM were last captured in February of 2001 at WaterColor; quarterly trapping has continued on the site in 2003 (St. Joe/Arvida 2003). Auburn University trapped West Crooked Island in October 2000, and the Service trapped the area in 2001 to 2003. The population estimate ranged from a low of 174 to a high of 244 CBM (Lynn 2000b, 2002a, 2003b, 2003c, 2003d). The Service estimated the total population of CBM in 2003, to be about 600 to 1,000 beach mice.

Since its listing in 1985, PKBM population estimates never reached more than 400 to 500 individuals until 2003. Before Hurricane Ivan (2004) a population estimate of 500 to 800 was divided between two populations - the Johnson Beach Unit of Gulf Islands National Seashore (GINS) and Perdido Key State Park (PKSP)(Service 2004). The status of PKBM at Gulf State Park – Florida Point (GSP) is uncertain, possibly extirpated in 1999. In October 2005, following the active hurricane seasons of 2004 and 2005, a trapping effort of less than one-third of the habitat available on public lands yielded captures of less than 30 individuals. Tracking data from

June 2006 indicated that about 25 and 32 percent of the available habitat was occupied at PKSP and GINS, respectively (Loggins 2007). Trapping at PKSP and GINS in March 2007, was cancelled after one night after the capture of only one mouse (a fatality) and very limited sightings of beach mouse sign (tracks, burrows) (Loggins 2007).

The SABM even at its lowest population probably numbered several hundred individuals (Gore as cited in 63 FR 70055). James estimated (1992) that the East Crooked Island subpopulation to be about 150. However, by 1996, SABM were no longer found on East Crooked Island. Following Hurricane Opal in 1995, Mitchell et al. (1997) estimated the St. Joe Peninsula State Park population to be between 300 and 500 mice. In November 1997 and January 1998, 19 pairs of SABM were relocated from St. Joseph Peninsula State Park to East Crooked Island, Tyndall Air Force Base (Moyers et al. 1999). Trapping surveys conducted on East Crooked Island in 2000 and 2002 indicated that beach mice occupied the entire island. Population estimates ranged from 71 to 133 mice (Lynn 2002e). A current overall population estimate for SABM post hurricane seasons of 2004 and 2005 is between 500 to 700 mice.

Atlantic Coast Beach Mice

Populations of the SEBM have been estimated to be around 5000 to 6000 mice. Recent surveys have confirmed that SEBM are found on the beaches of Canaveral National Seashore, Merritt Island NWR, and CCAFS in Brevard County, all on federally protected lands. In April 2002, a population of SEBM was documented at the Smyrna Dunes Park, at the north end of New Smyrna Beach (Sauzo 2004). Prior to 2006, populations of the SEBM were thought extirpated from both sides of the Sebastian Inlet (Bard, FDEP 2004 pers. communication). However, during surveys in June 2006, a single mouse was located at the very southern end of the Sebastian Inlet State Park. Mice were also found at Jungle Trail on the Pelican Island National Wildlife Refuge, another area where they were thought extirpated. Additional surveys of other areas south of Brevard County have not located any mice and indicate the distribution of this subspecies in the counties south of Brevard, severely fragmented. SEBM are no longer believed to occur at Jupiter Island, Palm Beach, Lake Worth, Hillsboro Inlet or Hollywood Beach (Service 1999).

Although the distribution of the AIBM has declined significantly, particularly in the northern part of its range, the populations at Anastasia State Park and Fort Matanzas National Monument have continued to fluctuate seasonally between two and 90 mice per acre. It is thought that populations should be characterized by a range rather than a static value (Humphrey and Frank 1992b). Quarterly surveys of these two sites have shown that the populations have remained stable. Due to the limited dune habitat at the Park, this population has not been able to maintain a stable population and it is unknown how many mice remain.

Population variability

Beach mouse populations fluctuate on a seasonal and annual basis. Attempts to explain population dynamics have revealed an incomplete understanding of the species and its population cycles. It is clear that beach mice, like all rodents, are known for high reproductive rates and experience extreme highs and lows in population numbers. Depressed beach mouse

populations may be associated with tropical storms and drought, perhaps resulting from reduced habitat and food resources. These fluctuations can be a result of reproduction rates, food availability, habitat quality and quantity, catastrophic events, disease, and predation (Blair 1951; Bowen 1968; Smith 1971; Hill 1989; Rave and Holler 1992; Swilling et al. 1998; Swilling 2000).

Population stability

Population viability analysis (PVA) is essentially a demographic modeling exercise to predict the likelihood a population will continue to exist over time (Groom and Pascual 1997). The true value in using this analytical approach is not to determine the probability of a species' extinction, but to clarify factors that have the most influence on a species' persistence. From 1996 to 1999, the Service funded Auburn University to develop a PVA for beach mice (Holler et al. 1999; Oli et al. 2001). Four subpopulations of Gulf Coast beach mice subspecies were modeled. They consisted of two subpopulations of PKBM, one at GINS-Perdido Key Area and one at Florida Point, and two subpopulations of ABM, one at Bon Secour NWR and one at Ft. Morgan State Park. They used a stochastic (random) differential equation (Wiener-drift) model, applied to long term demographic data. The model is "stochastic" because it incorporates the variable effects of the environment upon population change. However, it did not model the effects of hurricanes on the habitat or population of beach mice.

The Oli et al. (2001) analyses indicated that all four subpopulations were at risk of extinction, with habitat fragmentation as the most influential factor. The GINS-Perdido Key Area had the highest risk for extinction; the PKBM had a 100 percent chance of reaching one individual (becoming functionally extinct) within 21 (mode) or 45 (median) years. At Florida Point, the PKBM had a low risk of becoming functionally extinct (1.3 percent) within 13 to 20 years. However, following Hurricane Opal in 1995, and subsequent predation pressure, the PKBM population at Florida Point was believed extirpated in 1999. This localized extirpation clearly demonstrates that while PVA's are useful in determining significant factors in species survival, they have limited use in predicting the time to extinction for a given species.

More recently, the Conservation Breeding Specialist Group (Traylor-Holzer 2004, 2005, 2006) was contracted by the Service to conduct a population and habitat viability analysis (PHVA) on ABM using the Vortex population simulation model (Lacy and Kreeger 1992). The goal was to develop an ABM population model and use the model to assess the status of the ABM habitat and populations and projections for continued existence. The PHVA results project the ABM to have a $26.8\% \pm 1.0\%$ likelihood of extinction over the next 100 years. Much of this risk is due to hurricane impacts on ABM populations and habitat which can result in population declines. The model suggests that hurricanes are a driving force for ABM populations, both directly and indirectly as their impacts interact with other factors, including development of higher elevation (scrub) habitat and predation by cats. Due to the similarities in the subspecies and proximal location, it can be inferred that these factors also have a strong influence on the persistence of PKBM populations. (Again, when reviewing PHVA results, it is crucial that the actual values for the risk of extinction are not the focus of the interpretation. The true value of a PHVA is the ability to compare management strategies and development scenarios, run sensitivity analyses, and determine the main influence(s) on population persistence.)

Similar to the land use arrangement on Perdido Key, the Fort Morgan Peninsula (occupied by ABM) consists of three areas of public lands separated by two areas of private lands, which allow for limited (varied) dispersal between the public lands. The current level of dispersal between public lands through private lands is unknown, but is affected by development and habitat degradation. Without dispersal between public lands through private lands, the PHVA results project the ABM to have a $41.2 \text{ percent} \pm 1.1 \text{ percent}$ likelihood of extinction. If all privately-owned habitat between the public lands is lost, the likelihood of extinction increases to $46.8 \text{ percent} \pm 1.1 \text{ percent}$. Again, it can be inferred that a similar increase in risk of extinction would occur with the PKBM if dispersal could not occur through private lands.

Despite the similarities in the subspecies, it is important to note that carrying capacity (K), which was found to be a strong influence on the model, would be different in PKBM. For ABM, K was estimated using maximum ABM density estimates (4.5 to 11.6 ABM per acre) and acres of habitat (2,989 acres). As density estimates for PKBM would likely be lower, and remaining PKBM habitat is less than 1,300 acres, the Vortex model for PKBM would likely project a greater likelihood of extinction.

The Service contracted with The Georgia Cooperative Fish and Wildlife Research Unit to critique the PVAs for the ABM accomplished by Oli et al. (2001) and Conservation Breeding Specialist Group (Traylor-Holzer 2005). Conroy and Runge (2006) indicated that neither PVA provided reliable estimates of extinction probability for ABM. They recommended that future PVA work should incorporate sampling, temporal, and possibly spatial variance for input variables and should clearly and explicitly express uncertainty in extinction output. Until this can be done, reliable estimates of extinction probability for the ABM (and other beach mouse subspecies) cannot be estimated.

Species that are protected across their ranges have lower probabilities of extinction (Soulé and Wilcox 1980). Beach mouse populations naturally persist through local extirpations due to storm events or the harsh, stochastic nature of coastal ecosystems. Historically, these areas would be recolonized as population densities increase and dispersal occurs from adjacent populated areas. In addition, from a genetic perspective, beach mice recover well from population size reductions (Wooten 1994), given sufficient habitat is available for population expansion after the bottleneck occurs. As human development has fragmented the coastal dune landscape, beach mice can no longer recolonize along these areas as they did in the past (Holliman 1983). As a continuous presence of beach mice or suitable habitat along the coastline is no longer possible and any hurricane can impact the entire range of each subspecies, the probability of beach mice persisting would be enhanced by the presence of contiguous tracts of suitable habitat occupied by multiple independent populations (Shaffer and Stein 2000). The history of the PKBM alone illustrates the need for multiple populations (a now potentially extirpated population was the source of the two remaining populations of the subspecies) (Holler et al. 1989, 71 FR 60238). While maintaining multiple populations of beach mouse subspecies provides protection from total loss (extinction), especially when migration and relocations are possible (Oli et al. 2001), conservation of each subspecies necessitates protection of genetic variability throughout their ranges (Ehrlich 1988). Preservation of natural populations is therefore crucial, as the loss of a population of beach mice can result in a permanent loss of alleles (Wooten 1999 et al.). This loss of genetic variability cannot be regained through translocations or other efforts.

Status and Distribution

The distribution of all the beach mouse subspecies is significantly reduced from their historic ranges due to modification and destruction of the coastal dune ecosystem they inhabit. Habitat loss and alteration was likely a primary cause of the extinction of one subspecies, the Pallid beach mouse, which was endemic to barrier beach between Matanzas and Ponce de Leon inlets in Volusia and Flagler counties (Humphrey 1992a).

Atlantic Coast Beach Mice

The distribution of the SEBM has declined significantly, particularly in the southern part of its range. Historically, it was reported to occur along about 174 miles of Florida's central and southeast Atlantic coast from Ponce (Mosquito) Inlet, Volusia County, to Hollywood Beach, Broward County (Hall 1981). Bangs (1898) reported it as extremely abundant on all the beaches of the east peninsula from Palm Beach at least to Mosquito (Ponce) Inlet. During the 1990s, the SEBM was reported only from Volusia County (Canaveral National Seashore); in Brevard County (Canaveral National Seashore, Kennedy Space Center/Merritt Island NWR, and CCAFS); a few localities in Indian River County (Sebastian Inlet SRA, Treasure Shores Park, and several private properties), and St. Lucie County (Pepper Beach County Park and Fort Pierce Inlet SRA) (Humphrey et al. 1987; Robson 1989; Land Planning Group, Inc. 1991; Humphrey and Frank 1992b; Service 1993). The SEBM is geographically isolated from all other subspecies of *P. polionotus*.

Populations of the SEBM are still found on the beaches of Canaveral National Seashore, Merritt Island NWR, and CCAFS in Brevard County, all on federally protected lands. In April 2002, a population of SEBM was documented at the Smyrna Dunes Park, at the north end of New Smyrna Beach (A. Sauzo, University of Central Florida 2004 pers. communication). Populations from both sides of Sebastian Inlet appear to be extirpated (A. Bard, FDEP 2004 pers. communication).

The status of the species south of Brevard County is currently unknown. The surveys done during the mid-1990s indicate the distribution of this subspecies in the counties south of Brevard was severely limited and fragmented. There are not enough data available to determine population trends for these populations. These surveys revealed that it occurred only in very small numbers where it was found. In Indian River County, the Treasure Shores Park population experienced a significant decline in the 1990s, and it is uncertain whether populations still exist at Turtle Trail or adjacent to the various private properties (D. Jennings, Service 2004 pers. communication). Trapping efforts documented a decline from an estimated 300 individuals down to numbers in the single digits. In 2006, a population off Jungle Trail at Pelican Island National Wildlife Refuge was discovered (Van Zant, University of Central Florida 2006 pers. communication). No beach mice were found during surveys in St. Lucie County and it is possible that this species is extirpated there. The SEBM no longer occurs at Jupiter Island, Palm Beach, Lake Worth, Hillsboro Inlet or Hollywood Beach (Service 1999).

The primary reason for the significant reduction in the range of the SEBM is the loss and alteration of coastal dunes. Large-scale commercial and residential development on the coast of

Florida has eliminated SEBM habitat in the southern part of its range. This increased urbanization has also increased the recreational use of dunes, and harmed the vegetation essential for dune maintenance. Loss of dune vegetation results in widespread wind and water erosion and reduces the effectiveness of the dune to protect other beach mouse habitat. In addition to this increased urbanization, coastal erosion is responsible for the loss of the dune environment along the Atlantic coast, particularly during tropical storms and hurricanes. The extremely active 2004 hurricane season had a pronounced affect on Florida's Atlantic coast beaches and beach mouse habitat.

The encroachment of residential housing onto the Atlantic coast also increases the likelihood of predation and harassment by feral or uncontrolled cats and dogs. A healthy population of SEBM on the north side of Sebastian Inlet SRA in Brevard County was completely extirpated by 1972, presumably by feral cats (A. Bard, FDEP 2004 pers. communication). Urbanization of coastal habitat could also lead to potential competition of beach mice with house mice and introduced rats.

The distribution of the beach mouse is limited due to modification and destruction of its coastal habitats. On the Atlantic coast of Florida, the AIBM and the SEBM were federally listed as endangered and threatened, respectively, in 1989 (54 FR 20602). One additional Atlantic coast subspecies, the pallid beach mouse (*P. p. decoloratus*), was formerly reported from two sites in Volusia County, but extensive surveys provide substantial evidence that this subspecies is extinct (Humphrey and Barbour 1981).

The distribution of the AIBM has declined significantly, particularly in the northern part of its range. Historically, it was reported to occur from the vicinity of the Duval-St. Johns County line southward to Matanzas Inlet, St. Johns County, Florida (Humphrey and Frank 1992a). It currently occurs only on Anastasia Island, primarily at the north (Anastasia State Park) and south (Fort Matanzas National Monument) ends of the island, although beach mice still occur at low densities in remnant dunes along the entire length of the island (Service 1993). The original distribution consisted of about 50 linear miles of beach; current populations occupy about 14 linear miles of beach with possibly only 3 miles supporting viable populations (Service 1993).

In 1992 to 1993, 55 AIBM (27 females and 28 males) were reintroduced to GMTNERR-Guana River in St. Johns County. In 1993, the population was estimated at 220 mice. The reintroduction has been successful this far, despite several hurricanes and northeasterly storms that have caused erosion.

The primary reason for the significant reduction in the range of the AIBM is the loss and alteration of coastal dunes. Large-scale commercial and residential development on the coast of Florida has eliminated AIBM habitat in the northern two-thirds of its range. This increased urbanization has also increased the recreational use of dunes, and harmed the vegetation essential for dune maintenance. Loss of dune vegetation results in widespread wind and water erosion and reduces the effectiveness of the dune to protect other beach mouse habitat. In addition to this increased urbanization, coastal erosion is responsible for the loss of the dune environment along the Atlantic coast, particularly during tropical storms and hurricanes. The extremely active 2004

hurricane season had a severe affect on Florida's Atlantic Coast beaches and beach mouse habitat.

The encroachment of residential housing onto the Atlantic Coast also increases the likelihood of predation by domestic cats and dogs. Anastasia State Park has successfully reduced feral cat populations at the recreation area and has seen a benefit to the beach mice. Urbanization of coastal habitat could also lead to potential competition of beach mice with house mice and introduced rats.

Gulf Coast Beach Mice

PKBM populations have existed since the late 1970s as isolated populations along its historic range (16.9 miles). The effects of hurricane Frederic (1979) coupled with increased habitat fragmentation due to human development led to the extirpation of all but one population of PKBM. The less than 30 individuals at Gulf State Park (at the westernmost end of Perdido Key) were once the only known existing population of PKBM (Holler et al. 1989). Beach mice from this site were used to reestablish PKBM at Gulf Islands National Seashore (GINS) between 1986 and 1988 (Holler et al. 1989). Then in 1999 the population at Gulf State Park was considered extirpated (Moyers et al. 1999). In 2000, 10 PKBM (5 pairs) was relocated from GINS to Perdido Key State Park. In February of 2001, this relocation was supplemented with an additional 32 PKBM (16 pairs). The PKBM were released on both north and south sides of SR 292 in suitable habitat. Two years of quarterly survey trapping indicated that the relocations of PKBM to PKSP were successful and this was considered an established population (Lynn and Kovatch 2004). PKBM were also trapped on private land between GINS and PKSP in 2004, increasing documentation of current occurrences of the mouse (Lynn 2004b). Based on the similarity of habitat between these areas and the rest of Perdido Key, as well as the continuity of the habitat, the mouse is believed to inhabit other private properties where suitable habitat exists north and south of SR 292. The PKBM is considered to occur on 42 percent of Perdido Key (1,227 acres of 2,949 acres) (**Table 12**).

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Table 12. Perdido Key beach mouse habitat on Perdido Key in Florida and Alabama – 2007 estimate¹.

Area	Total in AL & FL		Total in Florida		Total in Alabama	
	Acres	Percent	Acres	Percent	Acres	Percent
Perdido Key	2,949	100	2,615	89	334	11
PKBM habitat	1,293	100	1,146	88	148	12
Private lands	1,440	49	1,278	43	162	5
PKBM habitat	303	23	270	24	33	3
Public lands	1,509	51	1,337	45	172	6
			GINS		GSP	
			1,052		172	
			PKSP			
			285			
PKBM habitat	990	76	876	67	114	9
			GINS		GSP	
			638		114	
			PKSP			
			238			

¹Data calculated by U.S. Fish and Wildlife Service Panama City, Florida using 2004 State of DOQQ aerial photography, 2005 parcel data from Baldwin County, AL and 2005 parcel data from Escambia County, Florida and revised June 2006.

The listing of PKBM was based on data collected in 1983-84, and at that time the mouse was recovering from the effects of Hurricane Frederick in 1979. Following Hurricane Frederick estimated population numbers based on trapping were 13 PKBM found at one location (Gulf State Park). Just prior to listing, only one PKBM was captured in trapping surveys, this again being at Gulf State Park. Since that time, numbers have fluctuated dramatically based on hurricanes and/or translocation efforts, but were at their highest estimate ever documented just prior to Hurricane Ivan in 2004 at between 500-800 individuals. This was a result of significant partnership efforts and included translocation and habitat restoration on public lands. Even with the destructive hurricanes of the last two years, current numbers of PKBM, while low (no population estimates are available), are greater than one mouse and mice have been confirmed from two areas (PKSP and GINS). Survey efforts (tracking and trapping) have also been sporadic and inconsistent; therefore, it is difficult to establish long term trend information at this time.

CBM sub-populations currently persist along approximately 15 miles of Gulf of Mexico shoreline consisting of four isolated areas along 11 miles of beachfront within its former range. Another five miles outside of the CBM's known historic range has been recently colonized (Lynn, 2000a, 2003a). In the 1950s, the CBM was widespread and abundant at that time according to Bowen (1968). By 1979, Humphrey and Barbour (1981) reported only 40 percent of the original habitat remained undeveloped in non-contiguous areas. They also documented that the CBM had been extirpated from seven of its nine historical localities being restricted to the Topsail Hill area in Walton County and Shell Island in Bay County. In 1985 when the CBM became federally protected, CBM were still only known from the Topsail Hill area and Shell Island, an area consisting of about ten miles of coastline (50 FR 23872). In 1989, a cooperative

interagency effort reintroduced CBM onto the central and west units of Grayton Beach State Park increasing the occupied coastline by another mile (Holler and Mason 1989). In 1999, with the closing of East Pass and Shell Island connecting to West Crooked Island, CBM increased their range by approximately four miles (Lynn 2000b). CBM are now known to occupy approximately 15 miles of Gulf of Mexico beachfront; 12 of the 15 miles are publicly owned lands.

There are four sub-populations of CBM that currently exist: 1) Topsail Hill Preserve State Park (and adjacent eastern and western private lands), 2) Shell Island (includes St. Andrew State Park mainland and Shell Island with private inholdings and Tyndall Air Force Base), 3) Grayton Beach (and adjacent eastern private lands), and 4) West Crooked Island. Approximately 96 percent of the lands known to be occupied by CBM are public lands. Translocations to establish a fifth sub-population of CBM occurred in March of 2003 and 2005. CBM from Topsail Hill Preserve State Park were moved to private lands at Camp Creek/WaterSound in Walton County, Florida (Lynn 2003a; Service 2005b, 2005c, 2005d, and 2005e).

Topsail Hill Preserve State Park consists of 1,637 acres of which 262 acres provide CBM habitat; the majority being occupied by CBM (**Table 3**). The Florida Park Service prepared a Unit Management Plan for the Preserve that explicitly plans for conservation and protection of CBM habitats (FDEP 2000). Private lands on the east side consist of approximately 9.63 acres. Of that, 7 acres consist of the development known as the Stallworth Preserve. The Service issued an ITP for CBM to the Stallworth Preserve development in 1995; an amendment to the permit was issued in 1999. The remaining 2.63 acres has been purchased by Walton County with a grant from the Service. Private lands on the west side of the Preserve consist of 24 acres and include Four-Mile Village, a low density single family development, and the Coffeen Nature Preserve managed by the Sierra Club.

Shell Island consists of lands within the St. Andrew State Park, Tyndall Air Force Base, and private lands. The Unit Management Plan for the State Park was completed in 1999. The plan identifies the need for protection and management of the CBM. Tyndall Air Force Base manages their portion of Shell Island under the installation's Integrated Natural Resources Management Plan. The Service has joined with the State Park and Tyndall AFB since 1995 by providing funding to protect and restore CBM habitats on Shell Island.

The St. Andrew State Park mainland consists of 1,260 acres of which 123 acres are beach mouse habitat. Several tracking efforts looking for signs of CBM on the mainland were made between 1995 and 1998; no evidence was found that indicated the presence of the beach mouse (Moyers et al. 1999). However, live-trapping to document the absence of the mouse has not been conducted. Reintroduction of this area is considered an action to support recovery of CBM.

The Grayton Beach subpopulation consists of two units in Grayton Beach State Park. The Park is divided into a central and western unit and is currently connected by a narrow band of primary dunes. Total acreage of the Park is 2,236 acres with 153 acres providing suitable CBM habitat. The Unit Management Plan for the Park identified the protection of the CBM as an important component. The Park has requested and received funds from the Service to implement CBM habitat restoration and protection. Portions of private lands (WaterColor and Seaside

developments) on the east side of the central unit are occupied by CBM or provide suitable habitat.

West Crooked Island consists of 1,558 acres of which 730 acres provide CBM habitat and remains occupied by CBM (Lynn 2004a). The West Crooked Island subpopulation resulted from its connection to Shell Island in 1998 -1999. The construction of the St. Andrew Pass navigation inlet in the early 1930s severed Shell Island from the mainland on its western end. Since then, the original pass, East Pass (or Old Pass) began to close. After passage of Hurricane Opal in 1995, East Pass temporarily closed and reopened; however, after passage of hurricanes Earl and Georges in 1998, the pass closed (Coastal Tech 1999; Middlemas 1999). CBM dispersed onto West Crooked Island from Shell Island colonizing most of the island within two years (Lynn 2004a). East Pass was reopened as a joint venture between Tyndall Air Force Base and Bay County in December of 2001 but has since closed again.

The passage of the Hurricane Ivan resulted in CBM sub-populations being affected by impacts resulting from a category 1 hurricane. Erosion of the beach and dunes occurred with the primary dunes being eroded with blow outs occurring in areas usually noted as weak points along the dune systems including areas such as coastal dune lake outlets. In the blow out areas overwash of vegetation was evident. Trapping conducted on private lands indicate CBM survived on the WaterSound property in Walton County, Florida and reproduction was ongoing (Moyers 2005 pers. communication). Preliminary and subsequent tracking and trapping on State Parks indicate that CBM survived the hurricane with tracks being observed in the secondary and scrub dune habitat at Topsail Hill Preserve State Park (Service 2005e; Suydan 2005 pers. communication).

SABM is now known to consist of two sub-populations, East Crooked Island and St. Joseph Peninsula State Park. The majority of the East Crooked Island sub-population is located on Tyndall AFB and the other on the St. Joseph Peninsula State Park. Other important public lands for the conservation of the mouse would include Eglin Air Force Base lands at Cape San Blas and Billy Joe Rish Park (**Table 3**). Private lands adjacent to Tyndall AFB and the State Park are either known to be occupied by SABM or contain habitat. Trapping by St Joe/Arvida on about 111 acres of SABM habitat at East Crooked Island was conducted in 2000, 2001, and 2003. The trapping confirmed existence of SABM on the property (Moyers and Shea 2002). However, trapping their property in St. Joe Beach did not result in capture of any beach mice (Moyers and Shea 2002). Although SABM is thought to continue to occupy habitat south of St. Joseph Peninsula State Park, only tracking has been conducted to confirm its presence on private lands since the late 1990s. Private lands adjacent to public lands are available for population dispersal and food source during periods of high population and after severe weather events. However, subpopulations on large tracts of private land within the historic range of the subspecies are needed for conservation of the SABM.

Land development has been primarily responsible for the permanent loss of SABM habitat along its approximate 40-mile historic range. In addition, construction of U.S. highway 98 accelerated the habitat loss from associated development. By the mid 1990's only about 12 linear miles were known to be occupied (Gore 1994; Gore 1995), indicating a 68 percent reduction in its historic distribution (63 FR70053). An effort to re-establish the SABM back into its historic range was initiated around the time of listing (Moyers et al. 1999); however, the range reduction

described above did not take this into account since the success of the re-introduction was not known at the time (63FR70053). Similar analyses have not been conducted since.

Our best documentation of the species' decline can be seen from trapping and/or tracking surveys conducted at various times throughout its range. By the mid to late 1980s, concerns were raised when trapping efforts failed to result in captures at West Crooked Island (Gore 1987). By 1990 the SABM appeared to only inhabit a small portion (approximately 11 linear miles) of its original range: west end of East Crooked Island and within St. Joseph Peninsula State Park (Gore 1990). SABM's apparent decline continued into the mid-1990s when in 1994, the population on East Crooked Island was "presumed to be extinct" (Wooten and Holler 1999), leaving only one known population on St. Joseph Peninsula (Moyers et al. 1999). Subsequent reintroduction efforts in 1997-1998 appeared to have re-established the population on East Crooked Island (Moyers et al. 1999).

The passage of hurricane Ivan resulted in SABM subpopulations being affected by impacts resulting from a category 1 hurricane. Erosion of the beach and dunes occurred with the primary dunes being eroded with blow outs occurring in areas usually noted as weak points along the dune systems including areas such as coastal dune lake outlets. In the blow out areas, overwash of vegetation was evident. Tracking conducted by State Park personnel since the hurricane indicate that SABM survived the hurricane with tracks being observed in the secondary and scrub dune habitat, however, no trapping has occurred since the hurricane.

Recovery criteria

The Recovery Plan (Service 1993) for the SEBM identifies the primary recovery objectives for the subspecies. For the SEBM to be considered for delisting, it is required that there be viable populations on the five public land areas where the subspecies occur. Each population should not fluctuate below an effective breeding size of 500 individuals. Five additional viable populations shall be established throughout the historic range of the subspecies. These populations should be monitored for at least 5 years before considering delisting.

The Recovery Plan (Service 1993) for the AIBM identifies the primary recovery objectives for the subspecies. For the AIBM to be considered for downlisting to threatened, it is required that those populations at the northern and southern end of Anastasia Island continue to be viable. Each population should support a breeding population of 500 individuals. Two additional viable populations shall be established within the mainland portion of the historic range. All of these populations should be monitored for 5 years.

The Recovery Plan for the PKBM, CBM, and ABM (Service 1987) identifies the primary recovery objectives to be the stabilization of present populations by preventing further habitat deterioration, and the re-establishment of populations in areas where they were extirpated. For each of the subspecies to be considered for downlisting to threatened, it is required that there be a minimum of at least three distinct self-sustaining populations in designated critical habitat with at least 50 percent of the critical habitat being protected and occupied by beach mice (Service 1987).

While this is the currently approved Recovery Plan for the three beach mouse subspecies, studies and research since the Recovery Plan publication has provided additional information concerning recovery needs for the subspecies. Protection and enhancement of existing populations and their habitat, plus reestablishment of populations in suitable areas within their historic ranges, are necessary for the subspecies survival and recovery. Core beach mouse populations remain isolated and are vulnerable to natural and anthropogenic factors that may further reduce or degrade habitat and/or directly reduce beach mouse population sizes. Maximizing the number of independent populations is critical to species survival. Protection of a single, isolated, minimally viable population risks the extirpation or extinction of a species as a result of harsh environmental conditions, catastrophic events, or genetic deterioration over several generations (Kautz and Cox 2001). To reduce the risk of extinction through these processes, it is important to establish multiple protected populations across the landscape (Soule and Simberloff 1986; Wiens 1996). Through the critical habitat designation process we are addressing this by designating five independent units for the subspecies spaced throughout its historic range, depending on the relative fragmentation, size, and health of habitat, as well as availability of areas with beach mouse primary constituent elements.

A draft Recovery Plan for the SABM is currently being prepared.

In accordance with the Act, the Service completes consultations with federal agencies (including ourselves) for actions that may adversely affect beach mice and their designated habitat. In Florida consultations have included military missions and operations, beach nourishment and other shoreline protection, and actions related to protection of coastal development (**Table 13**).

Table 13. Previous biological opinions within Florida that have been issued for projects that had adverse impact to the nesting beach mice.

PROJECT	YEAR	IMPACT (Habitat/critical habitat/individuals)
PKBM GINS Dune Protection	2000	0.01 acre
PKBM translocation to PKSP	2000	≤ 3 beach mice
PKBM supplemental translocation to PKSP	2003	≤ 3 beach mice
PKBM FEMA Berm Orange Beach, AL	2003	0.14 acre
PKBM FWS scientific collecting permit program	2004- 2005	1 beach mouse per 400 trap-nights per area
PKBM Florencia Development (within Action Area)	2005	3.5 acres
PKBM PKSP Re-build	2005	1.99 acres

PROJECT	YEAR	IMPACT (Habitat/critical habitat/individuals)
PKBM FEMA Berm Emergency consultation (within Action Area)	2005	Consultation not complete
PKBM GINS road rebuild	2005	1.7 acres
PKBM Magnolia West Development (within Action Area)	2006	5.2 acres
PKBM Palazzo Development	2006	0.58 acre
PKBM Searinity Development	2006	0.32 acre
PKBM Retreat Development	2006	0.21 acre
PKBM Bond Residence	2006	0.17 acre
CBM Stallworth Preserve Development	1995	7 acres
CBM Navy Panama City Beach site 4 construction	2000	0.01 acre
CBM East Pass Re-opening	2001	Temporary, indirect take
CBM WaterColor and WaterSound Developments	2000	7.6 acres
CBM FWS scientific collecting permit	2004-2005	1 beach mouse per 400 trap-nights per area
CBM FEMA beach berms post hurricane Ivan emergency consultation	2005	Consultation not complete
CBM Western Lake Reopening consultation	2006	2.7 acres annually for five years
AIBM Sea Colony Development	1998	0.7 acres
Anastasia State Park beach nourishment (AIBM)	2004	50 linear feet
Cape Canaveral Air Force borrow source (SEBM)	2007	Project pending
SEBM FWS scientific collecting permit program	2004-2005	1 beach mouse per 400 trap-nights per area
AIBM FWS scientific collecting permit program	2004-2005	1 beach mouse per 400 trap-nights per area
Kennedy Space Center Dune Restoration	2008	710 linear feet

Threats

Habitat Loss or Degradation

Coastal dune ecosystems are continually responding to inlets, tides, waves, erosion and deposition, longshore sediment transport, and depletion, and fluctuations in sea level. The location and shape of barrier island beaches perpetually adjusts to these physical forces. Winds move sediment across the dry beach forming dunes and the island interior landscape. The natural communities contain plants and animals that are subject to shoreline erosion and deposition, salt spray, wind, drought conditions, and sandy soils. Vegetative communities include foredunes, primary and secondary dunes, interdunal swales, sand pine scrub, and maritime forests. During storm events, overwash is common and may breach the island at dune gaps or other weak spots, depositing sediments on the interior and backsides of islands, increasing island elevation and accreting the sound shoreline. Breaches may result in new inlets through the island.

The quality of the dune habitat (primary, secondary, and scrub) is an important factor in maintaining and facilitating beach mouse recovery. Habitat manipulation is an old and widely used tool in wildlife management. It is especially useful in improving habitat suitability to increase local populations of a species. For beach mice, improving habitat can enhance the abundance and diversity of food resources, increase the chances of meeting a mate, and reduce competition for food and burrow sites.

Long-term trapping data has shown that beach mouse densities are cyclic and fluctuate by magnitudes on a seasonal and annual basis. These fluctuations can be a result of reproduction rates, food availability, habitat quality and quantity, catastrophic events, disease, and predation (Blair 1951; Bowen 1968; Smith 1971; Hill 1989; Rave and Holler 1992; Swilling et al. 1998; Swilling 2000; Sneckenberger 2001). Without suitable habitat sufficient in size to support the natural cyclic nature of beach mouse populations, subspecies are at risk from local extirpation and extinction, and may not attain the densities necessary to persist through storm events and seasonal fluctuations of resources.

Habitat loss and fragmentation associated with residential and commercial real estate development is the primary threat contributing to the endangered status of beach mice (Holler 1992a, 1992b; Humphrey 1992). Coastal development has fragmented all the subspecies into disjunct populations. Isolation of habitats by imposing barriers to species movement is an effect of fragmentation that equates to reduction in total habitat (Noss and Csuti 1997). Furthermore, isolation of small populations of beach mice reduces or precludes gene flow between populations and can result in the loss of genetic diversity. Demographic factors such as predation (especially by domestic cats), diseases, and competition with house mice, are intensified in small, isolated populations, which may be rapidly extirpated by these pressures. Especially when coupled with events such as storms, reduced food availability, and/or reduced reproductive success, isolated populations may experience severe declines or extirpation (Caughley and Gunn 1996). The influence these factors have on populations or individuals is largely dependent on the degree of isolation.

The conservation of multiple large, contiguous tracts of habitat is essential to the persistence of beach mice. At present, large parcels exist mainly on public lands. Protection, management, and recovery of beach mice on public areas have been complicated by increased recreational use as public lands are rapidly becoming the only natural areas left on the coast. Public lands and their staff are now under pressure to manage for both the recovery of endangered species and recreational use. Where protection of large contiguous tracts of beach mouse habitat along the coast is not possible, establishing multiple independent populations is the best defense against local and complete extinctions due to storms and other stochastic events (Danielson 2005). Protecting multiple populations increases the chance that at least one population within the range of a subspecies will survive episodic storm events and persist while vegetation and dune structure recover.

Habitat connectivity also becomes essential where mice occupy fragmented areas lacking one or more habitat types. If scrub habitat is lacking from a particular tract, adjacent or connected tracts with scrub habitat are necessary for food and burrow sites when resources are scarce in the frontal dunes, and are essential to beach mouse populations during and immediately after hurricanes. Trapping data suggests that beach mice occupying the scrub following hurricanes recolonize the frontal dunes once vegetation and some dune structure have recovered (Swilling et al. 1998; Sneckenberger 2001). Similarly, when frontal dune habitat is lacking from a tract and a functional pathway to frontal dune habitat does not exist, beach mice may not be able to attain the resources necessary to expand the population and reach the densities necessary to persist through the harsh summer season or the next storm. Functional pathways may allow for natural behavior such as dispersal and exploratory movements, as well as gene flow to maintain genetic variability of the population within fragmented or isolated areas. To that end, contiguous tracts or functionally connected patches of suitable habitat are essential to the long-term conservation of beach mice.

A lack of suitable burrow sites may be a consequence of habitat degradation. Beach mice use burrows to avoid predators, protect young, store food, and serve as refugia between foraging bouts and during periods of rest. Beach mice have been shown to select burrow sites based on a suite of abiotic and biotic factors. A limitation in one or more factors may result in a shortage of suitable sites and the availability of potential burrow sites in each habitat may vary seasonally. Beach mice tend to construct burrows in areas with greater plant cover, less soil compaction, steep slopes, and higher elevations above sea level (Lynn 2000a; Sneckenberger 2001). These factors are likely important in minimizing energy costs of burrow construction and maintenance while maximizing the benefits of burrow use by making a safe and physiologically efficient refuge. Similar to food resources, this fluctuation in availability of burrow sites suggests that a combination of primary, secondary and scrub dune habitat is essential to beach mice at the individual level.

Predation

Beach mice have a number of natural predators including coachwhip (*Masticophis flagellum*) and corn snakes (*Elaphe guttata guttata*), pygmy rattlesnake (*Sistrurus miliarius*), and Eastern diamondback rattlesnake (*Crotalus adamanteus*), short-eared (*Asio flammeus*) and great-horned

owls (*Bubo virginianus*), great blue heron (*Ardea herodias*), northern harrier (*Circus cyaneus*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*) skunk (*Mephitis mephitis*), weasel (*Shallela frenata*), and raccoon (*Procyon lotor*) (Blair 1951; Bowen 1968; Holler 1992a; Novak 1997; Moyers et al. 1999; Van Zant and Wooten 2003). Predation in beach mouse populations that have sufficient recruitment and habitat availability is natural and not a concern. However, predation pressure from natural and non-native predators may result in the extirpation of small, local populations of beach mice.

Free-roaming and feral pets are believed to have a devastating effect on beach mouse persistence (Bowen 1968; Linzey 1978) and are considered to be the main cause of the loss of at least one population of beach mice (Holliman 1983). Cat tracks have been observed in areas of low trapping success for beach mice (Moyers et al. 1999). The PHVA for the ABM indicated that if each population had as few as one cat which ate one mouse a day, rapid extinction occurred in over 99 percent of all iterations (Traylor-Holzer 2005).

In response to increasing depredation of sea turtle nests and shorebird nests/young by coyote, fox, hogs, and raccoon, multi-agency cooperative efforts to control predator populations on important coastal wildlife habitats have been initiated and are ongoing throughout Florida, in particular on public lands. These programs also benefit beach mice.

Hurricanes

Hurricanes can severely affect beach mice and their habitat, as tidal surge and wave action overwash habitat, leaving a flat sand surface denuded of vegetation; sand is deposited inland, completely or partially covering vegetation; blowouts between the ocean and bays and lagoons leave patchy landscapes of bare sand; primary dunes are sheared or eroded; and habitat is completely breached, creating channels from the ocean to bays and lagoons. Other effects include direct mortality of individuals, relocation/dispersal, and subsequent effects of habitat alterations (that impact such factors as forage abundance/production and substrate elevation). Habitat impacts can be widespread, encompassing the range of the subspecies.

Until frontal dune topography and vegetation redevelop, scrub habitat maintains beach mice populations and provides the majority of food resources and potential burrow sites (Lynn 2000a; Sneckenberger 2001). While storms temporarily reduce population densities (often severely), this disturbance regime maintains open habitat and retards plant succession, yielding a habitat more suitable for beach mice than one lacking disturbance. The low-nutrient soil of the coastal dune ecosystem often receives a pulse of nutrients from the deposition of vegetative debris along the coastline (Lomascolo and Aide 2001). Therefore, as the primary and secondary dunes recover, beach mice recolonize this habitat readily as food plants develop to take advantage of the newly available nutrients. Recovery times vary depending upon factors such as hurricane characteristics (*i.e.*, severity, amount of associated rain, directional movement of the storm eye, storm speed), successional stage of habitat prior to hurricane, elevation, and restorative actions post hurricane. Depending on these factors, recovery of habitat may take from one year to over 40 years.

The impact of hurricanes on plant communities temporarily affects food availability, and hence can limit population densities in impacted habitats soon after storms. Observations indicate that Hurricane Opal (a Category 3 storm in November 1995) caused a decrease in one population of ABM by 30 percent (Swilling 2000). However, population densities in scrub habitat typically increased following hurricanes (Swilling 2000). Sneckenberger (2001) also found atypical numbers of ABM in scrub following a hurricane. Five months post-storm, “densities (individuals/km) were up to 7.5 times greater in scrub areas than in frontal dune grids.” Impacts of the storm may have been apparent as long as 17 months after the storm when scrub densities remained triple those of frontal dunes (Sneckenberger 2001). Moyers et al. (1999) found similar results for CBM at Grayton Beach State Park. When frontal and primary dunes sustained extensive damage during Hurricane Opal in 1995, beach mice were captured behind what remained of primary dune habitat. By 1998, however, primary dunes and the immediate habitat inland appeared to support higher numbers of beach mice.

In addition to the overall change in post Hurricane Opal distribution of ABM, Swilling et al. (1998) found the mean percent of newly marked individuals increased from 14 percent for the three trapping periods before the storm to an average of 26.7 percent for the same interval post hurricane. The average for the three trapping periods immediately following was even higher, at 42.7 percent of the individuals captured. Swilling et al. (1998) concluded that this increased presence of new individuals reflected increased reproduction. A statistical analysis of the data indicated that the number of females exhibiting signs of reproduction was significantly higher than normal (18.9 percent higher). Moyers et al. (1999) also found similar results at Topsail Hill Preserve State Park. Four to five months following Hurricane Opal, all female CBM captured were pregnant or lactating. Trapping six months after the hurricane, Moyers et al. (1999) noted that 51.5 percent of captured CBM were new unmarked beach mice.

Although hurricanes can significantly alter beach mouse habitat and population densities in certain habitats, some physical effects may benefit the subspecies. Hurricanes are probably responsible for maintaining coastal dune habitat upon which beach mice depend through repeated cycles of destruction, alteration, and recovery of dune habitat. Holler et al. (1999) suggested that hurricanes could function to break up population subgroups and force population mixing. The resultant breeding between members of formerly isolated subgroups increases genetic heterogeneity and could decrease the probability of genetic drift and bottlenecks.

Beachfront Lighting

Artificial lighting increases the risk of predation and influences beach mouse foraging patterns and natural movements as it increases their perceived risk of predation. Foraging activities and other natural behaviors are influenced by many factors. Artificial lighting alters behavior patterns causing beach mice to avoid otherwise suitable habitat and decreases the amount of time they are active (Bird et al. 2004). The presence of vegetative cover reduces predation risk and perceived predation risk of foraging beach mice, and allows for normal movements, activity, and foraging patterns. Foraging in sites with vegetative cover is greater and more efficient than in sites without cover (Bird 2002). Beach mice have also been found to select habitat for increased percent cover of vegetation, and decreased distance between vegetated patches (Smith 2003).

Genetic variability

Selander et al. (1971) conducted an electrophoretic study on 30 populations of *P. polionotus*, including populations of beach mouse subspecies. Based on 30 allozyme loci, they estimated that the level of allozyme variation found in beach mouse populations was at least 40 percent lower than the level of variation in nearby inland populations. This work indicates that beach mouse populations already have lower genetic variability before inbreeding, bottleneck events, or founder effects that may occur in a reintroduced population. Lower levels of heterozygosity has been linked to less efficient feeding, fewer demonstrations of social dominance and exploratory behavior, and smaller body size (Smith et al. 1975; Garten 1976; Teska et al. 1990). Research focused on inbreeding depression in old-field mice (including one beach mouse subspecies), determined that the effects of inbreeding negatively influenced factors such as litter size, number of litters, and juvenile survivorship (Lacy et al. 1995).

In 1995, the Service contracted with Auburn to conduct genetic analysis of: 1) post-re-establishment gene structure in PKBM and CBM; 2) microgeographic patterning and its relevance to alternate management approaches for ABM on the Bon Secour NWR; and 3) if feasible, the historical relationship of SABM from Crooked Island relative to CBM from Shell Island and SABM from St. Joseph Peninsula.

Results of the work for CBM found: 1) founder effects were observed in the Grayton Beach State Park population (fixation of alleles common to the donor population and allele frequency shifts); 2) incongruity in number and size of several alleles was observed between Grayton Beach State Park and Shell Island; 3) overall genetic divergence between the donor and re-established population was moderate; 4) genetic differences between Topsail Hill Preserve State Park and other CBM sites were higher than expected given the spatial proximity; 5) Topsail Hill Preserve State Park appears to be a reservoir for unique variation within the remaining populations of CBM; and 6) the overall relatedness estimated for Grayton Beach State Park suggested that any mating would involve close relatives (Wooten and Holler 1999).

Wooten and Holler (1999) recommended strategies for management of CBM based on genetics. Management of the Grayton Beach State Park population for genetic characteristics appears to be needed; however, additional genetic analyses will be needed. Relocation of CBM to Grayton Beach State Park from Shell Island should be continued.

Results of the work for PKBM found that: 1) founder effect (from Florida Point to GINS) did impact the GINS-Perdido Key Area subpopulation. Loss of rare alleles and allele frequency shifts were noted; 2) a low to moderate level of overall genetic divergence was observed; 3) data suggests that some effects of genetic drift were mediated by continued transfer of individuals; 4) levels of heterozygosity were unexpected given recent history; 5) average levels of relatedness among individuals is high which may portend future inbreeding related problems (however, no evidence of existing inbreeding was observed in the data); and 6) the overall level of microsatellite variation retained in the GINS-Perdido Key Area subpopulation was higher than anticipated. Wooten and Holler (1999) recommended management of PKBM based on genetics by: 1) preserving the natural population to the maximum extent possible since the loss of the Florida Point subpopulation resulted in the permanent loss of alleles; 2) using the GINS-Perdido

Key Area subpopulation as a donor for re-establishment of other populations because of the retention of a substantial amount of genetic variation; and 3) reestablishment plans should include transfers between donor and reestablished subpopulations. In addition, translocations should be accomplished in pairs.

Analysis of genetic work focused on SABM indicated that there are two genetic histories for Crooked Island beach mice: 1) The last known beach mice from Crooked Island were derived from CBM or 2) the last known beach mouse from Crooked Island were unique from both CBM found on Shell Island or SABM found on St. Joseph peninsula possibly being some type of hybrid where the gene flow events did not occur at the same time (Van Zant 2003).

Analysis of the species/critical habitat likely to be affected

Beach mice are currently federally protected because of their low numbers caused by habitat loss with continuing threats to their habitat (including critical habitat for CBM, PKBM, and SABM) and resulting affects from storm events. The primary reason for the significant reduction in their range is the loss and alteration of coastal dunes. Large-scale commercial and residential development on the coast of Florida has eliminated beach mouse habitat. Coastal urbanization has also increased the recreational use of beachfront areas. Dune habitat maintenance is an important component of beach mouse conservation. Providing a healthy and continuous dune system assures mouse population stability. Integral to this is keeping beach goers off the dunes and replanting as necessary when impacts occur or are observed. The extremely active 2004 and 2005 hurricane seasons also had a severe affect on Florida's beaches and beach mouse habitat.

Critical habitat for three (PKBM, CBM, and SABM) of the five subspecies of beach mice has been designated in the continental United States and will be discussed. No critical habitat has been designated in the continental United States for the other two subspecies (SEBM and AIBM). Therefore, the proposed action would have no effect on designated critical habitat for these two subspecies because none is designated.

Generally, emergency berm repair and construction is not placed on existing beach mouse habitat consisting of vegetated dunes. Typical effects from these activities to beach mice and their habitats consist of the staging and storage of equipment, work vehicles, or materials and beach access for emergency berm repair and construction. These effects may result in the permanent and temporary loss, degradation, or fragmentation of beach mouse habitat and changes in essential life history behaviors (dispersal and movement, foraging, seeking mates, breeding, and care of young). Other activities that have affected the conservation of beach mice and required consultation with the Service are included in the Service's overall evaluation of the current status of each subspecies and listed in **Table 13**.

ENVIRONMENTAL BASELINE

Status of the species/critical habitat within the Action Area (all subspecies of beach mice)

The Action Area encompasses the entire ranges and designated critical habitats of the five beach mouse subspecies. Therefore, the previous discussion in "Status of the Species" applies here.

Factors affecting the species environment within the action area (all subspecies of beach mice)

Coastal development

Beach mice were listed as an endangered and threatened species primarily because of the fragmentation, adverse alteration and loss of habitat due to coastal development. The threat of development-related habitat loss continues to increase. Other contributing factors include low population numbers, habitat loss from a variety of reasons (including hurricanes), predation or competition by animals related to human development (cats and house mice), and the existing strength or lack of regulations regarding coastal development.

Hurricanes

Hurricanes were probably responsible for maintaining coastal beach habitat upon which beach mice depend through repeated cycles of destruction, alteration, and recovery of dune habitat. Hurricanes generally produce damaging winds, storm tides and surges, and rain and can result in severe erosion of the beach and dune systems. Overwash and blowouts are common on barrier islands. Hurricanes can impact beach mice either directly (*e.g.*, drowning) or indirectly (*e.g.*, loss of habitat). Depending on their frequency, storms can affect beach mice on either a short-term basis (*e.g.*, temporary loss of habitat) or long term (*e.g.*, loss of food, which in turn may lead to increased juvenile mortality, resulting in a depressed breeding season). How hurricanes affect beach mice also depends on the characteristics (winds, storm surge, rainfall), the time of year (within or outside of the nesting season), and where the northeast edge of the hurricane crosses land.

Because of the limited remaining habitat, frequent or successive severe weather events could compromise the ability of certain populations of beach mice to survive and recover. Beach mice evolved under natural coastal environmental events such as hurricanes. The extensive amount of pre-development coastal beach and dune habitat allowed beach mice to survive even the most severe hurricane events. It is only within the last 20 to 30 years that the combination, of habitat loss to beachfront development and destruction of remaining habitat by hurricanes, has increased the threat to beach mice survival and recovery. On developed beaches, typically little space remains for sandy beaches to become re-established after periodic storms. While the beach itself moves landward during such storms, reconstruction or persistence of structures at their pre-storm locations can result in a major loss of habitat for beach mice.

The 2004 hurricane season was the most active storm season in Florida since weather records began in 1851. Hurricanes Charley, Frances, Ivan, and Jeanne, along with Tropical Storm Bonnie, damaged the beach and dune system, upland structures and properties, and infrastructure in the majority of Florida's coastal counties. The cumulative impact of these storms exacerbated erosion conditions throughout the state.

Beachfront Lighting

Artificial lighting along developed areas of the both coastlines continues to cause concern for beach mouse recovery. While a majority of coastal local governments and Counties have adopted beachfront lighting ordinances compliance and enforcement is lacking in some areas. Further, the lighting in areas outside the beachfront ordinance coverage areas continues to have unregulated lighting resulting in urban glow. Even the darker areas of conservation managed lands are subject to being surrounded by the sky glow.

Predation

A major continuing threat to beach mice is predation by cats and other non-native species. The domestic cat *Felis catus* is not native to North America and is considered a separate species from its wild ancestral species, *Felis silvestris*. Cats are hunters, retaining this behavior from their ancestors. However, wildlife in the western Hemisphere did not evolve in the presence of a small, abundant predator like the domestic cat, and thus did not develop defenses against them. Cats were introduced to North America a few hundred years ago.

Free-ranging pet and feral cats prey on small mammals, birds, and other native wildlife. In the U.S., on a nationwide basis, cats kill over a billion small mammals and hundreds of millions of birds each year. Worldwide, cats are second only to habitat destruction in contributing to the extinction of birds. Cats have been documented to take beach mice, sea turtle hatchlings, shorebirds, and migratory birds. A significant issue in the recovery of beach mice is predation by free-ranging pet and feral cats. Beach mice have a number of natural predators including snakes, owls, herons, and raccoons. Predation is part of the natural world. However, predation pressure from both natural and non-native predators in combination with other threats may result in the extirpation of small, local populations of beach mice in a very short time.

EFFECTS OF THE ACTION

Factors to be considered

Emergency berm construction and repair will occur within habitat that is used by beach mice year round. The activities include the storage of equipment, work vehicles, or materials and creation, expansion, or use of beach access points for emergency berm construction and repair. The work, depending on the location may be conducted any time of the year. While most effects would be expected to be temporary, long-term and permanent impacts from the activities could include the loss of beach mice from excavation of dune habitat and degradation and fragmentation of beach mice habitat including critical habitat for the PKBM, CBM, and SABM. Short-term and temporary impacts could include loss of foraging habitat and altering beach mouse movement and dispersal activities.

There are typically different "levels" of access sites needed for a project. The primary access is a "lay-down" yard, where storage trailers, and other equipment and materials are stored. These are typically big paved parking lots, so that the contractor's trucks can access the area to drop off and pick up equipment. If the berm material source will be from an offshore or navigation channel

source, the use of pipes may be needed to transport the material to the beach. There's typically a beach access at that point to get the pipe and equipment onto the beach and that access is usually at least 50-ft wide (the pipes are frequently 40- to 50-ft sections). In NW Florida and Alabama these yards have been approximately 8 miles apart.

"Intermediate areas" are used at about the quarter points of the project length. These are used for the fuel tank, welding equipment, and other items or systems that get used a couple of times a day. These locations can vary from two to three miles apart.

Then there are access points to allow project vehicles and trucks on and off the beach. Based on previous projects it would be expected to have single-vehicle entry points at one-half to one-mile mile intervals.

Protective, avoidance, and minimization measures have been incorporated into the project plan to avoid or minimize the potential impacts from the emergency berm repair and construction activities. However, even with these measures, impacts to beach mice are expected to occur from some aspects of the project activities. The activities are expected to directly or indirectly adversely affect beach mice and/or their habitat including designated critical habitat for the PKBM, CBM, and SABM. The work may occur on public and/or private lands.

Proximity of action: Some aspects of the emergency berm construction and repair activities would occur directly in beach mouse habitat. The storage or staging of equipment, and vehicles, use or creation of beach access points, and placement of sand could occur in habitat occupied or used by SEBM, AIBM, PKBM, CBM, and SABM. Beach mice spend their entire life cycle within the coastal dune system.

Distribution: The storage of equipment and vehicles and use of beach access points that could occur in habitat occupied or used by SEBM, AIBM, PKBM, CBM, and SABM may vary depending on the individual project length and existing beach accesses and non-beach mouse habitat that can be used for storage and staging.

Timing: The timing of the activities would directly and indirectly impact beach mice and their habitat during all seasons as beach mice are permanent residents of coastal dune habitats. Beach mice reproduce year round with more mice being produced in the late winter and early spring. Impacts could include but would not be limited to disrupting mice seeking mates, constructing nest burrows, foraging for food, caring for their young and young mice leaving the nest burrow dispersing into new habitat.

Nature of the effect: The effects of the activities may include the loss of a few beach mice from excavation of habitat for beach access and reduction of beach mouse activity including feeding, reproduction, and movement from loss or alteration of habitat. Activities that decrease the amount or quality of dune habitat or movement could affect beach mice by reducing the amount of available habitat and fragmenting the habitat.

Duration: The emergency berm construction and repair will be done only in emergency situations. The berms are constructed to withstand 5-year storms. Thus, they are not expected to

remain on the beach for very long. Time to complete the project construction may vary depending on the project length, weather, and other factors (contractor and equipment availability, regulatory permitting). However, it is anticipated for most projects work could take from a week to 30 days to complete. Beach mouse habitats could remain disturbed until the project is completed and the habitats are restored.

Disturbance frequency: Depending on the emergency berm construction and repair, this could result in impacts to beach mice and their habitats at any time during the year. Following initial emergency berm repair and construction, activities could occur every year depending on the project location and emergency event (weather). The programmatic consultation will be reviewed every 5 years or sooner if new information concerning the projects or protected species occurs. The actual number of times the emergency berm repair and construction would occur is unknown and dependent on weather events.

Disturbance intensity and severity: Depending on the frequency needed to conduct the emergency berm construction and repair and the existence of staging areas and beach access points, effects to the recovery of beach mice may vary. However, the Action Area encompasses the entire of the range of each species and the overall intensity and depending on the number and size of the emergency events the berm projects could encompass each subspecies entire range. The length of time the project would occur would minimize disturbance of beach mice.

The staging and storage of equipment and materials and beach access points could occur within habitat occupied or used by SEBM, AIBM, PKBM, CBM, and SABM and could be adjacent to designated critical habitat for the PKBM, CBM, and SABM. Beach mice are permanent inhabitants of the coastal ecosystem conducting all their life cycles in this environment. While the current status of individual beach mouse subspecies is not specifically known, their general distribution is known.

Analyses for effects of the action

The Action Area consists of the Atlantic or Gulf beachfront including the dry unvegetated beach, developing foredunes, and areas that were formerly primary or secondary dunes. Beach mice would generally be found inhabiting stable primary, secondary, and scrub dunes on a permanent basis with other habitats being used periodically on a daily or seasonal basis for feeding and movement. Some of these areas also include designated critical habitat. The primary constituent elements for PKBM, CBM, and SABM critical habitat include the following.

1. A contiguous mosaic of primary, secondary and scrub vegetation and dune structure, with a balanced level of competition and predation and few or no competitive or predaceous nonnative species present, that collectively provide foraging opportunities, cover, and burrow sites.
2. Primary and secondary dunes, generally dominated by sea oats, that, despite occasional temporary impacts and reconfiguration from tropical storms and hurricanes, provide abundant food resources, burrow sites, and protection from predators.

3. Scrub dunes, generally dominated by scrub oaks, that provide food resources and burrow sites, and provide elevated refugia during and after intense flooding due to rainfall and/or hurricane induced storm surge.
4. Functional, unobstructed habitat connections that facilitate genetic exchange, dispersal, natural exploratory movements, and recolonization of locally extirpated areas.
5. A natural light regime within the coastal dune ecosystem, compatible with the nocturnal activity of beach mice, necessary for normal behavior, growth and viability of all life stages.

Direct and Indirect Impacts

Direct impacts are effects of the action on the species occurring as the project is implemented during the construction phase of the project. Direct loss of individual beach mice may temporarily occur during the creation or expansion of beach access points when heavy equipment clears the habitat and packs the sand. In general the length of time between disasters (berm reconstruction work) is expected to be sufficient for beach mouse habitat to be restored. Thus, it is not anticipated that the emergency berm construction and repair activity would result in permanent beach mouse habitat destruction (including critical habitat). However, habitat for all the beach mouse subspecies and designated critical habitat for the PKBM, CBM, and SABM that provides food or cover may be temporarily destroyed or altered from the activities.

Indirect effects are caused by or a result from the proposed action, are later in time and are reasonably certain to occur. The indirect effect of emergency berm construction and repair activities would include newly created or expanded existing beach access points that act as barriers to beach mouse movement for foraging, population expansion or dispersal. Maintaining the connectivity among habitats is vital to persistence of beach mice recovery. Recovery actions needed to assure the connectivity include restoration and maintenance of the dune system following project completion.

For the Service to determine if the project impacts on critical habitat would be an adverse modification, we shall determine if the impact on the habitat appreciably diminishes the capability of the critical habitat to satisfy essential requirements of beach mice with designated critical habitat. The long-term maintenance of the beach mouse populations in the project areas could be compromised if the emergency berm construction and repair activities occur too frequently resulting in a long-term barrier to mice movement. However, our evaluation indicates the impacts to critical habitat should be temporary in nature based on past history of emergency berm repair and construction projects. In addition, the area to be directly affected within the individual subspecies ranges would be a small percentage of the overall critical habitat and would not be expected to reduce the carrying capacity of the recovery unit or appreciably diminish the ability of the PCE's to provide for the essential functions of the critical habitat units.

Species' response to a proposed action

This BO is based on effects that are anticipated to beach mice (all life stages) as a result of the temporary physical disturbance of beach mouse habitat from the emergency berm repair and construction activities. Some beach mice (all life stages) may be lost during the initial construction or expansion of beach accesses where heavy equipment destroys dune habitat and compacts the sand within the access corridor. Any mice that survive the initial construction may move outside of the disturbed area and construct burrows elsewhere in the vicinity. Following access construction, a bare gap of sand could form a barrier to limit beach mouse movement within the area altering regular movement patterns. These impacts are expected to be limited to the construction phase of the project (a week to 30 days). Thus, effects would be short term in nature with the potential for one generation of mice to be lost (female mice can reproduce approximately every 26 days).

Beach mice have evolved to adapt to catastrophic weather events, while additional factors such as surrounding development pressure and non-native predators may affect the species' ability to recover from the loss of individuals and temporary habitat impacts. However, the temporary loss of the habitat itself is not expected to permanently impact the populations as no beach mouse habitat within the project areas would be permanently destroyed. Additionally, all temporary habitat loss would be restored and/or maintained as part of the conservation measures committed to by the local sponsors or the Applicants. The temporary nature of the impacts to dune habitats are not expected to alter the function and conservation role of the remaining beach mouse habitat, including designated critical habitat.

PIPING PLOVER

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/critical habitat description

The piping plover is a small, pale sand-colored shorebird, about seven inches long with a wingspan of about 15 inches (Palmer 1967). On January 10, 1986, the piping plover was listed as endangered in the Great Lakes watershed and threatened elsewhere within its range, including migratory routes outside of the Great Lakes watershed and wintering grounds (Service 1985). Piping plovers were listed principally because of habitat destruction and degradation, predation, and human disturbance. Protection of the species under the Act reflects the species' precarious status range-wide. Three separate breeding populations have been identified, each with its own recovery criteria: the northern Great Plains (threatened), the Great Lakes (endangered), and the Atlantic Coast (threatened) (**Figure 17**). The piping plover winters in coastal areas of the U.S. from North Carolina to Texas, and along the coast of eastern Mexico and on Caribbean islands from Barbados to Cuba and the Bahamas (Haig and Elliott-Smith 2004). Information from observation of color-banded piping plovers indicates that the winter ranges of the breeding populations overlap to a degree.

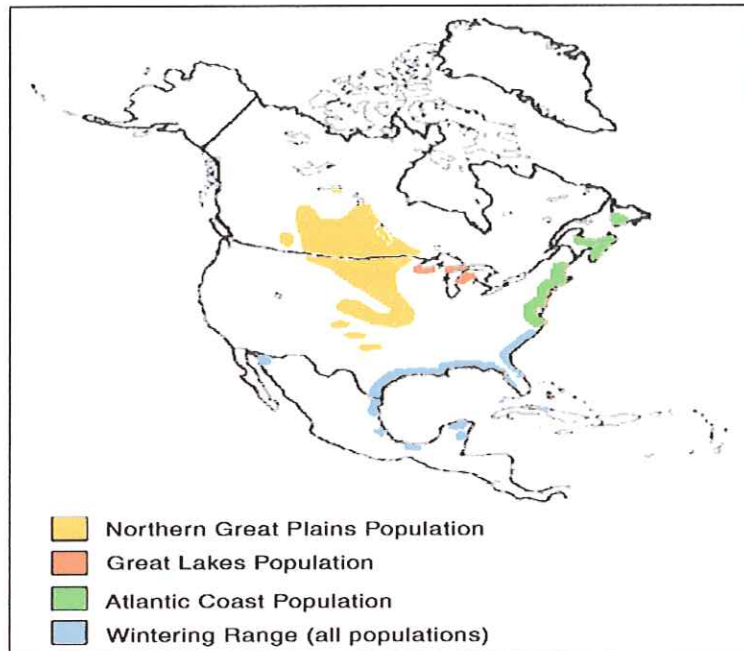


Figure 17. Range of piping plovers.

Natural protection: Cryptic coloration is a primary defense mechanism for this species; nests, adults, and chicks all blend in with their typical beach surroundings. Piping plovers on wintering and migration grounds respond to intruders (pedestrian, avian and mammalian) usually by squatting, running, and flushing (flying).

Foraging/food: Behavioral observation of piping plovers on the wintering grounds suggests that they spend the majority of their time foraging (Nicholls and Baldassarre 1990a; Drake 1999a, 1999b). Feeding activities may occur during all hours of the day and night (Staine and Burger 1994; Zonick 1997), and at all stages in the tidal cycle (Goldin 1993; Hoopes 1993). Wintering plovers primarily feed on invertebrates such as polychaete marine worms, various crustaceans, fly larvae, beetles, and occasionally bivalve mollusks (Bent 1929; Cairns 1977; Nicholls 1989; Zonick and Ryan 1996). They peck these invertebrates on top or just beneath the surface.

Feeding areas: Plovers forage on moist substrate features such as intertidal portions of ocean beaches, washover areas, mudflats, sand flats, algal flats, wrack lines, sparse vegetation, and shorelines of coastal ponds, lagoons, ephemeral pools and adjacent to salt marshes (Gibbs 1986; Zivojnovich 1987; Nichols 1989; Nicholls and Baldassarre 1990a; Nicholls and Baldassarre 1990b; Coutu et al. 1990; Hoopes et al. 1992; Loegering 1992; Goldin 1993; Elias-Gerken 1994; Wilkinson and Spinks 1994; Zonick 1997; Service 2001a). Studies have shown that the relative importance of various feeding habitat types may vary by site (Gibbs 1986, Coutu et al. 1990; McConnaughey et al. 1990; Loegering 1992; Goldin 1993; Hoopes 1993). Cohen et al. (2006) documented more abundant prey items and biomass in sound island and sound beaches than the ocean beach.

Habitat: Wintering piping plovers appear to prefer coastal habitat that include sand flats adjacent to inlets or passes, sandy mud flats along prograding spits (areas where the land rises with respect to the water level), ephemeral pools, and overwash areas as foraging habitats. These substrate types have a richer infauna than the foreshore of high energy beaches and often attract large numbers of shorebirds (Cohen et al. 2006). Wintering plovers are dependent on a mosaic of habitat patches and move among these patches depending on local weather and tidal conditions (Nicholls and Baldassarre 1990a). Drake (1999b) monitored the movement of 48 piping plovers in south Texas for one season. She found, using 95 percent of the documented locations, that these birds had a mean home range of 3,117 acres. Drake (1999b) also noted that the mean linear distance moved per individual bird was 2 miles for the fall through the spring of 1997-1998. Observations suggest that this species exhibits a high degree of wintering site fidelity (Drake et al. 2001; Stucker and Cuthbert 2006).

Migration: Plovers depart their breeding grounds for their wintering grounds from July through late August, but southward migration extends through November. Piping plovers use habitats in the Florida from July 15 through May 15. Both spring and fall migration routes of Atlantic Coast breeders are believed to occur primarily within a narrow zone along the Atlantic Coast (Service 1996). Some mid-continent breeders travel up or down the Atlantic Coast before or after their overland movements (Stucker and Cuthbert 2006). Use of inland stopovers during migration is also documented (Pompei and Cuthbert 2004). Information from observation of color-banded piping plovers indicates that the winter ranges of the breeding populations overlap to a significant degree. Therefore, the source breeding population of a given wintering individual cannot be determined in the field unless it has been banded or otherwise marked. Confirmed sightings from all three breeding populations have been documented in the Florida.

While piping plover migration patterns and needs remain poorly understood and occupancy of a particular habitat may involve shorter periods relative to wintering, information about the energetics of avian migration indicates that this might be a particularly critical time in the species' life cycle. The possibility of lower survival rates for Atlantic Coast piping plovers breeding at higher latitudes (based on relationships between population trends and productivity) suggest that migration stress may substantially affect survival rates of this species (Hecht 2006). The pattern of both fall and spring counts at many Atlantic Coast sites demonstrates that many piping plovers make intermediate stopovers lasting from a few days up to one month during their migrations (Noel et al. 2005; Stucker and Cuthbert 2006). In addition, this species exhibits a high degree of both intra- and inter-annual wintering site fidelity (Nicholls and Baldassarre 1990; Drake et al. 2001; Noel et al. 2005; Stucker and Cuthbert 2006).

The Service has designated critical habitat for the piping plover on three occasions. Two of these designations protected different breeding populations of the piping plover. Critical habitat for the Great Lakes breeding population was designated May 7, 2001 (66 FR 22938, Service 2001a), and critical habitat for the northern Great Plains breeding population was designated September 11, 2002 (67 FR 57637, Service 2002). The Service designated critical habitat for wintering piping plovers on July 10, 2001 (66 FR 36038, Service 2001b). Wintering piping plovers may include individuals from the Great Lakes and northern Great Plains breeding populations as well as birds that nest along the Atlantic coast. The three separate designations of

pipin plover critical habitat demonstrate diversity of constituent elements between the two breeding populations as well as diversity of constituent elements between breeding and wintering populations.

Designated wintering pipin plover critical habitat originally included 142 areas [the rule states 137 units; this is in error] encompassing about 1,793 miles of mapped shoreline and 165,211 acres of mapped areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

Since the designation of wintering critical habitat, 19 units (TX- 3,4,7-10, 14-19, 22, 23, 27,28, and 31-33) in Texas have been vacated and remanded back to the Service for reconsideration by Court order (Texas General Land Office v. U.S. Department of Interior (Case No. V-06-CV-00032)). Four units in North Carolina have been vacated and remanded back to the Service for reconsideration by Court order (Cape Hatteras Access Preservation Alliance v. U.S. Department of Interior (344 F. Supp. 2d 108 (D.D.C. 2004))). The four critical habitat units vacated were NC-1, 2, 4, and 5, and all occurred within Cape Hatteras National Seashore (CAHA). On June 12, 2006, the Service proposed to amend and re-designate these four units as critical habitat for wintering pipin plover (71 FR 33703, Service 2006b), leaving a total of 119 designated critical habitat units and 110,461 acres. The primary constituent elements for pipin plover wintering habitat are those biological and physical features that are essential to the conservation of the species. The primary constituent elements are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. These areas typically include those coastal areas that support intertidal beaches and flats and associated dune systems and flats above annual high tide (Service 2001a). PCEs of wintering pipin plover critical habitat include sand or mud flats or both with no or sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting pipin plovers (Service 2001a). Important components of the beach/dune ecosystem include surf-cast algae, sparsely vegetated back beach and salterns, spits, and washover areas. Washover areas are broad, unvegetated zones, with little or no topographic relief, that are formed and maintained by the action of hurricanes, storm surge, or other extreme wave action. The units designated as critical habitat are those areas that have consistent use by pipin plovers and that best meet the biological needs of the species. The amount of wintering habitat included in the designation appears sufficient to support future recovered populations, and the existence of this habitat is essential to the conservation of the species. Additional information on each specific unit included in the designation can be found at 66 FR 36038 (Service 2001a).

Life history

Pipin plover breeding activity begins in mid-March when birds begin returning to their nesting areas (Coutu et al. 1990; Cross 1990; Goldin 1990; MacIvor 1990; Hake 1993). Plovers are known to begin breeding as early as one year of age (MacIvor 1990; Haig 1992); however, the percentage of birds that breed in their first adult year is unknown. Pipin plovers generally fledge only a single brood per season, but may reneat several times if previous nests are lost.

Demographic models for pipin plovers indicate that even small declines in adult and juvenile survival rates will cause very substantial increases in extinction risk (Melvin and Gibbs 1994;

Amirault et al. 2005). Furthermore, insufficient protection of non-breeding piping plovers and their habitat has the potential to quickly undermine the progress toward recovery achieved at other sites. For example, a banding study conducted between 1998 and 2004 in Atlantic Canada found lower return rates of juvenile (first year) birds to the breeding grounds than was documented for Massachusetts (Melvin and Gibbs 1996, cited in Appendix E, Service 1996), Maryland (Loefering 1992), and Virginia (Cross 1996) breeding populations in the mid-1980s and very early 1990s. This is consistent with failure of the Atlantic Canada population to increase in abundance despite very high productivity (relative to other breeding populations) and extremely low rates of dispersal to the U.S. over the last 15 plus years (Amirault et al. 2005). Simply stated, this suggests that maximizing productivity does not ensure population increases. Management must focus simultaneously on all sources of stress on the population within management control (predators, ORVs, etc.). Drake et al. (2001) evaluated winter piping plover habitat use in Texas and determined they have relatively small home-ranges and high survivorship from arrival in fall through spring departure. Cohen et al. (2006) experienced 100 percent winter survival of radio-tagged birds in a study conducted in North Carolina from December 2005 to March 2006. They speculate their high survival rate was attributed to plovers food availability much of the day as well as the low occurrence of days below freezing and infrequent wet weather.

Piping plovers live an average of five years, although studies have documented birds as old as 11 (Wilcox 1959) and 15 years.

Population dynamics

Northern Great Plains Population

The northern Great Plains plover breeds from Alberta to Manitoba, Canada and south to Nebraska; although some nesting has recently occurred in Oklahoma. Currently the most westerly breeding piping plovers in the United States occur in Montana and Colorado. The northern Great Plains is the largest of the three breeding populations (2006 data report 4,698 birds including the 2,962 in the U.S. (Ryba 2007)). The 2006 International Census reported a substantial increase since 2001 in both the U.S. and Canadian portion of the northern Great Plains breeding population.

Great Lakes Population

The Great Lakes plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario, Canada. Russell (1983) reviewed historical records to estimate the pre-settlement populations of the plover throughout this range. Total population estimates ranged from 492 to 682 breeding pairs in the Great Lakes region. Michigan alone may have had the most plovers with as many as 215 pairs.

The endangered Great Lakes population is at a perilously low level. From an all-time low of 12 nesting pairs in 1990, the population increased to 32 nesting pairs in 1999, 58 nesting pairs in 2005, and 53 pairs in 2006 (Roche 2006). Although the increase from 32 pairs to 58 pairs is very important, this population remains extremely vulnerable due to the low numbers.

Sightings of banded birds in the Great Lakes during the 2005 breeding season indicate that adult mortality during winter 2004-2005 and spring migration 2005 was higher than normal, and this data is supported by a smaller population increase than was expected based on productivity in 2003 and 2004 (Stucker and Cuthbert 2006). Future-year detection of individuals presumed lost may determine that this survival estimate is low, but the apparent increase in mortality has potentially grave implications for survival and recovery of this imperiled population.

Atlantic Coast Population

The Atlantic Coast piping plover breeds on coastal beaches from Newfoundland and southeastern Quebec, Canada to North Carolina. The Atlantic Coast population has increased from 790 pairs since listing to a preliminary estimation of 1,632 pairs in 2005 (Service 2006b). Between 2004 and 2005, Atlantic Coast breeding population abundance estimates declined in the northern and central parts of the range and increased in the south, with an overall decline of approximately 2 percent. The 2005 productivity in the U.S. portion of the Atlantic range was below the long-term average. Atlantic Coast data for 2006 or 2007 are not yet available.

Status and distribution

Non-breeding (migrating and wintering)

Piping plovers winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean. Birds from the three breeding populations overlap in their use of migration and winter habitat. In Florida, the majority of wintering birds on the Gulf Coast are likely to be from the northern Great Plains population, although individuals from the Great Lakes and Atlantic populations have been documented. The majority of the birds using the Atlantic Coast are believed to be from the Atlantic breeding population. Repeated sightings for >8 years of banded Great Lakes birds have documented their use of the coast of the Carolinas, Georgia (Noel et al. 2005), Alabama (Stucker and Cuthbert 2006) and Florida's Atlantic Coast (Leary 2007).

In 2001, 2,389 piping plovers were located during a winter census, accounting for only 40 percent of the known breeding birds recorded during a breeding census (Ferland and Haig 2002). About 89 percent of birds that are known to winter in the U.S. do so along the Gulf Coast (Texas to Florida), while eight percent winter along the Atlantic coast (North Carolina to Florida). Four range-wide population surveys have been conducted for the piping plover; the 1991 (Haig and Plissner 1992), the 1996 (Plissner and Haig 1997), the 2001 (Ferland and Haig 2002) and the 2006. The 2006 International Census results have not yet been published. These four surveys were completed to help determine the species distribution and to monitor progress towards recovery. Table 14 summarizes the results of the wintering census. Total numbers have fluctuated over time with some areas experiencing increases and others decreases. Fluctuations are predominately due to the location, quality, and extent of suitable non-breeding habitat that may vary over time due to regional rainfall and anthropogenic hydrologic manipulation and disturbance. Fluctuations could also represent unequal survey efforts or localized conditions during surveys. The increased numbers of birds counted in Texas in 2006 may reflect a shift of birds away from areas such as the Chandeleur Islands in Louisiana that were negatively impacted

by Hurricane Katrina in 2005 (Cobbs 2006). The increase in the 2006 numbers from the Caribbean is due to increased survey efforts (Maddock 2006).

Table 14. Results of the 1991, 1996, 2001, and unofficial 2006 International Piping Plover Wintering Census.

Location	1991	1996	2001	2006
North Carolina	20	50	87	84
South Carolina	51	78	78	82
Georgia	37	124	111	212
Florida	551	375	416	414
-Atlantic	70	31	111	unk
-Gulf	481	344	305	unk
Alabama	12	31	30	29
Mississippi	59	27	18	78
Louisiana	750	398	511	224
Location	1991	1996	2001	2006
Texas	1,904	1,333	1,042	2,158
Puerto Rico	0	0	6	?
U.S. Total	3,935	2,416	2,299	~3,281
Mexico	27	16	Not surveyed	76
Caribbean	40	83	90	378
GRAND TOTAL	3,451	2,515	2,389	3,735
% of Breeding Census	62.9%	42.4%	40.2%	unknown

The status of piping plovers on winter and migration grounds is difficult to assess, but threats to piping plover habitat used during winter and migration identified by the Service during its designation of critical habitat continue to affect the species. Unregulated motorized and pedestrian recreational use, inlet and shoreline stabilization projects, beach maintenance and nourishment, and pollution affect most winter and migration areas. Conservation efforts at some locations have likely resulted in the enhancement of wintering habitat.

The 2004 and 2005 hurricane seasons affected a substantial amount of habitat along the Gulf Coast. Habitats such as those along Gulf Islands National Seashore have benefited from increased washover events which created optimal habitat conditions for piping plovers. On the flip side, hard shoreline structures are put into place throughout the species range to prevent such shoreline migration (see *Factors Affecting Species Environment within the Action Area*). The Chandeleur Islands, a north-south oriented chain of low-lying islands, located approximately 62 miles east of the city of New Orleans, Louisiana, were impacted by hurricanes Lili (2002), Ivan (2004), Dennis (2005) and Katrina (2005), the strongest and closest in proximity to the Chandeleurs (USGS 2005). Early estimates are that Hurricane Katrina removed about 85 percent of the sand from the beach and dunes of the Chandeleur Islands. It is unknown how much sand is likely to return under natural conditions to rebuild these barrier islands (Williams 2006). The Chandeleur Island Chain was used consistently by piping plovers and was designated critical habitat in 2001.

The Service is aware of the following site-specific conditions that affect the status of several habitats piping plover use while wintering and migrating, including critical habitat units. In Texas, one critical habitat unit was afforded greater protection due to the acquisition of adjacent upland properties by the local Audubon chapter. In another unit in Texas, vehicles were removed from a portion of the beach decreasing the likelihood of automobile disturbance to plovers. In Florida, land acquisition has been initiated within portions of one critical habitat unit in the panhandle. Exotic plant removal is occurring in another Florida critical habitat unit in South Florida that threatens to invade suitable piping plover habitat. The Service remains in a contractual agreement with the USDA for predator control within limited coastal areas in the panhandle, including portions of some critical habitat units. Continued removal of potential terrestrial predators is likely to enhance survivorship of wintering and migrating piping plovers. In North Carolina, one critical habitat unit was afforded greater protection when the local Audubon chapter agreed to manage the area specifically for piping plovers and other shorebirds following the relocation of the nearby inlet channel.

Several projects have resulted in formal consultation for piping plovers or their designated critical habitat in the Florida Panhandle (**Table 15**). Emergency consultation for beach nourishment at Navarre Beach resulted in supplying the permittee with avoidance and minimization measures to lessen the impacts to optimal piping plover habitat that may have been created by the hurricane. Emergency consultations with FEMA for berm placement post Hurricane Ivan, resulted in similar guidance. These projects are complete; however, final consultation is not yet complete. No formal consultations have taken place in South Florida Vero Beach jurisdiction. A few consultations have resulted in formal consultation for piping plovers or their designated critical habitat in Northeast Florida.

Table 15. Biological opinions issued for all projects that had adverse impact to the piping plovers on non-breeding grounds in Florida.

SPECIES Piping plover	YEAR	PROJECT ACTIVE YES/NO
East Pass re-opening	2001	Completed
Amend BO for south jetty extension in Ponce De Leon Navigation Inlet	2003	Completed
Terminal groin and nearshore breakwater on south end of Amelia Island, Nassau, FL	2004	Completed
Eglin AFB INRMP	2002-2007	Consultation ongoing
Pensacola Beach beach nourishment original Amd. 1	2002-2005	Initial completed & hurricane recovery completed
Navarre beach nourishment emergency consultation and Amd. 1-6	2005	Project completed, consultation not completed
Renewal and Amend Volusia County, FL ITP	2005	Consultation complete, actions ongoing
Eglin Santa Rosa Island Programmatic	2005-2007	Consultation ongoing
Tyndall AFB INRMP	2006-2007	Consultation ongoing

SPECIES Piping plover	YEAR	PROJECT ACTIVE YES/NO
St. Joseph Peninsula beach restoration	2007	Consultation complete, project not started
Alligator Point beach nourishment	2007	Consultation complete, project not started
NAS pass dredging and spoil placement	2007	Consultation ongoing

Recovery criteria

Northern Great Plains Population (Service 1994)

1. Increase the number of birds in the U.S. northern Great Plains states to 2,300 pairs.
2. Attain recovery objective of 813 pairs amongst 4 Provinces for Prairie Canada (Goossen et al. 2002).
3. Secure long term protection of essential breeding and wintering habitat.

Great Lakes Population (Service 2003d)

1. At least 150 pairs (300 individuals), for at least 5 consecutive years, with at least 100 breeding pairs (200 individuals) in Michigan and 50 breeding pairs (100 individuals) distributed among sites in other Great Lakes states.
2. Five-year average fecundity within the range of 1.5-2.0 fledglings per pair, per year, across the breeding distribution, and ten-year population projections indicate the population is stable or continuing to grow above the recovery goal.
3. Protection and long-term maintenance of essential breeding and wintering habitat is ensured, sufficient in quantity, quality, and distribution to support the recovery goal of 150 pairs (300 individuals).
4. Genetic diversity within the population is deemed adequate for population persistence and can be maintained over the long-term.
5. Agreements and funding mechanisms are in place for long-term protection and management activities in essential breeding and wintering habitat.

Atlantic Coast Population (Service 1996)

1. Increase and maintain for 5 years a total of 2,000 breeding pairs, distributed among 4 recovery units.
2. Verify the adequacy of a 2,000 pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term.
3. Achieve a 5-year average productivity of 1.5 fledged chicks per pair in each of the 4 recovery units described in criterion 1, based on data from sites that collectively support at least 90 percent of the recover unit's population.
4. Institute long-term agreements to assure protection and management sufficient to maintain the population targets and average productivity in each recovery unit.
5. Ensure long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population.

Threats to Piping Plovers

Predation: Predation has been identified as a major factor limiting piping plover reproductive success but the impact predation has on piping plovers while on migration or wintering grounds is unknown. Substantial evidence exists that human activities are affecting types, numbers, and activity patterns of predators, thereby exacerbating natural predation. Non-native species such as feral cats are considered significant predators on some sites (Goldin et al. 1990; Post 1991). Humans have also indirectly influenced predator populations; for instance, human activities abetted the expansions in the populations and/or range of other species such as gulls (Drury 1973; Erwin 1979). Strauss (1990) found that the density of fox tracks on a beach area was higher during periods of more intensive human use. Predatory birds also are relatively common during their fall and spring migration along the Atlantic Ocean coastline, and there is a possibility they may occasionally take piping plovers.

Weather: Piping plover habitats (breeding and non-breeding) are dependent on natural forces although storms and severe cold weather are believed to take their toll on piping plovers. After an intense snowstorm swept the entire North Carolina coast in late December 1989, high mortality of many coastal bird species was noted (Fussell 1990). Piping plover numbers decreased significantly from about 30 to 40 birds down to 15 birds. While no dead piping plovers were found, circumstantial evidence suggests that much of the decrease was mortality (Fussell 1990). Hurricanes may also result in direct mortality or habitat loss, and if piping plover numbers are low enough or if total remaining habitat is very sparse relative to historical levels, population responses may be impaired even through short-term habitat losses. Wilkinson and Spinks (1994) suggest that, in addition to the unusually harsh December 1989 weather, low plover numbers seen in South Carolina in January 1990 (11 birds, compared with more than 50 during the same time period in 1991 to 1993) may have been influenced by effects on habitat and food availability caused by Hurricane Hugo which came ashore there in September 1989. Hurricane Elena struck the Alabama Coast in September 1985 and subsequent surveys noted a reduction of foraging intertidal habitat on Dauphin and Little Dauphin Islands (Johnson and Baldassarre 1988). Birds were observed foraging at Sand Island, a site that was used little prior to the hurricane.

Vehicles: Vehicles significantly degrade piping plover habitat or disrupt normal behavior patterns. Vehicular and/or pedestrian disturbance that reduces plover use and/or impairs their foraging efficiency on soundside tidal flats is particularly injurious. Multiple studies have shown that bay tidal flats have relatively high indices of arthropod abundance compared with other microhabitats, and that piping plovers select these habitats in greater proportion than their availability (Loefering and Fraser 1995; Cross and Terwilliger 2000; Elias et al. 2000; Houghton et al. 2005). Zonick (2000) found that off road vehicle (ORV) density negatively correlated with abundance of roosting plovers on the ocean beach. Studies elsewhere (Wheeler 1979) demonstrate adverse effects of ORV driving on soundside beaches on the abundance of infauna essential to piping plover foraging requirements.

Recreational Activities: Pedestrian and non-motorized recreational activities can be a source of both direct mortality and harassment of piping plovers. There are a number of potential sources for pedestrians on the beach, including those individuals driving and subsequently parking on the

beach, those originating from off-beach parking areas (hotels, motels, commercial facilities, beachside parks, etc.), and those from beachfront and nearby residences. Essentially, the magnitude of threats to coastal species is particularly significant because vehicles extend impacts to remote stretches of beach where human disturbance would be very slight if access were limited to pedestrians only. Human recreation on coastal habitats can cause adverse impacts on dune formation, vegetation, and the invertebrate and vertebrate fauna.

Elliott and Teas (1996) found a significant difference in actions between piping plovers encountering pedestrians and those not encountering pedestrians. Piping plover not encountering pedestrians spend proportionately less time in active non-foraging behavior. This study suggests that interactions with pedestrians on beaches cause birds to shift their activities from calorie acquisition to calorie expenditure. In winter and migration sites, human disturbance continues to decrease the amount of undisturbed habitat and appears to limit local piping plover abundance (Zonick and Ryan 1996). The disturbance distance for wintering and migrating western snowy plovers in a California study was 98.4 feet for pedestrians and pets, but a higher proportion of pets than pedestrians disturbed plovers (Lafferty 2001).

During spring, summer, and fall months in Florida, recreational boaters find barrier island washover areas and peninsular tips attractive landing spots to spend the day, which may prove an increasing issue for piping plovers especially during migration months. This is particularly true on weekends and holidays.

Dogs: The presence of pets increases disturbance to wintering and migrating piping plovers. Pedestrians have been observed walking their dogs through congregations of feeding shorebirds and encouraging their dogs to chase the birds. Noncompliant pet owners who allow their dogs off leash have the potential to flush piping plovers and these flushing events may be more prolonged than those associated with pedestrians or pedestrians with dogs on leash. A study conducted on Cape Cod, Massachusetts found that the average distance at which piping plovers were disturbed by pets was 150 feet, compared with 75 feet for pedestrians. Furthermore, the birds reacted to the pets by moving an average of 187 feet, compared with 82 feet when the birds were reacting to a pedestrian, and the duration of the disturbance behavior stimulated by pets was significantly greater than that caused by pedestrians (Hoopes 1993). Disturbance also reduces the time migrating shorebirds spend foraging (Burger 1991) and has been implicated as a factor in the long-term decline of migrating shorebirds at staging areas (Pfister et al. 1992).

Viruses: Preliminary reports suggested West Nile virus was a potential threat on the northern Great Plains population in 2003 or 2004, but a case has yet to be confirmed (Dingledine 2006). Shorebird testing throughout the U.S. for Avian Flu is ongoing. One piping plover was captured and swabbed in Florida in December 2006. Results are undetermined with ongoing research.

Oil Spills: Oil spills pose a threat to piping plovers throughout their life cycle. Oiled plovers have been reported from Matagorda Island National Wildlife Refuge, Texas (Service 1996). Four piping plovers have been reported in the Jacksonville, Florida area with greased undersides (Leary 2007). No known oil spill was reported in the area. It is possible they became greased while roosting in wrack that accumulated remnant oil from some offshore activity. Impacts are undetermined.

Exotic vegetation: In Florida, 39-64% of the non-indigenous plant species considered to be most invasive by the Florida Exotic Pest Plant Council may actually alter the ecosystems that they invade through changes in such properties as geomorphology, hydrology, biogeochemistry, and disturbance (Gordon 1998). Like many invasive species, coastal exotic plants reproduce and spread quickly and exhibit dense growth habits, often outcompeting native plant species. Crowfootgrass (*Dactyloctenium aegyptium*) grows invasively along portions of the Florida coastline and forms thick bunches or mats that may change the vegetative structure of coastal plant communities and alter shorebird habitat. The exotic Australian pine (*Casuarina equisetifolia*) also changes the vegetative structure of the community. Because shorebirds prefer foraging in open areas where they are able to see potential predators and because tall trees provide good perch sites for avian predators, Australian pines may impact shorebirds by limiting the availability of optimal foraging habitat.

Habitat Loss/Degradation: Important components of ecologically sound barrier beach management include perpetuation of natural dynamic coastal formation processes. Man-made structures along the shoreline or manipulation of natural inlets upset the dynamic processes and result in habitat loss or degradation (Melvin et al. 1991). Throughout the range of migrating and wintering piping plovers, inlet and shoreline stabilization, inlet dredging, and beach maintenance and renourishment activities continue to constrict natural coastal processes. Dredging of inlets can affect spit formation adjacent to inlets, while jetties can cause widening of islands and subsequent growth of vegetation on inlet shores. Over time, both result in loss of plover habitat. Additional investigation is warranted to determine the extent to which these disturbance factors affect wintering plovers on a cumulative nature.

Analysis of the species/critical habitat likely to be affected

The proposed action has the potential to adversely affect wintering and migrating piping plovers and their habitat from all three populations within the proposed project area and Action Area. The Atlantic Coast nesting population of piping plover is a component of the entity listed as threatened which encompasses all breeding piping plovers (Great Plains and Atlantic) except the Great Lakes breeding population. As reported by Haig et al. (2005), results of the 2001 Plover Breeding Census indicate an 8.4 percent increase from 1991 census, but only a 0.2 percent increase since 1996. Regional trends suggest that since 1991, numbers of breeding birds increased on the Atlantic Coast by 78 percent and by 80 percent in the Great Lakes. The 2006 International Census reported a substantial increase since 2001 in both the U.S. and Canadian portion of the northern Great Plains breeding population.

Florida has 34 piping plover designated critical habitat units, comprising approximately 26 percent of its coastline. The 34 units include approximately 68 miles of federal shoreline, 120 miles of State shoreline and 24 miles of shoreline in private ownership (including non-profit organizations). This equates to approximately 212 miles of shoreline in Florida designated as critical habitat for the piping plover. As noted previously any FEMA berm of berm repair proposed within designated critical habitat for piping plover will require separate consultation.

We will consider the effects of the proposed action of berm placement on piping plovers and their habitat in the following sections. The effects of the proposed berm placement are expected to fill newly created habitat and to impede natural coastal processes, which will continue to diminish quantity and quality of bayside intertidal foraging habitats used by piping plovers within the Action Area, resulting in possible decreased survivorship of migrating and wintering piping plovers. Other projects, which include beach nourishment, jetty extensions, and inlet dredging activities that have affected the conservation of piping plovers wintering or migrating in northwest Florida are included in the Service's evaluation of the species current status (Table 15).

ENVIRONMENTAL BASELINE

Status of the species within the action area

The coastline of Florida is composed of barrier and peninsular islands that are part of a complex and dynamic coastal system that continually responds to inlets, tides, waves, erosion and deposition, longshore sediment transport, and depletion, fluctuations in sea level, and weather events. The location and shape of barrier islands beaches perpetually adjusts to these physical forces. Winds move sediment across the dry beach forming dunes and the island interior landscape. The natural communities contain plants and animals that are subject to shoreline erosion and deposition, salt spray, wind, drought conditions, and sandy soils. Vegetative communities include foredunes, primary and secondary dunes, interdunal swales, sand pine scrub, and maritime forests. During storm events, overwash is common and may breach the island at dune gaps or other weak spots, depositing sediments on the interior and backsides of islands, increasing island elevation and accreting the sound shoreline. Breaches may result in new inlets through these islands.

The interaction between the biology and geomorphology of barrier islands is complex. Just as the barrier island undergoes a process of continual change, so do the ecological communities present. Vegetation zones gradually re-establish following storms, and in turn affect physical processes such as sand accretion, erosion, and overwash. The beach front, dunes, and overwash areas all provide important habitat components. Many barrier island species are adapted to respond positively to periodic disturbance. As the island widens, new feeding habitat (sand and mud flats) is created for shorebirds such as the piping plover. Low wide beaches provide roosting and feeding habitat for shorebirds. These barrier island habitats are becoming increasingly rare as our Nation's coastlines rapidly develop.

The known distribution of the piping plover in Florida is a result of occasional statewide cursory surveys combined with sporadic localized surveys that provide better estimates on abundance and seasonal use in those specific areas depending on the strength of the surveys. Currently the International Plover Winter Census as summarized in Table 14 remains the only consistent winter survey effort for piping plovers on a statewide basis (Ferland and Haig 2002). Relative to abundance and relying on the results of the International Plover Winter Census, Florida ranks in the top third of eight southeastern states on which wintering piping plovers depend. The section above "*Status and Distribution: non-breeding (migrating and wintering)*" explains the limitations in the data collected during the International Census survey window with regard to

locating all sites and exact numbers of plovers in specific locations. By their nature, the habitat features that piping plovers depend on are in a constant state of change thereby making it difficult to document the exact status of piping plovers in the Action Area on any given year at any given site.

We use the results of the following survey effort to demonstrate the limitations of relying on just the results of the International Plover Winter Census or any short term, one day or season survey effort for a species dependent on dynamic habitats. In 2006, the Service and the American Bird Conservancy funded the Apalachicola Riverkeeper to collect shorebird abundance and distribution data throughout Franklin County, Florida. Survey data was collected from August 2006, through May 2007. Attempts were made to visit each primary site at least twice monthly. One area known for its historic plover use, Phipps Preserve, was visited twenty-four times with surveys between August 15, 2006 through May 1, 2007. Numbers of piping plover recorded ranged from zero to a high of 47 piping plovers on two different days (**Figure 18**). The 2005 International Plover Winter Census reported 17 piping plovers on Phipps Preserve. Given that piping plovers evolved in a dynamic system, and that they are dependent upon these ever-changing features for their survival and conservation it is important that sites that experience these natural processes where plover habitat may come and go, are protected.

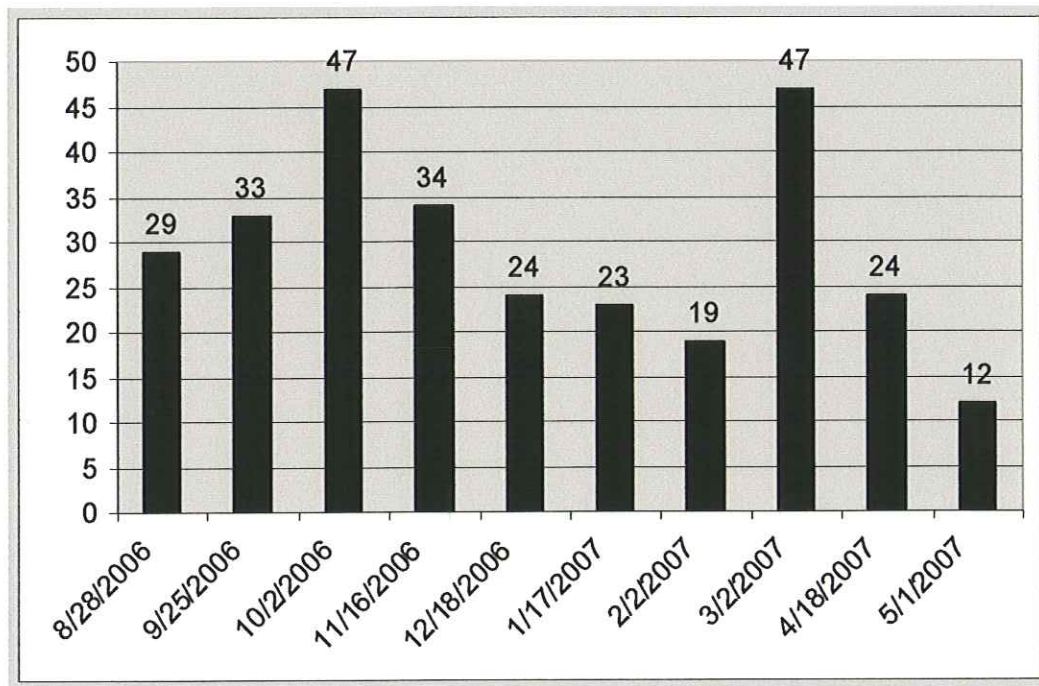


Figure 18. Apalachicola Riverkeeper and American Bird Conservancy piping plover sightings from August 2006 through May 1, 2007.

Factors affecting species environment within the action area

A number of ongoing anthropogenic and natural factors may affect the piping plover in the Action Area. Many of these effects have not been evaluated with respect to biological impacts on the species. In addition, some are interrelated and the effects of one cannot be separated from others. Known or suspected factors affecting the species in the Action Area are discussed below.

All threats discussed above (*see threats: Status and Distribution section*) are threats seen throughout piping plover habitat in the entire Action Area. Depending on the local land codes, land ownership and enforcement capabilities, some threats are more pronounced in some areas than others.

Increasing Trend of Berm Placement and Nourishment Projects in Response to Storm Events

In the wake of an apparent increasing trend in episodic storm events, managers of lands under public, private and county ownership chose to protect coastal structures using emergency storm berms usually followed by nourishment activities. Berm placement and beach nourishment place substantial amounts of sand along the Gulf beaches in hopes of preventing what otherwise would be considered “natural processes” of overwash and island migration.

Past and ongoing stabilization projects along the NW Florida coastline and all of the Action Area have fundamentally altered the naturally dynamic coastal processes that create and maintain beach strand habitats (**Figure 18**). Hard shoreline stabilization structures such as jetties and groins interrupt littoral drift, while artificially created berms and nourishment prevent overwash. These structures prevent natural shoreline migration. Such stabilization has encouraged residential and commercial development and associated infrastructure along otherwise ephemeral and/or flood prone habitats. The subsequent development has forestalled formation of highly productive piping plover overwash habitats and eliminated connectivity of piping plover oceanfront and bayside roosting and foraging habitats. The results of these projects have essentially forced public lands and some undeveloped private lands into becoming an oasis for endangered species such as the piping plover as well as other non-listed species. Of concern is the increasing trend of public lands applying these same actions. Figure 19 shows the designated critical habitat units for piping plovers in the NW Florida panhandle and the results of the 2006 International Plover Winter Census. It does not seem a coincidence that the areas populated with piping plovers in this snapshot survey are the areas that are not artificially stabilized and developed and preclude natural successional stages and processes from occurring. While berms are installed to protect existing structures they further prevent natural shoreline processes. A similar pattern is seen throughout Florida (ABC and FWS unpublished data 2007). Recreational pressures are heavy on both the natural and unnatural lands, so it appears to be more a habitat component that makes the difference in areas selected for use by piping plovers.

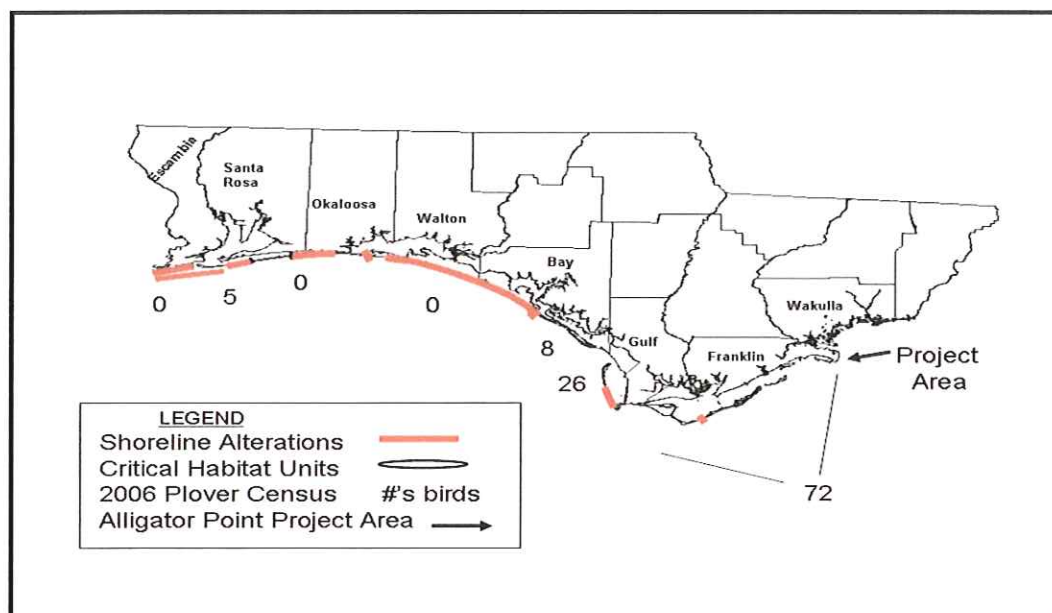


Figure 19. Comparison of shoreline stabilization projects (beach nourishment, hardening) and piping plover census data.

Intraspecific and Interspecific Shorebird Competition

Historically, prior to high human densities and beach hardening projects, approximately 825 miles of coastline and parallel bayside flats (unspecified amount) of habitat occurred in Florida. This provided an unspecified amount of optimal foraging habitat for many shorebird species depending on the cumulative successional stages of the coastline. To date, approximately thirty-five percent of the coastline remains where coastal dynamics are allowed to function in Florida. As coastal functions are prohibited, formations of habitat appealing to different bird species dependent on these processes become more and more concentrated into the remaining optimal areas for foraging and roosting. It is likely they are, or will be, forced to forage and roost in less optimal areas.

Up to 24 shorebird species migrate or winter along the Atlantic Coast and almost 40 species of shorebirds occur during migrational and wintering periods in the Gulf of Mexico region (Helmert 1992). Continual degradation and loss of habitat needed by migrating and wintering shorebirds elevates the risk of increased pressure on remaining food supplies. Food limitations potentially increase intraspecific and interspecific competition and could result in eventual mortality. Shorebirds require maximum fat reserves to complete migrations. Birds with less than maximum fat reserves could be expected to show reduced survivorship. Piping plovers are part of this overall shorebird niche that may be forced to compete with the other 24 to 40 species of shorebirds dependent on Florida coastline habitats for some part of their life cycle. Shorebird species numbers are universally declining. The complexities of a shorebird life cycle make it difficult to determine what role the loss of 65 percent of habitat has played in this overall decline but it is likely significant.

EFFECTS OF THE ACTION

Factors to be considered

Unknown lengths of emergency berm repairs are proposed under this consultation. FEMA requires that emergency berms be confined to locations and dimensions needed to protect improved property from no more than a five (5) year storm event. We consider the effects of the proposed action on piping plovers and their habitat in the following sections. The effects of the proposed berm constructions are expected to impact portions of the Action Area for the life of the project.

The geomorphic characteristics of barrier islands, peninsulas, beaches, dunes, overwash fans, and inlets are critical to a variety of natural resources and influence a barrier beach's ability to respond to wave action, including storm overwash and sediment transport. However, the protection or persistence of these important natural land forms, processes, and wildlife resources is often in conflict with long-term, large-scale beach stabilization and property protection projects and their indirect effects, i.e., increases in residential development, infrastructure, and public recreational uses, and preclusion of overwash and creation of inlet formations on which plovers thrive.

Protective, avoidance, and minimization measures have been incorporated into the project plan to avoid or minimize the potential impacts from the emergency berm repair and construction activities. However, even with these measures, impacts to piping plovers are expected to occur from some aspects of the project activities. The work may occur on public and private lands. The manufactured berms will fill in any newly created washover or low lying areas and impede future overwash to bayside flats when placed along barrier islands or peninsulas as is their intention, thereby causing successional advances in the habitat that will preclude its use by piping plovers.

Proximity of action: The emergency beach berm and associated activities may occur within newly created piping plover habitat. Indirect effects of the action – alterations and restrictions in the natural processes of the barrier island, are expected to occur throughout barrier and peninsular islands of Florida, (*i.e.* the Project and Action Area).

Distribution: Project construction activities and berm placement that may impact piping plovers will occur on the Gulf of Mexico and Atlantic Ocean coastlines throughout the Action Area. Direct and indirect impacts to migrating and wintering piping plover are expected along approximately an equal amount of bayside habitat and washover areas that but for the project would exist in the future.

Timing: The timing of the emergency berm construction and repair activities may occur during the migration and wintering period for piping plovers (July 15-May 15). Indirect effects will occur later in time.

Nature of the effect: The immediate effects are loss of foraging and roosting habitats of migrating and wintering piping plovers. Changes to plover habitat are expected in island morphology due to the elimination or reduction of potential for washover due to the presence of

the constructed berms. Any decrease in survival of birds on migrating or wintering grounds due to lack of optimal habitat could contribute to decreased survival rates, decreased productivity on the breeding grounds, and therefore increased vulnerability to any of the three piping plover populations.

Duration: The emergency berm construction and repair will be done only in emergency situations. The berms are constructed to withstand 5-year storms. The direct effects will be sporadic depending on the amount of suitable piping plover habitat created by the storm event that created the need for an emergency berm. Alteration of the natural barrier island processes are expected for the life of the berm (5 years).

Disturbance frequency: Construction will be a short term disturbance. The frequency will be dependent on the frequency of storm events.

Disturbance intensity and severity: The construction activities are expected to have short-term and temporary effects on the piping plover populations. Piping plovers located within construction areas would be expected to move outside of the construction zone due to disturbance. Berm construction is expected to indirectly effect island morphology and bayside shoreline dynamics, temporarily eliminating the creation of piping plover habitat.

Analysis for Effects of the Action

Berm placement to protect improved property generally occurs within 1-2 years of erosional weather events that may have facilitated the need for the berms. Optimal piping plover habitat is not usually in the immediate vicinity of highly developed properties due to disturbance factors as well as unsuitable habitat. Following storm events, piping plover habitat may have been created within the vicinity of these developed properties but more likely, piping plovers will be more attracted to habitats that may have formed on the adjacent baysides if development does not completely hinder the dynamics of a washover event. Expected indirect effects are loss of habitat and increased intraspecies and interspecies competition.

Direct effects

Direct effects are those direct or immediate effects of a project on the species or its habitat. The construction window (*i.e.*, disposal of sand for berm placement) for each berm placement project will extend through approximately one piping plover migration and winter season. In low-lying areas, burial and suffocation of invertebrate species will occur during berm placement. Benthic recruitment will not occur in the areas of sand fill.

Heavy machinery and equipment (*e.g.*, trucks and bulldozers operating on project area beaches, the placement of the dredge pipeline along the beach, and sand disposal) may adversely affect migrating and wintering piping plovers in the project area through disturbance and disruption of normal activities such as roosting and feeding, and possibly forcing birds to expend valuable energy reserves to seek available habitat elsewhere.

Indirect effects

The constructed berms will be placed as a protective element against shoreline erosion to protect man-made infrastructure. Indirect effects of temporarily reducing the potential for the formation of optimal habitats, especially along barrier peninsulas that are susceptible to overwash, pose a concern for piping plovers with respect to survival and recovery. The proposed project will perpetuate and contribute to the widespread activities that prevent the formation of these preferred early successional overwash habitats. Additional investigation is warranted to determine the extent to which these disturbance factors cumulatively affect wintering plovers.

The proposed project will limit the creation of optimal foraging and roosting habitat and will increase the attractiveness of these beaches to recreation. The increased recreational use of artificially elevated beaches is often cited by the Corps and others as a benefit of these projects. Recreational activities that may potentially adversely affect plovers include unleashed pets, increased pedestrian use and reduction of foraging habitat from deliberate removal of wrack.

Berms increase the likelihood that landowners or local governments will initiate construction of new infrastructure or upgrade existing facilities, such as roads, buildings, or parking areas adjacent to the project area. Short-term adverse effects may include disturbance to nearby plovers due to construction activities. Longer-term impacts could include a decrease in use of nearby habitat due to increased disturbance levels from recreational activities, increased levels of intraspecies and interspecies competition by concentrating piping plovers and other shorebirds into smaller or less optimal foraging and roosting areas, and the temporary preclusion of the creation of additional recovery habitat.

Species response to the proposed action

This BO is based on direct and indirect effects that are anticipated to piping plovers (wintering and migrating) as a result of constructed berms. In the context of migrating and wintering piping plovers, it is anticipated that highly eroded areas along the Florida coastline and an unspecified number of piping plovers could be impacted by habitat loss due to direct fill, construction disturbance, increased recreational disturbance and increased competition in the remaining habitats by intraspecific and interspecific shorebirds, and temporarily preclude the creation of habitat.

Disturbance reduces the time migrating shorebirds spend foraging (Burger 1991) and has been implicated as a factor in the long-term decline of migrating shorebirds at staging areas (Pfister et al. 1992). While piping plover migration patterns and needs remain poorly understood and occupancy of a particular habitat may involve shorter periods relative to wintering, information about the energetics of avian migration indicates that this might be a particularly critical time in the species' life cycle. Foraging and roosting on suboptimal habitat or in higher shorebird concentrations on the non-breeding grounds by migrating and wintering piping plovers may reduce the fitness of individuals.

Demographic models for piping plovers indicate that even small declines in adult and juvenile survival rates will cause very substantial increases in extinction risk (Melvin and Gibbs 1994; Amirault et al. 2005). Furthermore, insufficient protection of non-breeding piping plovers and their habitat has the potential to quickly undermine the progress toward recovery achieved on the breeding grounds.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the Action Area considered in this BO. Future Federal actions that are unrelated to the proposed project are not considered in this opinion because they require separate consultation pursuant to section 7 of the Act.

It is reasonably certain to expect that coastal development, human occupancy and recreational use along the Atlantic and Gulf coasts of Florida will increase in the future. Redevelopment along with new developments following the hurricane seasons of 2004 and 2005 are occurring as allowed by local zoning standards. It is unknown how much influence a beach berm would contribute to the development and recreational use of the shoreline. Any projects that are within endangered or threatened species habitat will require section 7 or 10 permitting from the Service.

In recognizing the importance of coastal barrier islands along the Atlantic and Gulf coasts, Congress passed the Coastal Barrier Resources Act (CBRA) of 1982 and Coastal Barrier Improvement Act (CBIA) in 1991. The purpose of CBRA is "...to minimize the loss of human life, wasteful expenditure of Federal revenues, and the damage to fish, wildlife, and other natural resources associated with the coastal barriers along the Atlantic and Gulf coasts by restricting future Federal expenditures and financial assistance which have the effect of encouraging development of coastal barriers." Congress established the Coastal Barrier Resources System (CBRS) units for which this Act applies. FEMA individually consults with the Service on berm projects that occur in the CBRS.

Following the hurricane seasons of 2004 and 2005, FEMA funded local municipalities and counties to construct emergency berms to provide storm protection along the Gulf of Mexico and Atlantic beachfronts.

CONCLUSION

Sea Turtles

After reviewing the current status of the loggerhead, green, leatherback, hawksbill, and Kemp's ridley sea turtles, the environmental baseline for the Action Area, the effects of the proposed emergency berm construction and repair, and the cumulative effects, it is the Service's biological opinion that the project, as proposed, is not likely to jeopardize the continued existence of the loggerhead, green, leatherback, hawksbill or Kemp's ridley sea turtles. No critical habitat has been designated for any of the sea turtle species in the continental United States; therefore, none will be affected.

The conservation of the five loggerhead nesting subpopulations is essential to the recovery of the loggerhead sea turtle. Each individual subpopulation is necessary to conserve genetic and demographic robustness, or other features necessary for long-term sustainability of the entire population. Thus, maintenance of viable nesting in each subpopulation contributes to the overall population. Three of the five loggerhead subpopulations occur within the Action Area.

There is approximately 1,400 miles of available sea turtle nesting habitat in the southeastern U.S. Of this available nesting habitat, impacts will only occur after an emergency event in critically eroded areas of the shoreline estimated to be 75 miles of shoreline. From the overall sea turtle recovery, this equates to 5.4 percent of the estimated 1,400 miles of available sea turtle nesting habitat in the southeastern U.S. FEMA berms are only funded based on the previous existence of a berm. This could include existing beach nourishment projects and previous FEMA funded berms. It is not possible to determine the exact extent of the shoreline to be impacted every two years since this would be based on an emergency situation. However, impacts will be reduced through habitat restoration and project design.

Beach Mice

All known populations of SEBM and the AIBM are located completely on county, state, or federally protected lands, except for a small area in St. Johns County, Florida, in which the AIBM are found on private lands along the Florida coast. After reviewing the current status of the SEBM, AIBM, PKBM, CBM, and SABM, the environmental baseline for the Action Area, the effects of emergency berm construction and repair, and the cumulative effects, it is the Service's biological opinion that the Programmatic action for these projects, as proposed, is not likely to jeopardize the continued existence of any of the above subspecies of beach mice and is not likely to destroy or adversely modify designated critical habitat for the PKBM, CBM, or SABM. For the Service to determine if the impacts of the proposed action on designated critical habitat would be an adverse modification, we must determine if the impact would appreciably diminish the capability (or ecological function) of the critical habitat to satisfy essential requirements of the PKBM, CBM, and SABM in the Action Area.

Temporary impacts are expected to be limited to the construction/maintenance phase of the project and habitat restoration period following the project, which could be completed between a week and 30 days. Thus, effects would be short term in nature with the potential for one generation of mice to be lost (female mice can reproduce approximately every 26 days) during each project. Beach mice can reproduce rapidly so colonization or recolonization of the restored habitat would be expected within several months, if sufficient habitat and resources are available.

While a few beach mice may be lost, beach mice recover well from population size reductions (Wooten 1994) given sufficient habitat is available for population expansion after the bottleneck occurs. Therefore, we do not consider the potential loss of individuals to be significant.

Also, we would not anticipate that the temporary loss of the critical habitat would alter or affect the remaining critical habitat in the Action Area for each subspecies (PKBM, CBM, and SABM) to the extent that it would appreciably diminish the habitat's capability to provide the intended conservation role for the subspecies in the wild. This BO does not rely on the regulatory

definition of destruction or adverse modification of critical habitat at 50 Code of Federal Regulations [C.F.R.] 402.02. Instead, we have relied upon the statutory provisions of the Act to complete our analysis with respect to critical habitat.

Piping Plover

After reviewing the current status of the wintering population of the northern Great Plains, the Great Lakes and the Atlantic Coast piping plover, the environmental baseline for the berm placement and associated activities, proposed protective avoidance and minimization measures, and the cumulative effects, it is the Service's BO that implementation of the project, as proposed, is not likely to jeopardize the continued existence of non-breeding piping plover. Specific rationale for the non-jeopardy determination for each population is provided below. As noted previously, the overall status of the listed entity is stable, if not increasing.

Of greatest concern is the reliance that piping plovers have on the remaining 35 percent of Florida's coastal shoreline where the natural coastal processes are allowed to function. In these natural areas, piping plover habitat conceivably comes and goes as a function of storm events and associated tides, winds, elevation, and vegetational succession. The best we can hope for is a balance between suitable and unsuitable piping plover habitat remaining in Florida as there is little opportunity to expand the amount of habitat available for future conservation of the species. The amount available today appears sufficient to sustain the species but it is unknown if it is sufficient to conserve the species into perpetuity. The remaining habitat in Florida available today for piping plover use where coastal processes are allowed to function are still subjected to threats, especially human disturbance, coastal highways, military missions, and dredge disposal projects. Increased management to minimize such impacts to piping plover in these areas is the best defense we may have to conserve the species.

The proposed project would directly and indirectly affect an unspecified amount of newly created habitat as well as impact subsequent mud and sand flats by precluding natural development of additional habitat within the Action Area. FEMA berms are set in place usually immediately following highly erosive weather events. Plovers have confirmed site fidelity and are documented consistently using the same wintering and migrating locations year after year which minimizes the number of piping plovers that may be directly impacted if the habitat is altered prior to them becoming dependent on its availability. They have also been reported using newly created habitat within six months after its creation. Newly created piping plover feeding and roosting areas in locations where emergency berms will be placed are in developed areas as the intent is to protect improved property. The human disturbance factor and their associated recreational activities such as kite flying, pet walking, and beach driving reduce the likelihood of piping plovers using these newly created and otherwise suitable areas. Foraging on optimal, but disturbed habitat, on the non-breeding grounds by migrating and wintering piping plovers may reduce the fitness of individuals, which will have an unknown affect on the listed entity.

Due to the unlikelihood of large numbers of piping plover becoming established before newly created habitats are bermed and the inconclusive, but seemingly high winter survivorship (see *Status of the Species, Life History section*), we conclude that implementation of the proposed project would not appreciably affect the survival and recovery of the piping plover from the

Atlantic Coast, Great Plains nor the Great Lakes populations. Proposed FEMA Berm Repair and Construction projects that occur within piping plover critical habitat are not included in this programmatic BO and will be consulted on individually.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and shall be implemented by FEMA so that they become binding conditions of any grant or permit issued to the Applicant, as appropriate, for the exemption in section 7(o)(2) to apply. FEMA has a continuing duty to regulate the activity covered by this incidental take statement. If FEMA (1) fails to assume and implement the terms and conditions or (2) fails to require the FEMA grant Applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, FEMA shall report the progress of the action and its impacts on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

AMOUNT OF EXTENT OF TAKE

Sea Turtles

It is anticipated that no more than 75 miles of highly eroded shoreline could be affected Statewide as a result of beach berm construction after a federally declared emergency event; incidental take of sea turtles will be difficult to detect for the following reasons:

- (1) turtles nest primarily at night and all nests are not located because
 - [a] natural factors, such as rainfall, wind, and tides may obscure crawls; and
 - [b] human-caused factors, such as pedestrian and vehicular traffic, may obscure crawls, and result in nests being destroyed because they were missed during a nesting survey and egg relocation program;
- (2) the total number of hatchlings per undiscovered nest is unknown;

- (3) the reduction in percent hatching and emerging success per relocated nest over the natural nest site is unknown;
- (4) an unknown number of females may avoid the project beach and be forced to nest in a less than optimal area;
- (5) lights may misdirect an unknown number of hatchlings and cause death; and
- (6) escarpments may form and cause an unknown number of females from accessing a suitable nesting site.

The level of incidental of the sea turtle species can be anticipated by the disturbance and sand placement of suitable turtle nesting beach habitat because: (1) turtles nest within the project site; (2) emergency berm repair and construction will likely occur during a portion of the nesting season; (3) the emergency berm repair and construction project will modify the incubation substrate, beach slope, and sand compaction; and (4) artificial lighting will deter and/or misdirect nesting females and hatchlings.

Incidental take is expected to be in the form of: (1) destruction of all nests that may be constructed and eggs that may be deposited from April 15 through April 30 and from September 1 through September 30 and missed by a nest survey and egg relocation program within the boundaries of the berm project(s); (2) destruction of all nests deposited from October 31 through April 30 when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project; (3) reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site; (4) harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities; (5) misdirection of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting; (6) behavior modification of nesting females due to escarpment formation within the project area during a nesting season, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; and (7) destruction of nests from escarpment leveling within a nesting season when such leveling has been approved by the Service.

Table 16 represents the level of take that could occur if the reasonable and prudent measures were not implemented. According to Schroeder (1994), there is an average survey error of seven percent; therefore, there is the possibility that some nests within the action area may be misidentified as false crawls and missed. However, due to implementation of the sea turtle protection measures, we anticipate that the take will not exceed seven percent of the nesting average in the project area. This number is not the level of take exempted because the exact number cannot be predicted nor can the level of incidental take be monitored.

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Table 16. The average annual number of sea turtle nests that will be taken within the Action Area (75 miles Statewide), based on the best available commercial and scientific information.

SPECIES Loggerhead, Green, Leatherback, and Kemp's Ridley sea turtles	INDIVIDUALS (NESTS)	TAKE TYPE	CRITICAL HABITAT DESTROYED
Gulf of Mexico and Atlantic Coast of Florida	All nests within the 75 miles of beachfront where berm construction will occur after a federally declared emergency event	harm/harassment	None

Table 17. How the incidental take will be monitored if the specific number of individuals cannot be determined. This will be based on the best available commercial and scientific information.

SPECIES Loggerhead, Green, Leatherback, and Kemp's Ridley sea turtles	CRITICAL HABITAT	HABITAT	OTHER
Gulf of Mexico and Atlantic Coast of Florida	None	Statewide Nesting Beach Survey protocol	NA
Gulf of Mexico and Atlantic Coast of Florida	None	Index Nesting Beach Survey protocol	NA

Beach Mouse

It is anticipated that no more than 75 miles of highly eroded shoreline could be affected Statewide as a result of beach berm construction after a federally declared emergency event; incidental take of beach mice will be difficult to detect for the following reasons:

- (1) an unknown number of beach mice may be injured, crushed or buried during beach access construction work and remain entombed in the sand;
- (2) beach mice are nocturnal, are small and finding a dead or injured body is unlikely because of predation, and
- (3) changes in beach mouse essential life behaviors may not be detectable in standardized monitoring surveys.

The incidental take is expected to be in the form of: (1) harm or harassment to all beach mice occupying the created or expanded beach access points; (2) harassment of beach mice from disturbance of foraging opportunities within the access areas during the construction period; (3) harassment of beach mice from temporary loss of foraging and burrow habitat; and (4) harassment of beach mice from temporary restriction of movement across access areas.

The level of incidental take of beach mice can be expected by the loss of habitat that is fragmented temporarily. To assess the effects of the impacts to beach mice the following will be monitored: 1) beach mouse distribution and abundance, and 2) success of habitat restoration.

Table 18. The average annual number of beach mice and designated critical habitat that will be affected within the Action Area (75 miles Statewide), based on the best available commercial and scientific information.

SPECIES	INDIVIDUALS	TAKE TYPE	CRITICAL HABITAT DESTROYED
Southeastern and Anastasia beach mice	All mice within beach access corridors used for berm construction after a federally declared emergency even	harm/harassment	None
St. Andrew, Choctawhatchee, and Perdido Key beach mice	All mice within beach access corridors used for berm construction after a federally declared emergency even	harm/harassment	All designated CH that is within beach access corridors used for berm construction

Table 19. How the incidental take will be monitored if the specific number of individuals cannot be determined. This will be based on the best available commercial and scientific information.

SPECIES	CRITICAL HABITAT	HABITAT	OTHER
Southeastern and Anastasia beach mice	None	Species abundance and distribution and habitat restoration success	NA
St. Andrew, Choctawhatchee, and Perdido Key beach mice	Species abundance and distribution and habitat restoration success	Species abundance and distribution and habitat restoration success	NA

Piping Plovers

It is anticipated that no more than 75 miles of highly beachfront eroded shoreline as well as the equivalent bayside habitats could be affected Statewide as a result of beach berm construction after a federally declared emergency event; incidental take of piping plover, incidental take of piping plovers will be difficult to detect for the following reasons:

- (1) harassment to the level of harm from loss or disturbance of habitat may only be apparent on the breeding grounds the following year; and

- (2) dead plovers may be carried away by waves or predators.

Incidental take (**Table 18**) of this species can be anticipated by the proposed project activities because:

- (1) piping plovers migrate and winter in the Action and Project Area;
- (2) equipment may disturb plovers attempting to forage and roost within the Project Area;
- (3) the effects of sediment disposal in low lying coastal areas will reduce prey sources;
- (4) the berm placement is expected to temporarily (up to 5 years) affect the island morphology and prevent early successional stages, thereby precluding the maintenance and creation of additional recovery habitat; and
- (5) increased levels of pedestrian and dog disturbance is expected.

The Service has reviewed the biological information and other information relevant to this action. The take is expected in the form of harm and harassment because of: (1) decreased fitness and survivorship of wintering plovers due to loss and degradation of foraging and roosting habitat resulting in more energy expenditure seeking foraging and roosting habitat and (2) decreased fitness and survivorship of plovers attempting to migrate to breeding grounds due to loss and degradation of foraging and roosting habitat.

Table 20. The average annual number of piping plover and designated critical habitat that will be affected within the Action Area (75 miles Statewide), based on the best available commercial and scientific information.

SPECIES	INDIVIDUALS	TAKE TYPE	CRITICAL HABITAT DESTROYED
Piping plover	All birds using beachfront or bay shoreline feeding and roosting habitat (may be newly created) within a berm construction project area after a federally declared emergency event beach	harm/harassment	All designated CH that is within beach access corridors used for berm construction

Table 21. How the incidental take will be monitored if the specific number of individuals cannot be determined. This will be based on the best available commercial and scientific information.

SPECIES	CRITICAL HABITAT	HABITAT	OTHER
Piping plover	Monitoring of bird presence; project and or human disturbance	Monitoring of bird presence; project and or human disturbance	NA

EFFECT OF THE TAKE

Sea Turtles

In the accompanying BO, the Service determined that this level of anticipated take is not likely to result in jeopardy to the loggerhead, green, leatherback, hawksbill or Kemp's ridley sea turtle species. Critical habitat has not been designated in the project area; therefore, the project will not result in destruction or adverse modification of critical habitat for any of the sea turtle species.

Incidental take of nesting and hatchling sea turtles is anticipated to occur during project construction and during the life of the project. Take will occur on nesting habitat consisting of the length of the beach where the restoration material will be placed.

Beach Mouse

In the accompanying BO, the Service determined that this level of anticipated take is not likely to result in jeopardy to AIBM, SEBM, PKBM, CBM, and SABM or in adverse modification or destruction of designated critical habitat. Critical habitat for the SEBM and AIBM has not been designated; therefore, the project will not result in destruction or adverse modification of critical habitat for either subspecies.

Incidental take of SEBM, AIBM, PKBM, CBM, and SABM is anticipated to occur during the construction of the emergency berm repair and construction activities. The take will occur during project construction where beach access points are expanded or created and where equipment is staged or stored within beach mouse habitat.

Piping Plover

In the accompanying BO, the Service determined that this level of anticipated take is not likely to result in jeopardy to the piping plover species. Projects occurring in critical habitat units designated for piping plovers require a separate consultation and therefore the project will not result in destruction or adverse modification of critical habitat for any of the piping plover breeding populations.

Incidental take of piping plovers is anticipated to occur during project construction and during the life of the project. Take will occur along the GOM and Atlantic Ocean shoreline as well as associated bayside habitats both during and after berm placement.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of the loggerhead, green, leatherback, hawksbill, and Kemp's ridley sea turtles, SEBM, AIBM, CBM, PKBM, and SABM, and non-breeding piping plover in the proposed emergency berm construction and repair Action Area.

1. Conservation Measures included in FEMA's BA that address protection of nesting sea turtles, beach mice, and non-breeding piping plover must be implemented (unless revised below) in the berm project.
2. Beach quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence, beach mouse burrow construction and piping plover food prey species substrate shall be used for the emergency berm construction and repair projects.
3. **For emergency berm construction and repair projects in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward counties, Florida,** work activities shall not occur from May 1 through October 31, the period of the main sea turtle egg laying and egg hatching season, to reduce the possibility of sea turtle nest burial, crushing of eggs, or nest excavation. An exemption to this may occur if it is determined through coordination or emergency consultation with the Service.
4. **For emergency berm construction and repair projects in Nassau, Duval, St. Johns, Flagler, Volusia, Miami-Dade, Monroe, Collier, Lee, Sarasota, Hillsborough, Pinellas, Pasco, Franklin, Gulf, Bay, Walton, Okaloosa, Santa Rosa, and Escambia counties, Florida,** work activities may occur during the nesting season. For higher density nesting beaches in Gulf, and Franklin counties, and on Manasota Key located in Sarasota County, emergency berm construction shall not occur during the main part of the nesting season (June 1 through October 31). An exemption to this may occur if it is determined through coordination or emergency consultation with the Service.
5. All disaster related debris including derelict coastal armoring shall be removed from the beach prior to any emergency berm construction.
6. The placement and design of the emergency berm shall emulate the natural dune system to the maximum extent practicable, including the emergency berm configuration and shape.
7. The FEMA grant applicant shall install and maintain predator proof trash receptacles at all public beach access points to minimize the potential for attracting predators of sea turtles, beach mice, and piping plover.
8. Educational signs shall be placed where appropriate at beach access points with information on sea turtles, beach mice and non-breeding piping plover conservation.
9. The FEMA grant applicant shall ensure that contractors performing the emergency berm construction and repair work fully understand and correctly implement the sea turtle, beach mice, and non-breeding piping plover protection measures detailed in this incidental take statement.
10. Surveys for early and late nesting sea turtles shall be conducted if the FEMA berm construction will be conducted during the sea turtle nesting season, but outside the peak nesting and hatching periods, the eggs shall be relocated if nests are constructed in the area of berm construction to minimize sea turtle nest burial, crushing of eggs, or nest excavation.

11. No nighttime activities shall occur if FEMA berm construction will be conducted during the sea turtle nesting season to reduce the likelihood of impacting sea turtle nesting and hatching activities.
12. Beach compaction shall be monitored and tilling shall be conducted as required to reduce the likelihood of impacting sea turtle nesting and hatching activities.
13. Monitoring shall be conducted to determine if escarpments are present and if present shall be leveled as required to reduce the likelihood of impacting sea turtle nesting and hatching activities.
14. Construction equipment and materials shall be stored in a manner that will minimize impacts to nesting and hatching sea turtles (during the sea turtle nesting season and including the early and late portions of the sea turtle nesting season), beach mice and piping plovers to the maximum extent practicable.
15. Existing vegetated habitat at each of the beach access points shall be protected to the maximum extent practicable and shall be delineated by fence or other suitable material to ensure vehicles and equipment transport stay within the beach access corridor. New beach access locations created for the project work shall be approved by the Service.
16. Expanded or newly created beach accesses shall be restored to dune habitat within 3 months following project completion. The habitat restoration shall consist of restoring the beach and dune topography and planting with appropriate native dune vegetation (*i.e.*, native to coastal dunes in the respective county and grown from plant stock from that region of Florida). All dune restoration and planting shall be designed and conducted to minimize impacts to sea turtles, beach mice and piping plover.
17. Protect optimal piping plover feeding and roosting habitat.
18. All vegetation planting on the newly constructed berms shall be designed and conducted to minimize impacts to sea turtles, beach mice and non breeding piping plovers.
19. A report describing the actions taken to implement the terms and conditions of this incidental take statement shall be submitted to the Service within 60 days of completion of the proposed work for each year when the activity has occurred.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, FEMA shall comply with the following terms and conditions which (1) implement the reasonable and prudent measures described above and (2) outline required reporting/monitoring. These terms and conditions are non-discretionary. All conservation measures described in FEMA's BA are hereby incorporated by reference as terms and conditions within this document pursuant to 50 CFR § 402.14(I) with the addition of the following terms and conditions.

Proposed work

1. For berm material obtained from an upland source:

Sand Specifications

The fill material shall be beach compatible and meet the specifications required by Florida Administrative Codes 62B-41.007 (j) and 62B-33.002 (8). In addition the fill shall meet the following requirements.

The fill material to be placed at the work area shall be clean sand from a permitted upland source, free of construction debris, asphalt, gravel, rocks, clay balls, branches, leaves and other organics, components prone to cause cementation, oil, pollutants and any other non-beach-compatible materials. The sand shall be similar to the existing beach sediments in color and texture.

The grain size of the fill material shall conform to the following, by weight (all sieve sizes refer to U.S. Std. sieves):

- (a) not more than 2.5% finer than the No. 200 sieve
- (b) not more than 10% finer than the No. 140 sieve
- (c) not more than 50% finer than the No. 80 sieve
- (d) not more than 15% coarser than the No. 10 sieve, and
- (e) not more than 5% coarser than the No. 4 sieve

At minimum, using the Munsell Color Scale, all sand placed shall have a Value of at least 6.0 or higher and a Chroma of between 1.0 and 2.0 (inclusive) when graded on the 7.5YR or 10YR Hues under air dry sample conditions. Material with higher Value grades and higher Chroma grades (within the Chroma range specified), are preferred.

If sand from multiple sources is used, the materials should be mixed at the beach access sites before it is transferred to the beach so that sand will be consistent throughout the placement areas. On site mixing should not be done to achieve beach quality material, rather mixing would be done to make the fill aesthetically consistent due to the fact that the multiple sources are beach quality material.

Sand Inspection

The contents of each sand delivery truck will be inspected upon arrival to the beach access site. Sand quality is to be visually compared to FDEP approve benchmark samples before the sand is dumped. Sand is more closely inspected as the material is dumped. During visual inspection of the material upon arrival at the beach access site, if the quality of the material is uncertain, a physical sample will be taken with the option of quantitative analysis (sieving, color, etc). If in doubt the material will be loaded back into the truck and returned to the borrow source.

Post Placement Sampling

After material is placed on the beach and graded to template, sand sample will be collected along the constructed dune at a rate of one sample per 1,000 cubic yards of placed material. The

location of the sampling sites will be recorded with GPS. These samples will be quantitatively assessed for grain size analysis using the No. 230, 200, 170, 140, 80, 60, 45, 35, 25, 18, 14, 10, 7, 5, 4 and ¾" sieves. Samples will also be assessed for color and carbonate content. The results from the quantitative analysis will be submitted to DEP within 90 days after completing construction.

Compliance and Remediation

Continuous inspection of material upon arrival to the beach access site will minimize the likelihood of non-compliant material being placed. If initial post placement sampling indicates non-compliant material may have been placed, more extensive sampling and quantitative assessment will be conducted for the area in question to determine the extent of non-compliance, if any. In the event it is concluded that material has been placed that does not meet the specifications required by Florida Administrative Codes 62B-41.007 (j) and 62B-33.002 (8) the applicant will consult with the Service and FDEP to determine the most appropriate solution, including removal and/or replacement of the material if necessary; subject to constraints imposed by marine turtle nesting activity.

2. For berm material obtained from an offshore source:

Beach compatible fill shall be used for the berm construction. Beach compatible fill is material that maintains the general character and functionality of the material occurring on the beach and in the adjacent dune and coastal system. Such material shall be predominately of carbonate, quartz or similar material with a particle size distribution ranging between 0.062mm (4.0Φ) and 4.76mm (-2.25Φ) (classified as sand by either the Unified Soils or the Wentworth classification), shall be similar in color and grain size distribution (sand grain frequency, mean and median grain size and sorting coefficient) to the material in the historic beach sediment at the disposal site and shall not contain:

- (a) Greater than 5 percent, by weight, silt, clay or colloids passing the #230 sieve (4.0φ);
- (b) Greater than 5 percent, by weight, fine gravel retained on the #4 sieve (- 2.25φ);
- (c) Coarse gravel, cobbles or material retained on the 3/4 inch sieve in a percentage or size greater than found on the native beach;
- (d) Construction debris, toxic material or other foreign matter; and
- (e) Material that will result in cementation of the beach.

If rocks or other non-specified materials appear on the surface of the filled beach in excess of 50 percent of background in any 10,000 square foot area, then surface rock should be removed from those areas. These areas shall also be tested for subsurface rock percentage and remediated as required. If the natural beach exceeds any of the limiting parameters listed above, then the fill material shall not exceed the naturally occurring level for that parameter.

3. For berm material obtained from a navigation channel:

Pursuant to subsection 62B-41.005(15), Florida Administrative Code (F.A.C.), sandy sediment derived from the maintenance of coastal navigation channels shall be deemed

suitable for beach placement with up to 10 percent fine material passing the #230 sieve, provided that it meets the criteria contained in 1a to 1e above and water quality standards. If this material contains between 10 percent and 20 percent fine material passing the #230 sieve by weight, and it meets all other sediment and water quality standards, it shall be considered suitable for placement in the nearshore portion of the beach.

These standards shall not be exceeded in any 10,000 square foot section extending through the depth of the beach berm. If the native beach exceeds any of the limiting parameters listed above, then the fill material shall not exceed the naturally occurring level for that parameter.

4. **For emergency berm construction and repair projects in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward counties, Florida,** emergency berm construction and repair activities shall be started after October 31 and be completed before May 1. During the May 1 through October 31 period, no construction equipment or work materials shall be placed and/or stored on the beach.

The Service shall be contacted for coordination, on a project by project basis, if berm work is needed in these counties during the above exclusionary period. The Service will determine whether work (a) may proceed in accordance with the Terms and Conditions; (b) proceed in accordance with the Terms and Conditions and other requirements as developed by the Service; or (c) require that an individual emergency consultation be performed.

5. **For emergency berm construction and repair projects in Nassau, Duval, St. Johns, Flagler, Volusia, Miami-Dade, Monroe, Collier, Lee, Charlotte, Sarasota, Manatee, Hillsborough, Pinellas, Pasco, Franklin, Gulf, Bay, Walton, Okaloosa, Santa Rosa, and Escambia counties, Florida,** emergency berm construction and repair activities may occur during the nesting season except on publicly owned conservation lands such as state parks and areas where such work is prohibited under local land use codes.

The Service shall be contacted for coordination, on a project by project basis, if berm work is needed in higher density nesting beaches in Gulf and Franklin counties, and on Manasota Key located in Sarasota County during the above exclusionary period. The Service will determine whether work (a) may proceed in accordance with the Terms and Conditions; (b) proceed in accordance with the Terms and Conditions and other requirements as developed by the Service; or (c) require that an individual emergency consultation be performed.

- a. Prior to any sand placement, all disaster related debris including derelict coastal armoring shall be removed from the beach to the maximum extent practicable. Debris removal activities shall be conducted during daylight hours and during the dates listed on Table 20 and shall not commence until completion of the sea turtle survey each day.

Table 22. Time periods for debris removal work during the sea turtle nesting season.

COUNTY PROJECT OCCURS	DATE
Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward	March 1 through November 30
Dade, Monroe	April 1 to November 30
Volusia, Flagler, St. John, Duval, Nassau	April 15 to November 30
Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf, Franklin, Pasco, Pinellas, Manatee, Sarasota, Charlotte, Lee, Collier	May 1 to October 31

- b. The emergency berm shall have a slope of 1.5:1 followed by a gradual slope of 4:1 for approximately 20 feet seaward.
6. The FEMA grant applicant shall ensure that the contractors conducting the work provide predator proof trash receptacles for the construction workers. All contractors and their employees shall be briefed on the importance of not littering and keeping the project area trash and debris free. Predator proof trash receptacles shall be installed and maintained at all access points, eating areas, and rest-room areas.
7. Educational signs shall be placed where appropriate at beach access points explaining the importance of species such as sea turtles, beach mice, and piping plovers that are dependent on coastal habitats and ways to minimize human impacts. The Service can provide design ideas (Share the Shore Signs). These signs shall also include existing ordinances such as Animal Control Ordinances, informing beach users about the County/Municipality's ordinance that will minimize the harassment of sea turtles, beach mice and piping plovers. These signs shall be maintained for the life of the project, or five (5) years, whichever is lesser.
8. The FEMA grant applicant shall arrange a meeting between representatives of the contractor, the Service, the FWC, and the permitted sea turtle surveyor at least 10 days prior to the commencement of work on this project. At least 5 days advance notice shall be provided prior to conducting this meeting. This will provide an opportunity for explanation and/or clarification of the species protection measures as well as additional guidelines when construction occurs such as storing equipment, minimizing driving, and follow up meetings during construction.

Protection of Sea Turtles

For emergency berm construction and repair projects in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward counties, Florida:

1. If the emergency berm construction and repair project will be conducted during the period from March 1 through April 30, early morning surveys for sea turtle nests shall be conducted daily from March 1 through April 30 or until completion of the project (whichever is earliest). If the berm will be conducted during the period from November 1 through November 30, daily early morning sea turtle nesting surveys shall be conducted 65 days prior to project initiation and continue through September 30. From March 1 through April 30 and

November 1 through November 30 and eggs shall be relocated per the following requirements.

- 1a. Nesting surveys and egg relocations shall only be conducted by personnel with prior experience and training in nesting survey and egg relocation procedures. All nesting surveys, nest relocations screening or caging activities etc. shall be conducted only by persons with prior experience and training in these activities and who is duly authorized to conduct such activities through a valid permit issued by FWC, pursuant to F.A.C 68E-1. Nesting surveys shall be conducted daily between sunrise and 9 a.m. (this is for all time zones). The contractor shall not initiate work until daily notice has been received from the sea turtle permit holder that the morning survey has been completed. Surveys shall be performed in such a manner so as to ensure that construction activity does not occur in any location prior to completion of the necessary sea turtle protection measures.
- 1b. Only those nests that may be affected by berm construction activities shall be relocated. Nests requiring relocation shall be moved no later than 9 a.m. the morning following deposition to a nearby self-release beach site in a secure setting where artificial lighting will not interfere with hatchling orientation. Relocated nests shall not be placed in organized groupings; relocated nests shall be randomly staggered along the length and width of the beach in settings that are not expected to experience daily inundation by high tides or known to routinely experience severe erosion and egg loss, or subject to artificial lighting. Nest relocations in association with construction activities shall cease when construction activities no longer threaten nests.
- 1c. Nests deposited within areas where construction activities have ceased or will not occur for 65 days shall be marked and left *in situ* unless other factors threaten the success of the nest. The turtle permit holder shall install an on-beach marker at the nest site and/or a secondary marker at a point landward as possible to assure that future location of the nest will be possible should the on-beach marker be lost. A series of stakes and highly visible survey ribbon or string shall be installed to establish a 10-foot radius around the nest. No activity shall occur within this area nor will any activities occur which could result in impacts to the nest. Nest sites shall be inspected daily to assure nest markers remain in place and the nest has not been disturbed by the restoration activity.
2. If the emergency berm construction and repair projects will be conducted in Indian River, St. Lucie, St. Martin, and/or Palm Beach counties during the period from March 1 through April 30, daytime surveys for leatherback sea turtle nests shall be conducted beginning March 1. Nighttime surveys for leatherback sea turtles shall begin when the first leatherback nest is recorded within the project area and through April 30 or until completion of the project (whichever is earliest). Nesting surveys shall be conducted nightly from 9 p.m. until 6 a.m. The project area shall be surveyed at 1-hour intervals (since leatherbacks require at least 1.5 hours to complete nesting, this will ensure all nesting leatherbacks are encountered) and eggs shall be relocated per the preceding requirements.
3. From March 1 through April 30 and November 1 through November 30, staging areas for construction equipment shall be located off the beach to the maximum extent practicable.

Nighttime storage of construction equipment not in use shall be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all construction work materials or equipment that are placed on the beach shall be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of work materials or equipment shall be off the beach to the maximum extent possible. Temporary storage of work materials or equipment on the beach shall be in such a manner to minimize the impact to nesting habitat and shall not compromise the integrity of remaining dune systems. If pipes are needed for the project they shall be placed parallel to the dune and not less than 5 to 10 feet from the dune. Stored pipes shall be placed perpendicular to the shoreline.

4. Immediately after completion of the emergency berm and repair project and prior to March 1 for 3 subsequent years, sand compaction shall be monitored in the berm area in accordance with a protocol agreed to by the Service, FWC and the Applicant or local sponsor. At a minimum, the protocol provided under 4a, 4b, and 4c below shall be followed. If tilling is required, the area shall be tilled to a depth of 36 inches. Each pass of the tilling equipment shall be overlapped to allow more thorough and even tilling. All tilling activity shall be completed prior to March 1. A report on the results of the compaction monitoring shall be submitted to the Service's field office prior to any tilling actions being taken (**Table 21**). (NOTE: The requirement for compaction monitoring can be eliminated if the decision is made to till regardless of post-construction compaction levels. Additionally, out-year compaction monitoring and remediation are not required if placed material no longer remains on the dry beach.)

Table 23. Service's Field Offices and Address.

COUNTY PROJECT OCCURS	SERVICE FIELD OFFICE	ADDRESS
Brevard	North Florida Ecological Service Office	6620 Southpoint Dr. South # 310, Jacksonville, FL 32216
Indian River, St. Lucie, Martin, Palm Beach, Broward	South Florida Ecological Service Office	1339 20 th Street Vero Beach, FL 32960

- 4a. Compaction sampling stations shall be located at 500-foot intervals along the project area. One station shall be at the seaward edge of the berm and one station shall be midway between the berm and the high water line (normal wrack line). At each station, the cone penetrometer shall be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to ensure accurate readings of successive levels of sediment. The penetrometer may need to be reset between pushes, especially if sediment layering exists. Layers of highly compact material may lay over less compact layers. Replicates shall be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments. The three replicate compaction values for each depth shall be averaged to produce final values for each depth at each station. Reports shall include all 18 values for each transect line, and the final 6 averaged compaction values.
- 4b. If the average value for any depth exceeds 500 pounds per square inch (psi) for any two or more adjacent stations, then that area shall be tilled prior to March 1. If values exceeding 500 psi are distributed throughout the project area, but in no case do those

values exist at two adjacent stations at the same depth, then consultation with the Service will be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the project area, tilling will not be required.

- 4c. Tilling shall occur landward of the wrack line and avoid all vegetated areas three square feet or greater with a 3 square foot buffer around the vegetated areas.
5. Visual surveys for escarpments along the project area shall be made immediately after completion of the berm project and prior to March 1 for 3 subsequent years. Escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet shall be leveled and the beach profile shall be reconfigured to minimize scarp formation by March 1. If the project is completed during the early part of the sea turtle nesting and hatching season (March 1 through April 30), escarpments may be required to be leveled immediately, while protecting nests that have been relocated or left in place. Surveys for escarpments shall be conducted weekly. Results of the surveys shall be submitted within one month to the Service's appropriate Field Office prior to any action being taken during the nesting season. The Service shall be contacted immediately if subsequent reformation of escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet occurs during the nesting and hatching season to determine the appropriate action to be taken. If it is determined that escarpment leveling is required during the nesting or hatching season, the Service will provide a brief written authorization that describes methods to be used to reduce the likelihood of impacting existing nests. An annual summary of escarpment surveys and actions taken shall be submitted to the Service's Field Office (**Table 20**). (NOTE: Out-year escarpment monitoring and remediation are not required if placed material no longer remains on the dry beach).

For emergency berm construction and repair projects in Nassau, Duval, St. Johns, Flagler, Volusia, Miami-Dade, Monroe, Collier, Lee, Charlotte, Sarasota, Manatee, Hillsborough, Pinellas, Pasco, Franklin, Gulf, Bay, Walton, Okaloosa, Santa Rosa and Escambia counties, Florida

6. Daily early morning surveys for sea turtle nests will be required if any portion of the berm construction occurs as follows:

For Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf, Franklin and Pasco counties, nesting surveys shall be initiated 70 days prior to berm construction activities or by May 1 whichever is later. Nesting surveys shall continue through the end of the project or through October 31 whichever is earlier. If nests are constructed in areas where they may be affected by construction activities, eggs shall be relocated per the requirements listed below;

For Dade, Pinellas, Manatee, Sarasota, Charlotte, Lee, Collier, and Monroe, nesting surveys shall be initiated 65 days prior to berm construction activities or by April 1 whichever is later. Nesting surveys shall continue through the end of the project or through November 30 whichever is earlier. If nests are constructed in areas where they may be affected by construction activities, eggs shall be relocated per the requirement listed below;

For Volusia, Flagler, St. John, Duval and Nassau Counties, nesting surveys shall be initiated 65 days prior to berm placement or by April 15 whichever is later. Nesting surveys shall continue through the end of the project or through November 30 whichever is earlier. If nests are constructed in areas where they may be affected by construction activities, eggs shall be relocated per the requirements listed below;

- 6a. Nesting surveys and egg relocations will only be conducted by personnel with prior experience and training in nesting survey and egg relocation procedures. All nesting surveys, nest relocations screening or caging activities etc. shall be conducted only by persons with prior experience and training in these activities and who is duly authorized to conduct such activities through a valid permit issued by FWC, pursuant to FAC 68E-1. Nesting surveys shall be conducted daily between sunrise and 9 a.m. (this is for all time zones). The contractor shall not initiate work until daily notice has been received from the sea turtle permit holder that the morning survey has been completed. Surveys shall be performed in such a manner so as to ensure that construction activity does not occur in any location prior to completion of the necessary sea turtle protection measures.
- 6b. Only those nests that may be affected by construction activities will be relocated. Nests requiring relocation shall be moved no later than 9 a.m. the morning following deposition to a nearby self-release beach site in a secure setting where artificial lighting will not interfere with hatchling orientation. Relocated nests shall not be placed in organized groupings; relocated nests shall be randomly staggered along the length and width of the beach in settings that are not expected to experience daily inundation by high tides or known to routinely experience severe erosion and egg loss, or subject to artificial lighting. Nest relocations in association with construction activities shall cease when construction activities no longer threaten nests.
- 6c. Nests deposited within areas where construction activities have ceased or will not occur for 65 days shall be marked and left *in situ* unless other factors threaten the success of the nest. The turtle permit holder shall install an on-beach marker at the nest site and/or a secondary marker at a point landward as possible to assure that future location of the nest will be possible should the on-beach marker be lost. A series of stakes and highly visible survey ribbon or string shall be installed to establish a 10-foot radius around the nest. No activity will occur within this area nor will any activities occur which could result in impacts to the nest. Nest sites shall be inspected daily to assure nest markers remain in place and the nest has not been disturbed by the restoration activity.
7. Immediately after completion of the project and prior to the following dates in **Table 24** for 3 subsequent years, sand compaction shall be monitored in the area of restoration in accordance with a protocol agreed to by the Service, the FWC, and the Applicant or local sponsor. At a minimum, the protocol provided under 7a, 7b, 7c, 7d, and 7e below shall be followed. If tilling is required, the area shall be tilled to a depth of 36 inches. All tilling activity shall be completed prior to those dates listed above.

Table 24. Dates related to compaction monitoring.

DATE	COUNTY THE PROJECT OCCURS IN
April 15	Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf, Franklin, Pasco, Volusia, Flagler, St. John, Duval, Nassau, Pinellas, Manatee, Sarasota, Charlotte, Lee, Collier
April 1	Dade, Monroe

Each pass of the tilling equipment shall be overlapped to allow more thorough and even tilling. If the project is completed during the nesting season, tilling will not be performed in areas where nests have been left in place or relocated. (NOTE: The requirement for compaction monitoring can be eliminated if the decision is made to till regardless of post-construction compaction levels. Additionally, out-year compaction monitoring and remediation are not required if placed material no longer remains on the dry beach.) A report on the results of the compaction monitoring shall be submitted to the Service's field office prior to any tilling actions being taken (Table 25).

Table 25. Service's Field Offices.

COUNTY THE PROJECT OCCURS IN	SERVICE FIELD OFFICE	ADDRESS
Nassau, Duval, St. Johns, Flagler, Volusia, Manatee, Pinellas and Hillsborough	North Florida Ecological Service Office	6620 Southpoint Dr. South Suite# 310 Jacksonville, FL 32216
Charlotte, Collier, Lee, Martin, Miami-Dade, Monroe and Sarasota	South Florida Ecological Service Office	1339 20 th Street Vero Beach, FL 32960
Bay, Escambia, Franklin, Gulf, Okaloosa, Santa Rosa and Walton	Panama City Ecological Service Office	1601 Balboa Avenue Panama City, FL 32405

- 7a. Compaction sampling stations shall be located at 500-foot intervals along the project area. One station shall be at the seaward edge of the dune/bulkhead line (when material is placed in this area), and one station shall be midway between the dune line and the high water line (normal wrack line).
- 7b. At each station, the cone penetrometer shall be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to ensure accurate readings of successive levels of sediment. The penetrometer may need to be reset between pushes, especially if sediment layering exists. Layers of highly compact material may lie over less compact layers. Replicates shall be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments. The three replicate compaction values for each depth shall be averaged to produce final values for each depth at each station. Reports will include all 18 values for each transect line, and the final 6 averaged compaction values.
- 7c. If the average value for any depth exceeds 500 pounds per square inch (psi) for any two or more adjacent stations, then that area shall be tilled immediately prior to the following dates listed above.

- 7d. If values exceeding 500 psi are distributed throughout the project area but in no case do those values exist at two adjacent stations at the same depth, then consultation with the Service will be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the project area, tilling will not be required.
- 7e. Tilling shall occur landward of the wrack line and avoid all vegetated areas three square feet or greater with a 3 square foot buffer around the vegetated areas.
8. Visual surveys for escarpments along the project area shall be made immediately after completion of the project and prior to the following dates (**Table 26**) for 3 subsequent years. Escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet shall be leveled and the beach profile shall be reconfigured to minimize scarp formation.

Table 26. Dates for escarpment visual surveys.

DATE	COUNTY THE PROJECT OCCURS IN
April 15	Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf, Franklin, Pasco, Volusia, Flagler, St. John, Duval, Nassau, Pinellas, Manatee, Sarasota, Charlotte, Lee, Collier
April 1	Dade, Monroe

If the project is completed during the sea turtle nesting and hatching season, escarpments may be required to be leveled immediately, while protecting nests that have been relocated or left in place. Surveys for escarpments shall be conducted weekly. Results of the surveys shall be submitted within one month to the Service's appropriate Field Office prior to any action being taken during the nesting season. The Service shall be contacted immediately if subsequent reformation of escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet occurs during the nesting and hatching season to determine the appropriate action to be taken. If it is determined that escarpment leveling is required during the nesting or hatching season, the Service will provide a brief written authorization that describes methods to be used to reduce the likelihood of impacting existing nests. An annual summary of escarpment surveys and actions taken shall be submitted to the Service (**Table 25**). (NOTE: Out-year escarpment monitoring and remediation are not required if placed material no longer remains on the beach).

9. Staging areas for construction equipment shall be located off the beach to the maximum extent practicable during the following time periods (**Table 27**):

Table 27. Dates when construction equipment shall be located off the beach.

DATE	COUNTY PROJECT OCCURS
April 1 to November 30	Dade, Monroe
April 15 to November 30	Volusia, Flagler, St. John, Duval, Nassau
May 1 to October 31	Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf, Franklin, Pasco, Pinellas, Manatee, Sarasota, Charlotte, Lee, Collier

Nighttime storage of construction equipment not in use shall be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all construction pipes that are placed on the beach shall be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes shall be off the beach to the maximum extent possible. Temporary storage of pipes on the beach shall be in such a manner so as to impact the least amount of nesting habitat and shall not compromise the integrity of the dune systems. Pipes placed parallel to the dune shall be five to ten feet away from the toe of the dune (placement of pipes perpendicular to the shoreline is recommended as the method of storage).

Protection of Beach Mice

1. Existing beach access points shall be used for vehicle and equipment beach access to the maximum extent practicable. Existing access may be expanded to accommodate project work equipment and vehicles. These accesses shall be delineated by fence or other suitable material to ensure vehicles and equipment transport stay within the access corridor. The accesses shall be fully restored to pre-project work configuration following project completion. Equipment and material staging/storage areas for the project shall be located outside of vegetated dune habitat and public lands. No storage of equipment or materials shall occur on the beach or dunes at any time of year. Parking areas for construction crews shall be located as close as possible to the work sites, but outside of vegetated dunes to minimize impacts to existing habitat and the need to transport workers along the beachfront. The number of beach access sites for vehicles and equipment shall be minimal, clearly marked. All access and staging areas shall be restored upon completion of emergency berm construction and repair.
2. The creation of new or expansion of existing beach accesses within beach mouse habitat for vehicles and equipment is authorized no more than every 4 miles. The accesses shall be delineated by fence or other suitable material to ensure vehicles and equipment transport stay within the access corridor. These accesses shall be fully restored following project completion.

Protection of Piping Plovers

1. The FEMA or their grant applicant shall consult individually for the following emergency berm construction and repair projects located in:
 - 1a. Designated piping plover critical habitat units (**Appendix B**).
 - 1b. Florida State Parks and other non-federal public lands except to protect “existing structures” such as offices or restroom facilities. Berm placement to protect coastal roads, parking lots, boardwalks, picnic tables, gazebos, light poles, and benches require separate consultations and are not covered under “existing structures”. Federal lands are exempt from FEMA berm funds.

2. **The FEMA or their grant applicant shall conduct either the following Term and Condition or “Protection of Piping Plovers prior, during, and after the project 3a-i:”**

FEMA or their grant applicant shall contribute at least **\$3,100** for each mile or **\$0.60 per linear foot** of berm constructed. The Service will take the lead and work with FEMA or the grant applicant to develop a mechanism for receiving and allocating these monies. The funds will be used towards the management and monitoring of piping plovers and their habitat on public or private lands which have a demonstrated use or potential use by piping plovers. Management may include but not be limited to posting and roping important use areas, enforcement of pet ordinances, and protection of closed off areas. Monitoring may assist in summarizing the status of plovers and their habitat. Trends in areas used by piping plovers may also be assessed in portions of Florida depending on data collected as funding allows." An oversight committee will be formed and they will determine funding allocation. Funds (federal, state or private) from outside sources may contribute to this “Shorebird Conservation Funding Program.” These funds are to be used to minimize potential impacts to areas that may be used by piping plover that may be displaced permanently or temporarily by the project.

OR

3. **Protection of piping plover prior, during, and after the project.**

- 3a. Prior to construction, survey and map onto aerial photography, throughout the project area, optimal non-breeding piping plover habitat (low lying areas, washover passes, inlets, ephemeral ponds, lagoons, and mud and sand flats).
- 3b. Avoid berm placement in optimal piping plover habitat whether existing or newly created by storm events. If these areas cannot be avoided, the FEMA grant applicant shall arrange a meeting between representatives of the contractor, the Service, and the FWC, at least 10 days prior to the commencement of work on this project to discuss avoidance and minimization of impacts to the habitat.
- 3c. Avoid berm placement within 300 feet of inlets (dune lakes, bay inlets, island inlets, etc) and any open body of water except GOM or Atlantic Ocean. If this requirement is not feasible, the FEMA grant applicant shall arrange a meeting between representatives of the contractor and the Service at least 10 days prior to the commencement of work on this project to discuss avoidance and minimization of impacts to the habitat.
- 3d. If piping plovers are reported in the project area, poles or pier pilings occurring within 300 feet of optimal piping plover habitat shall be reported to the Service. The FEMA grant applicant shall coordinate a meeting with the Service to discuss retro-fitting these poles to reduce avian predation.
- 3e. Conduct surveys for non-breeding piping plover in the project area daily starting two weeks prior to project initiation for the duration of the berm construction period between July 15 and May 15 (10 months of the year), if optimal non-breeding piping plover

habitat is documented in the project area. Submit daily piping plover survey results to the Service (**Table 20**) with maps documenting the locations of piping plovers (with GPS coordinates or latitude and longitude coordinates) if seen during this survey period.

- 3f. Conduct bi-monthly surveys for piping plovers in the project areas from July 15 through May 15 of each year (10 months of the year) beginning two weeks post construction and continuing for the duration of the berm. Maintain information in a database (e.g. Access or Excel). Report negative and positive survey data and the amount and type of recreational use documented. Record piping plover locations with a Global Positioning System (GPS), habitat type used (intertidal area, mid-beach, etc), and observed behavior (foraging, roosting, etc). Incorporate all information collected into the database. Guidelines for conducting surveys are included in **Appendix C**. Submit yearly piping plover survey results (datasheets and database) to the Service (Table 20) with maps documenting the locations of piping plovers (with GPS coordinates or latitude and longitude coordinates) when seen.

Conduct at least one of the bi-monthly shorebird surveys April through October on a weekend to document the amount of recreational pressure potentially occurring along the shoreline.

- 3g. The FEMA or their grant applicant shall meet with the Service and FWC to discuss areas within the project area where natural organic material (wrack) can remain along the shoreline year-round. Wrack provides important foraging and roosting habitat by piping plovers on winter and migration grounds as well as an abundance of other shorebirds. Protection of wrack will help to offset the impacts of shorebird habitat directly or indirectly impacted by berm placement and ensuing human disturbance.
- 3h. When piping plovers or optimal habitat are documented in the project area, "Disturbance-Free Zones" shall be posted and roped off at least 300 feet away from the berm construction areas where potential bird resting and feeding are occurring. These areas shall remain roped off for the duration of the project.
- 3i. Excluding the Florida Panhandle Counties (Escambia to Jefferson County), surveys for and removal of exotic vegetation shall be conducted annually on the berm and within ten (10) feet on either side of the berm for the duration of the project or five (5) years, whichever is lesser to minimize the chances of an exotic seed source contained in the berm material becomes established on the beach.

Surveys should focus on the removal of all exotics, including the following which are known to impact coastal areas in Florida: Australian pine (*Casuarina equisetifolia*), melaleuca (*Melaleuca quinquenervia*), Brazilian pepper (*Schinus terebinthifolius*), beach naupaka (*Scaevola taccada*), latherleaf (*Colubrina asiatica*), carrotwood (*Cupaniopsis anacardioides*), lantana (*Lantana camara*), sisal (*Agave sisalana*), beach vitex (*Vitex rotundifolia*) and bowstring hemp (*Sansevieria hyacinthoides*).

Stabilization of Berms with Vegetation

1. Berms constructed within Perdido Key beach mouse habitat shall be stabilized by planting of native dune vegetation per the requirements provided below. The need to stabilize berms with vegetation in Choctawhatchee, St. Andrew, Anastasia Island, and Southeastern beach mouse habitat shall be coordinated with the Service Field Office as indicated on Table 28.

Table 28. Beach mouse occurrence relative to Fish and Wildlife Service Field Office.

COUNTY PROJECT OCCURS	SERVICE FIELD OFFICE	ADDRESS
Anastasia Island beach mouse- St. Johns Southeastern beach mouse – Volusia, Brevard,	North Florida Ecological Service Office	6620 Southpoint Dr. South # 310, Jacksonville, FL 32216
Southeastern beach mouse - Indian River	South Florida Ecological Service Office	1339 20 th Street Vero Beach, FL 32960
Perdido Key beach mouse- Escambia Choctawhatchee beach mouse- Okaloosa, Walton, and Bay St. Andrew beach mouse- Gulf	Panama City Ecological Service Office	1601 Balboa Avenue Panama City, FL 32405

2. Planting of vegetation on the berms may occur year round with the following conditions implemented.
 - 2a. Daily early morning sea turtle nesting surveys shall be conducted during the period from May 1 through October 31. If the planting is conducted in Brevard, Indian River, Martin, Palm Beach, St. Lucie and Broward Counties, daily early morning sea turtle nesting surveys are required and shall include March 1 to April 30 and November 1 to November 30. Nest surveys shall only be conducted by personnel with prior experience and training in nest surveys. Surveyors shall have a valid FWC permit. Nest surveys shall be conducted daily between sunrise and 9 a.m. (all times). No dune planting activity shall occur until after the daily turtle survey and nest conservation and protection efforts have been completed.
 - 2b. Nesting surveys shall be initiated 65 days prior to dune planting activities or by May 1, whichever is later and by March 1, if the planting occurs in Brevard, Indian River, Martin, Palm Beach, St. Lucie or Broward counties. Nesting surveys shall continue through the end of the project or through September 1, whichever is earlier. Hatching and emerging success monitoring will involve checking nests beyond the completion date of the daily early morning nesting surveys.
 - 2c. Any nests deposited in the dune planting area not requiring relocation for conservation purposes shall be left *in situ*. The turtle permit holder shall install an on-beach marker at the nest site and a secondary marker at a point as far landward as possible to assure that future location of the nest will be possible should the on-beach marker be lost. A series of stakes and highly visible survey ribbon or string shall be installed to establish an area of 3-foot radius surrounding the nest. No planting or other activity shall occur within this area or will any activities occur which could result in impacts to the nest. Nest sites shall

be inspected daily to assure nest markers remain in place and the nest has not been disturbed by the planting activity.

- 2d. If a nest is disturbed or uncovered during planting activity, the Applicant or their contractors shall cease all work and immediately contact the responsible turtle permit holder. If a nest(s) cannot be safely avoided during planting, all activity within the affected project site shall be delayed until hatching and emerging success monitoring of the nest is completed.
- 2e. All berm planting activities shall be conducted by hand and only during daylight hours.
- 2f. All dune vegetation shall consist of coastal dune species native to the local area; (*i.e.*, native to coastal dunes in the respective county and grown from plant stock from that region of Florida). Seedlings shall be at least 1 inch by 1 inch with a 2.5-inch pot. Planting shall be on 18-inch centers throughout the created dune; however, 24-inch centers may be acceptable depending on the area to be planted. Vegetation shall be planted with an appropriate amount of fertilizer and anti-desiccant material, as appropriate, for the plant size.
- 2g. No use of heavy equipment (trucks) shall occur on the dunes or seaward for planting purposes. A lightweight (ATV type) vehicle, with tire pressures of 10 psi or less may be operated on the beach.
- 2h. All irrigation equipment shall be installed as authorized under a FDEP permit.

Reporting

- 1. A report describing the projects conducted during the year and actions taken to implement the reasonable and prudent measures and terms and conditions of this incidental take statement shall be submitted to the Service (**Table 25**) by March 1 of the following year of completing the proposed work for each year when the activity has occurred. This report will include the project location (include DEP R-Monuments), project description, dates of actual construction activities, sand source and beach compatibility analysis, names and qualifications of personnel involved in sea turtle nest surveys and relocation activities, descriptions and locations of self-release beach sites, sea turtle nest survey and relocation results and the information outlined in **Table 30**, acreage of new or widened access areas affected in beach mouse habitat, vegetation completed for new or widened access areas, success rate of vegetation of vegetation, names and qualifications of personnel involved in piping plover surveys, results of the daily piping plover surveys shall be submitted, with maps documenting the locations of piping plover (with GPS points or latitude and longitude coordinates), if observed during the survey period, post-construction maps.
- 2. In the event a sea turtle nest is excavated during construction activities, the permitted person responsible for egg relocation for the project shall be notified so the eggs can be moved to a suitable relocation site.

3. Upon locating a sea turtle adult, hatchling, or egg, beach mouse, or piping plover, that may have been harmed, destroyed, killed or injured as a direct or indirect result of the project, notification shall be immediately made to the FWC at 1-888-404-3922 and the Service (Table 29).

Care shall be taken in handling injured turtles or eggs, beach mice or piping plovers to ensure effective treatment or disposition and in handling dead specimens to preserve biological materials in the best possible state for later analysis.

Table 29. Service Field Offices for contacting concerning injury or death of a species during project construction.

COUNTY PROJECT OCCURS	SERVICE FIELD OFFICE	PHONE NUMBER
Nassau, Duval, St. Johns, Flagler, Volusia, Brevard, Manatee, Pinellas and Hillsborough	North Florida Ecological Service Office	(904) 232-2580
Indian River, Broward, Charlotte, Collier, Lee, Martin, Miami-Dade, Monroe, Palm Beach, Sarasota and St. Lucie	South Florida Ecological Service Office	(772) 562-3909
Bay, Escambia, Franklin, Gulf, Okaloosa, Santa Rosa and Walton	Panama City Ecological Service Office	(850) 769-0552

Table 30. Sea Turtle Monitoring for Emergency Berm Construction and Repair Projects.

CHARACTERISTIC	PARAMETER	MEASUREMENT	VARIABLE
Nesting Success	False crawls - number	Visual assessment of all false crawls	Number and location of false crawls in nourished areas and non nourished areas: any interaction of the turtle with obstructions, such as groins, seawalls, or scarps, should be noted.
	False crawl - type	Categorization of the stage at which nesting was abandoned	Number in each of the following categories: emergence-no digging, preliminary body pit, abandoned egg chamber.
	Nests	Number	The number of sea turtle nests in nourished and non nourished areas should be noted. If possible, the location of all sea turtle nests shall be marked on map of project, and approximate distance to sea walls or scarps measured using a meter tape. Any abnormal cavity morphologies should be reported as well as whether turtle touched groins, seawalls, or scarps during nest excavation
		Lost Nests	The number of nests lost to inundation, erosion or the number with lost markers that could not be found.
	Lighting Impacts	Disoriented sea turtles	The number of disoriented hatchlings and adults shall be documented and reported in accordance with existing FWC protocol for disorientation events.

CHARACTERISTIC	PARAMETER	MEASUREMENT	VARIABLE
Reproductive Success	Emergence & hatching success	Standard survey protocol	Numbers of the following: unhatched eggs, depredated nests and eggs, live pipped eggs, dead pipped eggs, live hatchlings in nest, dead hatchlings in nest, hatchlings emerged, disoriented hatchlings, depredated hatchlings

The RPMs, with their implementing T&Cs, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. The Service has determined that no more than 75 miles of shoreline in highly eroded areas of the Florida coastline within a federally declared emergency event area with suitable habitat for nesting loggerhead, green, leatherback, Kemp's ridley, and hawksbill sea turtles, and SEBM, AIBM, CBM, SABM, PKBM, and non-breeding piping plovers will be incidentally taken. If during the course of the action, this level is exceeded; such incidental take represents new information requiring initiation of consultation and review of the RPMs provided. FEMA shall immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the RPMs.

COORDINATION OF INCIDENTAL TAKE STATEMENTS WITH OTHER LAWS, REGULATIONS, AND POLICIES

Migratory birds including bald eagles

Relative to the piping plover, the Service will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712) or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. 668-668d), if such take is in compliance with the terms and conditions specified here.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

1. Appropriate native salt-resistant dune vegetation should be established on the berms.
2. Surveys for nesting success of sea turtles should be continued for a minimum of 3 years following berm construction to determine whether sea turtle nesting success has been adversely impacted.

3. The FEMA grant Applicant should implement predator control programs that target free ranging domestic and feral cats;
4. The FEMA grant Applicant should install dune walkovers at public beach access points to protect the constructed berms;
5. The FEMA grant Applicant should work with property owners and managers within the project area to install and maintain predator proof trash receptacles at beach accesses points;
6. FEMA should consider measures to limit coastal development that would exacerbate coastal erosion and then require storm protection in the future;
7. The FEMA grant Applicant should consider purchasing land for shorebird conservation which could include locations where natural shoreline processes can occur unimpeded. These might include not only undeveloped areas, but the potential “buy-out” of developments in areas that are sparsely developed and have high potential habitat value (*e.g.*, proximity to feeding areas, prone to overwash, etc.).
8. In order to comply with the MBTA^b and potential for this project to impact nesting shorebirds, the FEMA grant Applicant should follow FWC’s standard guidelines to protect against impacts to nesting shorebirds during implementation of this project during the periods from February 15-August 31.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in FEMA’s request concerning the construction of 5-year berms on the beach for storm protection following a federally declared emergency event. As written in 50 CFR ' 402.16, reinitiation of formal consultation is required where discretionary FEMA involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the FEMA action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the FEMA action is later modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease until reinitiation.

For this biological opinion, the incidental take would be exceeded when the take as identified in Tables 16, 18, and 20 is exceeded which is what has been exempted from the prohibitions of

^b The Migratory Bird Treat Act (MBTA) implements various treaties and conventions between the U.S., Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory bird. Under the provisions of the MBTA it is unlawful “by any means or manner to pursue, hunt, take, capture or kill any migratory bird except as permitted by regulations issued by the Fish and Wildlife Service. The term “take” is not defined in the MBTA, but the Service has defined it by regulation to mean to pursue, hunt, shoot, wound, kill, trap, capture or collect any migratory bird, or any part, next or egg or any migratory bird covered by the conventions or to attempt those activities.

section 9 by this opinion. The Service appreciates the cooperation of the FEMA during this consultation. We would like to continue working with you and your staff regarding this project. The above findings and recommendations constitute the report of the Service. If you have any questions about this BO, please contact Ann Marie Lauritsen of this office at (904) 525-0661, Lorna Patrick of the Panama City Field Office at (850) 769-0552 or Jeffrey Howe of the South Florida Field Office at (772) 562-3909.

Sincerely,



David L. Hankla
Field Supervisor

cc:

FWC, Tallahassee, Florida, (Robbin Trindell),
FWC, Panama City, Florida (John Himes)
FWC, Lake City, Florida (Terry Doonan)
FWC, Lake City, Florida (Melissa Tucker)
FWC, Lake City, Florida (Nancy Douglas)
Service, Panama City, Florida, (Patricia Kelly)
Service, Panama City, Florida (Lorna Patrick)
Service, Vero Beach, Florida (Jeffrey Howe)
Service, Jacksonville, Florida (Sandy MacPherson)
Service, Jacksonville, Florida (Nicole Adimey)
Service, Atlanta RO digital version in word (Ken Graham)

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Appendix A

Previous formal consultations/biological opinions within Florida that have been issued for all projects that had adverse impacts to the nesting sea turtle.

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
JAX FIELD OFFICE					
1991	Brevard	Lighting at Cape Canaveral Air Force and Patrick Air Force Station	Lighting at both installations	Sea turtle lighting	75 disoriented loggerhead nests; 2 green turtles nests at CCAFS and 2 loggerhead nests at PAFB
1993	Brevard	Beach nourishment on Cape Canaveral		Beach nourishment	2 miles
1995	Brevard	Inlet bypass on Brevard County Beach at Cape Canaveral	R-1 to R-14	Inlet bypass	
1996	Brevard	Canaveral Port Authority dredge and beach disposal	R-34 to R-38	Dredge and beach restoration	
1998	Brevard	Inlet bypass on Brevard County Beach at Cape Canaveral	R-1 to R-14		

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2000	Brevard	Amended lighting at Cape Canaveral Air Force and Patrick Air Force Station	Lighting at both installations	Sea turtle lighting	2 percent hatchling and nesting female disorientations at each installation.
2001	Brevard	Brevard County Shore Protection Project (North Reach)	R-5 to R-12 and R-13 to R-54.5	Beach nourishment	9.4 miles
2001	Brevard	Patrick Air Force Base Beach Restoration	R-53 to R-70	Beach nourishment	
2002	Brevard	Brevard County Shore Protection Project (South Reach)	R-123.5 to R-139	Beach nourishment	3.02 miles
2002	Brevard	Brevard County Shore Protection Project (North Reach)	R-4 to R-20	Beach nourishment	
2002	Brevard	Permanent sand tightening of north jetty at Canaveral Harbor	North jetty at Canaveral Inlet	Sand tightening and extension of existing jetty	500 feet
2003	Brevard	Brevard County Shore Protection Project (South Reach)	R-118.3 to R-123.5		0.94 mile
2004	Brevard	Canaveral Harbor Federal Sand Bypass and Beach Placement	R-14 to R-20	Inlet bypass and beach nourishment	18,600 linear feet

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2005	Brevard	Brevard County Shore Protection Project (North and South Reach)	R-5 to R-20 and R-21 to R-54.5 and R-118 to R-139	Beach nourishment	13.2 miles
2005	Brevard	Brevard County FEMA Berm and Dune Restoration	R-75 to R-118	Dune repair	12 miles
2005	Brevard	Patrick Air Force Base Beach Restoration	R-54.5 to R-75.3	Beach nourishment	
2005	Brevard	Sloped Geotextile Revetment Armoring Structures	5 tubes along north and south Melbourne beach	Protect tube installation	4,600 linear feet
2006	Brevard	Brevard County FEMA Berm and Dune Restoration	R-75 to R-118	Dune repair	12 miles
2006	Brevard	Amended Lighting at Cape Canaveral Air Force and Patrick Air Force Station		Sea turtle lighting	3 percent hatchling and nesting female disorientations at each installation
2008	Brevard	Patrick Air Force Base Dune Restoration	R-65 to R-70	Dune Restoration	6,000 linear feet

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2008	Brevard	Brevard County's Dune Restoration	R-75 to R-118 and R-138 to R-202	Dune Restoration	140,000 cy along 3,000 linear feet
1991	Duval	Duval County Beach Erosion Control	R-44 to R-52.5	Beach nourishment	9,000 linear feet
1996	Duval	Duval County Beach Erosion Control	R-47 to R-80	Beach nourishment	5 miles
2003	Duval	Duval County Beach Erosion Control	R-72 to R-80	Beach nourishment	
2005	Duval	Duval County Beach Erosion Control	R-43 to R-53 and R-57 to R-80	Beach nourishment	5.7 miles
2005	Flagler	Road Stabilization from SR A1A		Seawall	140 linear feet
2005	Hillsborough	Egmont Key Nourishment	R-2 to R-10	Beach nourishment	8,000 linear feet
1993	Manatee	Anna Maria Island Beach Restoration	R-2 to R-36	Beach nourishment	4.7 miles
1997	Manatee	Dredge Material Disposal and Longboat Key Beach Restoration	R-48 to R-51	Dredge and beach nourishment	
2002	Manatee	Anna Maria Island Beach Restoration	R-7 to R-10 and R-12 to R-36	Beach nourishment	5.2 miles
2005	Manatee	Anna Maria Island Shore Protection Project	R-7 to R-10	Beach nourishment	3,000 linear feet

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2005	Manatee	Anna Maria Island Emergency Beach Restoration	R-2 to R-41	Beach nourishment	4.2 miles
2005	Manatee	Town of Longboat Key Beach Renourishment	R-44.5 to R-46	Beach nourishment	0.34 mile
2007	Manatee	Longboat Key Groin Installation		Groin installation	2,210 linear feet
1994	Nassau	South Amelia Island Beach Restoration	R-60 to R-78	Beach nourishment	
1997	Nassau	Dredging of Sawpit Creek Cut and Beach Disposal	R-73.5 to R-78	Dredge and beach nourishment	2,900 linear feet
2002	Nassau	South Amelia Island Beach Restoration	R-50 to R-80	Beach nourishment	3.4 miles
2002	Nassau	Fernandina Harbor Dredge and Beach Disposal	R-1 to R-9	Dredge and beach nourishment	8,000 linear feet
2004	Nassau	Nassau County Shore Protection Project at Amelia Island	R-9 to R-33	Beach nourishment	3.6 miles
2005	Nassau	Nassau County Shore Protection Project at Amelia Island	R-11 to R-34	Beach nourishment	4.3 miles
2005	Nassau	Dredging of Sawpit Creek Cut and Beach Disposal	R-73.5 to R-78	Dredge and beach nourishment	2,900 linear feet
1988	Pinellas	Sand Key/Redington Beach Restoration	R-99 to R-107	Beach nourishment	
1990	Pinellas	Sand Key/Indian Rocks Beach Restoration	R-72 to R-85	Beach nourishment	

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
1991	Pinellas	Long Key Beach Restoration	R-144 to R-147	Beach nourishment	0.45 mile
1991	Pinellas	Johns Pass Dredge Material Disposal	R-127 to R-130	Dredge disposal and sand placement	
1992	Pinellas	Sand Key/Redington Beach Restoration	R-99 to R-107	Beach nourishment	
1992	Pinellas	Sand Key/Indian Shore Beach Restoration	R-85 to R-99	Beach nourishment	
1996	Pinellas	Treasure Island Beach Restoration	R-138 to R-142	Beach nourishment	2,500 linear feet
1996	Pinellas	Long Key Beach Restoration	R-144 to R-146	Beach nourishment	0.45 mile
1998	Pinellas	Sand Key/Belleair Beach Restoration	R-56 to R-66	Beach nourishment	
1999	Pinellas	Sand Key Beach Restoration	R-71 to R-107	Beach nourishment	
2000	Pinellas	Treasure Island Beach Restoration	R-136 to R-141	Beach nourishment	2.0 miles
2000	Pinellas	Terminal Groin at North End of Treasure Island		Groin construction	
2000	Pinellas	Long Key Beach Restoration	R-144 to R-145.6	Beach nourishment	2,800 linear feet
2000	Pinellas	Dredge Material Disposal and Honeymoon Island Beach Restoration	R-10 to R-12	Dredge disposal and sand placement	
2004	Pinellas	Treasure Island Beach Restoration	R-136 to R-141	Beach nourishment	
2004	Pinellas	Long Key Beach Restoration	R-144 to R-148	Beach nourishment	4,000 linear feet

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2005	Pinellas	Sand Key Emergency Renourishment	R-56 to R-66 and R-72 to R-106	Beach nourishment	8.6 miles
2006	Pinellas	Treasure Island, Sunset, Long Key, Pass a Grill Emergency Renourishment	R-126 to R-146	Beach nourishment	9.5 miles
2006	Pinellas	Dredge Material Disposal and Mullet Key and Fort DeSoto Beach Restoration	R-177 to R-179.5 and R-181 to R-183	Dredge disposal and sand placement	4,500 linear feet
1997	St. Johns	Maintenance Dredging of Matanzas Inlet and Sand Placement at Summer Haven	R-197 to R-209		
2001	St. Johns	Maintenance Dredging of Matanzas Inlet and Sand Placement at Summer Haven			
2002	St. Johns	St. Johns County Shore Protection Project at St. Augustine	R-137 to R-152	Beach nourishment	2.5 miles
2003	St. Johns	St. Johns County Shore Protection Project at St. Augustine	R-132 to R-152	Beach nourishment	3.8 miles
2003	St. Johns	Maintenance Dredging of Matanzas Inlet and Sand Placement at Summer Haven	R-197 to R-209	Beach nourishment	
2005	St. Johns	St. Johns County Shore Protection Project at St. Augustine	R-137 to R-150	Beach nourishment	2.5 miles
2006	St. Johns			Beach driving	41.1 linear miles

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2007	St. Johns	Maintenance Dredging of Matanzas Inlet and Sand Placement at Summer Haven	R-200 to R-208	Beach nourishment	4,000 linear feet
2004	Volusia	Volusia County FEMA Berm	R-40 to R-145 and R-161 to R208	Beach nourishment	
2005	Volusia	Ponce de Leon Dredge and Beach Placement	R-143 to R-145	Dredge and sand placement	3,000 linear feet
2005	Volusia			Beach driving	50 miles
2006	Volusia	New Smyrna/Silver Sands Dune Restoration	R-161 to R-175	Beach restoration	5.4 miles
2006	Volusia	Volusia County FEMA Berm		Repair of right of way and beach placement	230 linear feet
2007	Volusia	Ponce de Leon Dredge and Beach Placement	R-158 to R-175	Dredge and sand placement	3.2 miles
PANAMA FIELD OFFICE					
1998	Bay	Panama City Beach beach nourishment	R-4.4 and R-93.2	Beach nourishment new project	16 miles
1998	Bay	Tyndall AFB driving on the beach	V-9 (virtual) to R-122	Driving on the beach for military missions	18 miles
1998	Bay	Lake Powell Emergency Opening	R-0.5	Emergency Outlet opening	1,500 feet

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
1999	Bay	Panama City Beach beach nourishment amendment 1	R-0.5 to R-9	Beach nourishment completion	16 miles (no additional take provided from original)
2000	Bay	Panama City Beach beach nourishment amendment 2	R-35 to R-71	Relief from tilling requirement Beach nourishment	16 miles (no additional take provided from original)
2000	Bay	Panama City Beach beach nourishment amendment 3	R-35 to R-71	Relief from tilling requirement Beach nourishment	16 miles (no additional take provided from original)
2000	Bay	Panama City Beach beach nourishment amendment 4	R-35 to R-71	Relief from tilling depth requirement and compaction testing sample numbers Beach nourishment	16 miles (no additional take provided from original)
2001	Bay	East Pass re-opening	No R-monuments	Dredging of a closed inlet and dredged material placement on beach	2 miles
2001	Bay	Panama City Beach beach nourishment amendment 5	R-35 to R-71	Relief from tilling depth requirement Beach nourishment	16 miles (no additional take provided from original)

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2001	Bay	City of Mexico Beach sand bypass system	Mexico Beach canal	Dredging and spoil disposal	3,700 feet 2.0 acres
2005	Bay	Panama City Beach beach nourishment amd. 5	R-4.4 and R-93.2	Post hurricane restoration	16 miles (no additional take provided from original)
2006	Bay	Tyndall Air Force Base INRMP	V-9 (virtual) to R-122	Integrated Natural Resources Mgmt Plan	18 miles
2006	Bay	Mexico Beach Canal Sand By Pass amendment 1	R-127 to R-129	By pass system improvements	5,000 feet
2007	Bay	Panama City Beach beach nourishment amendment 6	R-4.5 to R-30 and R-76 to R-88	New work and post hurricane restoration	31,500 feet of 16 miles total no additional take provided
2007	Bay	Panama City Beach nourishment amendment 8	2008 project: R-74 to R-91; Entire project: R-0.5 to R-91	Beach nourishment	17.9 miles

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2000	Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf, Franklin	Destin Dome OCS offshore oil and gas drilling	Gulf of Mexico federal waters	Oil and gas offshore exploration	Formal consultation with no take
2002	Escambia	Pensacola Beach beach nourishment	R-108 to R-143	Beach nourishment	8.3 miles Loggerhead 14 nests Green 1 nest Leatherback < 1 nest Kemp's ridley <1 nest
2005	Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf	FEMA beach berms post Hurricane Ivan emergency coordination – consultation not completed	UK	Emergency beach berms	Walton 20 miles Okaloosa 4.2 miles Mexico Bch 1 mile Panama City Bch UK St Joseph peninsula UK Perdido Key UK Navarre UK

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2004	Franklin	Alligator Point beach nourishment	R-207 to R-210	Beach nourishment	2,500 feet Loggerhead,: 2 nests, green 1 nest; leatherback 1 nest
2007	Gulf	St. Joseph peninsula beach nourishment	R-67 to R-105.5	Beach nourishment	7.5 miles
2001	Okaloosa	Eglin AFB porous groin within season	Eglin AFB Test Sites 1 and 3	Experimental porous groin system	
2002	Okaloosa	Eglin 737 Sensor Test Site 13-A SRI	V-507	Military testing	0.01 acre 0.12 mile
2004	Okaloosa, Santa Rosa	Eglin AFB Advance Skills Training	R-502 to R-534	Military training	7 miles 70 acres
2002	Santa Rosa, Okaloosa, Gulf	Eglin AFB INRMP	V-621 to V-501	Integrated natural resources Management Program	17 miles
2003	Santa Rosa, Okaloosa	Eglin Marine Expeditionary Unit Training	V-621 to V-501	Military Marine training	17 miles

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2003	Santa Rosa, Okaloosa	Eglin AFB U.S. Army Ranger Los Banos	V-502 to V-533	Military Army training	7 miles
2004	Santa Rosa, Okaloosa	Eglin AFB Airborne Littoral Reconnaissance Test	V-501 to V-514	Military Naval testing	0.5 mile 15.2 acres
2005	Santa Rosa	Navarre beach nourishment emergency coordination – consultation not completed	R-192.5 to R-213.5	Emergency beach nourishment	4.1 miles
2005	Santa Rosa, Okaloosa	Eglin Air Force Base military mission & training Santa Rosa Island Programmatic	V-621 to V-501	Military missions	17 miles
2006	Santa Rosa	Navarre Beach restoration amendment 1		Walkover construction associated with beach nourishment	4.1 miles (no additional take provided from original)
2006	Santa Rosa	Navarre Beach restoration amendment 1		Walkover construction associated with beach nourishment	4.1 miles (no additional take provided from original)
2006	Santa Rosa	Navarre Beach restoration amendment 1		Walkover construction associated with beach nourishment	4.1 miles (no additional take provided from original)

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2006	Santa Rosa	Navarre Beach restoration amendment 1		Walkover construction associated with beach nourishment	4.1 miles (no additional take provided from original)
2004	Walton, Okaloosa	Walton County-Destin beach nourishment	R-39 (Okaloosa Co.) to R-21.93 (Walton Co.)	New Beach nourishment	6.7 miles Loggerhead: 11 nests; green 1 nests; leatherback & Kemp's ridley: < 1 nests
2006	Walton	Western Lake Emergency Opening	R-72 to R-73	Emergency Outlet opening	0.5 miles 3.0 acres
2007	Walton	Eastern Lake Emergency Opening	R-94 to R-95	Emergency opening of coastal dune lake to GOM	0.5 mile
SOUTH FLORIDA FIELD OFFICE					

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2003	Broward	Broward County Shore Protection Project		Port Everglades dredging and beach nourishment	3,390 feet
2003	Broward	Diplomat Beach Nourishment		Nourishment and 200 feet of riprap	
2004	Broward	Fishermen's Pier		Pier repair	14,910 square feet
2007	Broward	Hillsboro Inlet Maintenance Dredging and Beach Placement	315 feet of the Inlet and 500 feet of shoreline at R-25.	Inlet dredging and beach nourishment	500 feet
2007	Broward	Town of Hillsboro Beach Pressure Equalizing Modules (PEMs) Pilot Project	R-7 to R-12 1 mile of shoreline	Pilot project to investigate the effectiveness of the PEMs	1 mile
2005	Charlotte	Manasota Key Groin Construction	R-19 to R-20	Stump Pass dredging (material placed on beach); and groin construction	1,000 feet
2006	Charlotte	Stump Pass Dredging and Beach Nourishment	R-16.5 to R-18	Stump Pass dredging and beach nourishment	1,500 feet
2003	Collier	Keewaydin Island Limited Partnership T-groin Project	R-90 to R-91	Gordon Pass – maintenance dredge; nourish the section of beach where groins are to be constructed; construct three t-groins	1,000 feet

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2005	Collier	Hideaway Beach	H-1 to H-5 and H-9 to H-12	Beach nourishment and T-groin construction	1.4 miles
2005	Collier	Collier County Beach Re-nourishment Project	Segments within R-22 and R-79	Beach nourishment	13.4 miles
2005	Collier	South Marco Island Beach Re-nourishment	R-144 to G-2	Beach nourishment	0.83 mile
2004	Indian River	Issuance of permits to homeowners for emergency coastal armoring			3,196 feet
2005	Indian River	Indian River County Beach Nourishment - Sectors 3 and 5	Gaps between R-21 and R-107	Dune restoration and beach nourishment	5.90 miles dunes 0.8 mile beach
2005	Indian River	Indian River County Beach Nourishment – Sector 7	R-97 to R-108	Beach nourishment	2.2 miles
2006	Indian River	Indian River County Beach Nourishment – Sectors 1 and 2	R-3.5 to R-12	Dune enhancement and beach nourishment	1.62 miles
2007	Indian River	Sebastian Inlet Channel and Sand Trap Dredging, Sectors 1 and 2 Beach Nourishment	R-3 to R-12	Sand trap dredging and beach nourishment	1.61 miles
2002	Lee	Gasparilla Island Beach Nourishment	R-10 to R-26.5 R-25, R-25.5, R-26	Beach nourishment; breakwater construction; and two T-head groins	3.2 miles

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2003	Lee	Bonita Beach Re-nourishment		Beach nourishment	3,922 feet
2005	Lee	Sanibel and Captiva Island Beach Nourishment	R-83 to R-109 and R-110 to R-118	Beach nourishment	6.0 miles
2007	Lee	Gasparilla Island Beach Nourishment (BO amendment)	South of R-26A	Beach nourishment	
2007	Lee	North Captiva Island Beach Nourishment	R-81 and 208 feet south of R-81A	Beach nourishment	0.23 mile
2002	Martin	Jupiter Island	R-75 to R-117	Beach nourishment	6.5 miles
2005	Martin	Martin County Shore Protection Project	R-1 to R-25.6	Beach nourishment	4.1 miles
2005	Martin	Jupiter Island Modification	R-76 to R-84 and R-87 to R-11	Beach nourishment	5 miles
2007	Martin	Sailfish Point Marina Channel Dredging and Beach Nourishment	R-36 to R-39	Channel dredging and beach nourishment	0.66 mile
2005	Miami-Dade	Bal-Harbour T-Groin Reconstruction	R-27 to R-31.5	Groin removal and reconstruction	0.85 mile

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2005	Miami-Dade	Bakers Overhaul AIW Maintenance Dredging	R-28 to R-32	Dredging and beach nourishment	0.85 mile
2006	Miami-Dade	Miami-Dade Beach Nourishment	3 segments within R-48.7 and R-61	Beach nourishment	3,716 feet
2007	Miami-Dade	Miami Beach Nourishment	R-67 to R-70	BO modification to June 7, 2006 BO	3,000 feet
2003	Palm Beach	Palm Beach Harbor M & O	200 feet south of the south jetty	Jetty sand tightening	200 feet
2004	Palm Beach	Boca Raton Inlet Sand Bypassing	200 feet south of R-223	Inlet sand bypassing and beach nourishment	500 feet
2005	Palm Beach	Palm Beach Shoreline Protection Project - Delray Segment	R-175 to R-188	Beach restoration	2.7 miles
2005	Palm Beach	Palm Beach Shoreline Protection Project - Ocean Ridge Section	R-153 to R-159	Beach nourishment	1.12 miles
2005	Palm Beach	South Lake Worth Inlet Sand Transfer Plant Reconstruction and Bypassing	135 feet south of R-151, to 275 feet south of R-152	STP reconstruction and bypassing	900 feet
2005	Palm Beach	Mid-Town Beach Nourishment Project	R-90.4 to R-101.4	Beach nourishment	2.4 miles
2005	Palm Beach	Palm Beach Harbor M & O	R-76 to R-79	Dredging and beach nourishment	3,450 feet

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2006	Palm Beach	Boca Raton Beach Nourishment Project – Central and South	R-216 to R-222 R-223.3 to R-227.9	Dredge shoal fronting Boca Raton Inlet and beach nourishment	2.3 miles
2006	Palm Beach	Palm Beach Nourishment Project – Reach 8	R-125 to R-134	Beach nourishment	2.17 miles
2006	Palm Beach	Sea Dunes Condominium Seawall		Seawall construction	0.03 acre
2006	Palm Beach	North Ocean Boulevard Rock Revetment	290 feet north of R-84; 1,150 feet south of R-85	Rock revetment construction	0.34 mile
2007	Palm Beach	Palm Beach Sand Transfer Plant Reconstruction	R-76 to R-79	Sand transfer plant reconstruction and discharge pipe extension	0.57 mile
2007	Palm Beach	Lake Worth Inlet Jetty Repair	200 feet north of R-75 and 200 feet south of R-76	Jetty repair	400 feet
2007	Palm Beach	Singer Island and South Palm Beach Emergency Dune Restoration	385' south of R-137 to 500' north of R-136; 500'south of R-60 to 850' south of R-65	Dune Restoration	6,135 feet

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2007	Palm Beach	Jupiter Island ICWW Maintenance Dredging and Beach Nourishment	16,000 feet (130,000 cy) of the ICWW dredged; material placed between R-13 and R-19.	Channel dredging and beach nourishment	1.04 miles
2007	Palm Beach	North Boca Raton Beach Nourishment	T-205 to 181 feet south of R-212	Beach nourishment	1.45 miles
2007	Palm Beach	Jupiter Inlet and channel dredging	R-13 to R-17	Dune restoration	~ 4,000 linear feet
2007	Palm Beach	Jupiter Inlet Sand Trap Dredging and Sand Placement	Maintenance dredging of the inlet; beach compatible placed R-13 to R-19	Inlet dredging and beach nourishment	1.02 miles
2007	Palm Beach	Modification to a sheet pile and rubble-mound T-head groin system	500 feet north of R-94 south to R-95	T-groin repair, extension, construction	0.4 mile
2008	Palm Beach	Reach 8 dune restoration	R-125 to 350 feet south of R-134	Dune restoration	2.17 miles

YEAR	COUNTY	PROJECT NAME	PROJECT LOCATION	PROJECT TYPE	ANTICIPATED INCIDENTAL TAKE (linear footage, no. of eggs, etc.)
2003	St. Lucie	Fort Pierce Shoreline Protection	R-33.8 to R-41	Beach nourishment; berm expansion; and six T-head groins	1.3 miles
2006	St. Lucie	Blind Creek Restoration and South St. Lucie Emergency Berm Remediation Project	R-98 to R-115 R-88 to R-90	Wetland restoration and beach nourishment	3.6 miles
2004	Sarasota and Manatee	Longboat Key Beach Nourishment	R-46A to R-29.5	Beach nourishment	9.45 miles
2005	Sarasota and Manatee	Longboat Key Beach Nourishment Project – BO Amendment			0.47 mile
2005	Sarasota	South Siesta Key	R-67 to R-77 plus 200 feet	Beach nourishment	2.1 miles
2007	Sarasota	Lido Key Beach Fill Placement Project	R-35.5 to R-44.2 2.27 miles	Beach nourishment	2.27 miles

Appendix B

General Locations and Unit Descriptions of the Designated Critical Habitat for the Wintering Piping Plover

(Federal Register / Vol. 66, No. 132 / Tuesday, July 10, 2001 Rules and Regulations)

General locations of the designated critical habitat for the Wintering Piping Plover.



Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Units: 1, 2 and 3

Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Units 1, 2, & 3

Unit FL-1: Big Lagoon. 8 ha (19 ac) in Escambia County.

The majority of the unit is within Big Lagoon State Recreation Area. This unit includes the peninsula and emerging sand and mudflats between 0.33 km (0.21 mi) west of the lookout tower along the shoreline and 0.24 km (0.15 mi) east of the lookout tower along the shoreline. Land along the shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All emerging sandbars to MLLW are included.

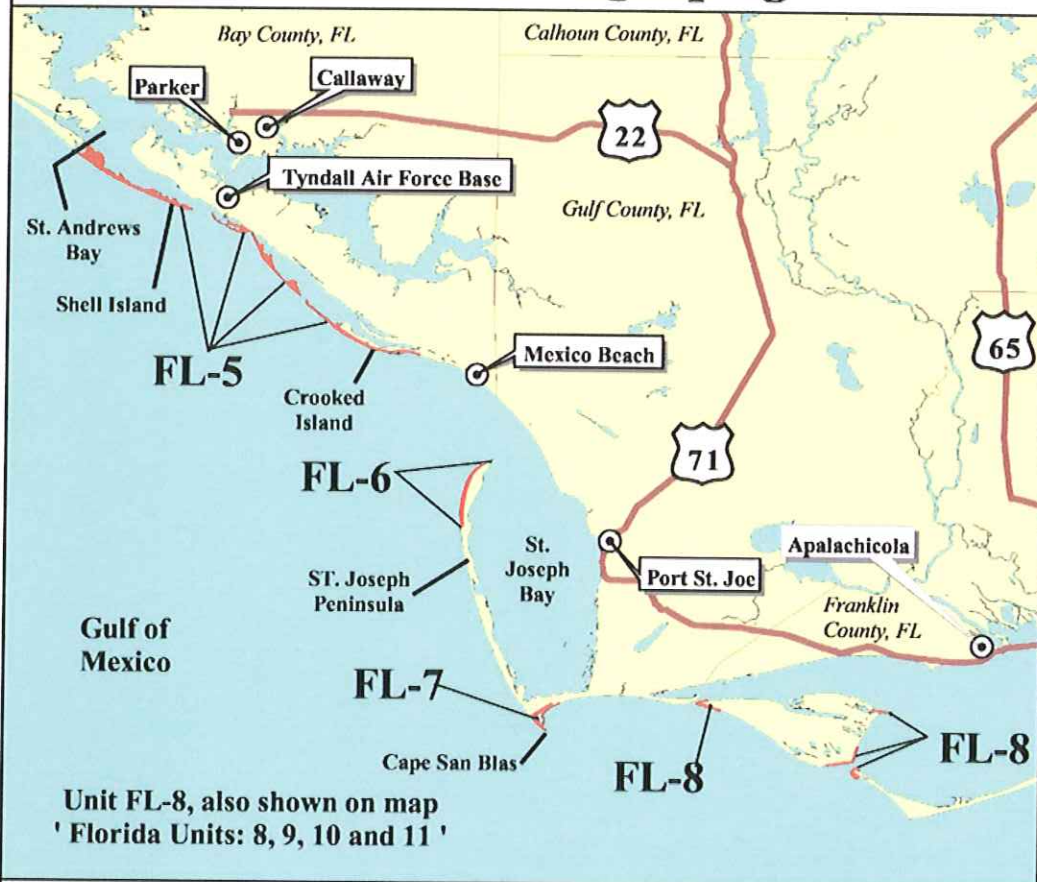
Unit FL-2: Big Sabine. 182 ha (450 ac) in Escambia County.

The majority of the unit is owned by the University of West Florida. This unit includes areas adjacent to Santa Rosa Sound of Big Sabine Point and adjacent embayment between 8.0 km (5.0 mi) and 11.6 (7.2 mi) east of the Bob Sike's Bridge. It begins 0.10 km (.06 mi) north of SR 399 to MLLW on the Santa Rosa Sound.

Unit FL-3: Navarre Beach. 48 ha (118 ac) in Escambia and Santa Rosa Counties.

The majority of the unit is owned by Eglin Air Force Base and Santa Rosa Island Authority. This unit includes lands on Santa Rosa Island Sound side, between 0.09 and 0.76 mi east of the eastern end of SR 399 to MLLW on Santa Rosa Sound side.

General locations of the designated critical habitat for the Wintering Piping Plover.



General Area



Distance: Miles



Legend

- ⊙ City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Units: 5, 6 and 7

Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Units 5, 6, & 7

Unit FL-5: Shell/Crooked Islands. 1789 ha (4419 ac) in Bay County.

The majority of the unit is within Tyndall Air Force Base and St. Andrews State Recreation Area. This unit includes all of Shell Island, Crooked Island West, and Crooked Island East from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

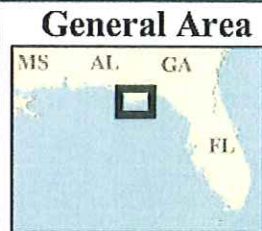
Unit FL-6: Upper St. Joe Peninsula. 182 ha (449 ac) in Gulf County.

The majority of the unit is within St. Joseph State Park. This unit includes the northern portion of the peninsula from the tip to 8.0 km (5.0 mi) south along the Gulf of Mexico from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL-7: Cape San Blas. 158 ha (390 ac) in Gulf County.

The entire unit is within Eglin Air Force Base. This unit includes the area known as the Cape between the eastern boundary of Eglin and mile marker 2.1, including the peninsula and all emerging sandbars. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

General locations of the designated critical habitat for the Wintering Piping Plover.



Distance: Miles

0 5 10



Legend

- City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Units: 8, 9, 10 and 11

Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Units 8, 9, 10, & 11

Unit FL-8: St. Vincent Island. 146 ha (361 ac) in Franklin County.

The majority of the unit is within St. Vincent National Wildlife Refuge. This unit includes the western tip of St. Vincent Island that is adjacent to Indian Pass (0.80 km (0.50 mi) east of tip along Indian Pass, and 1.9 km (1.2 mi) from tip southeast along Gulf of Mexico). The unit also includes St. Vincent Point from the inlet at Sheepshead Bayou east 1.6 km (1.0 mi) to include emerging oysters shoals and sand bars and extends south 0.21 km (0.13 mi) of St. Vincent Point. The unit includes the southeastern tip of St. Vincent Island extending north 1.4 km (0.90 mi) and south and west 2.1 km (1.3 mi). The western tip of Little St. George Island 0.80 km (0.50 mi) from West Pass is included (state owned lands). All sections of this unit include land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL-9: East St. George Island. 1433 ha (3540 ac) in Franklin County.

The majority of the unit is within St. George State Park. This unit begins 5.3 km (3.3 mi) east of the bridge and extends to East Pass. Shell Point, Rattlesnake Cove, Goose Island, East Cove, Gap Point, and Marsh Island are included. This unit includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur on the Gulf of Mexico, East Pass, and St. George Sound.

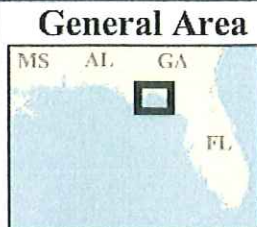
Unit FL-10: Yent Bayou. 153 ha (378 ac) in Franklin County.

The majority of the unit is State owned. This unit is adjacent to the area known as Royal Bluff. It includes the St. George Sound shoreline between 5.9 km (3.7 mi) and 9.5 km (5.9 mi) east of SR 65. It includes from MLLW to where densely vegetated habitat or developed structures such as SR 65, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL-11: Carabelle Beach. 56 ha (139 ac) in Franklin County.

The area within this unit is privately owned. This unit is the peninsula created by Boggy Jordan Bayou. It includes St. George Sound shoreline (south of US 98) 1.6 km (1.0 mi) southwest along US 98 from the Carrabelle River Bridge and extends 1.9 km (1.2 mi) east along the St. George Sound shoreline. It includes from MLLW to where densely vegetated habitat or developed structures such as US 98, not used by the piping plover, begin and where the constituent elements no longer occur.

General locations of the designated critical habitat for the Wintering Piping Plover.



Distance: Miles



Legend

- City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Units: 12, 13 and 14

Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Units 12, 13, & 14

Unit FL-12: Lanark Reef. 260 ha (643 ac) in Franklin County.

The entire unit is State owned. This unit includes the entire island and emerging sandbars to MLLW.

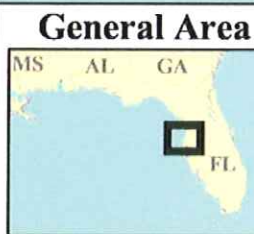
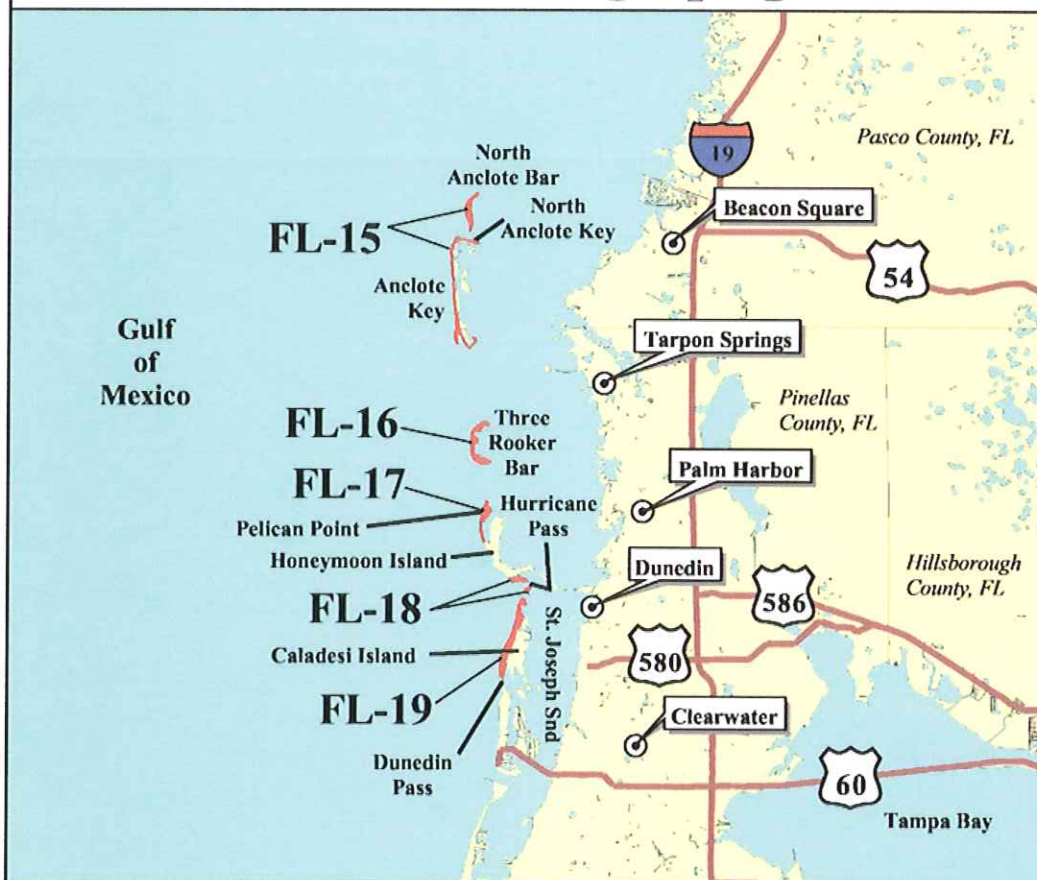
Unit FL-13: Phipps Preserve. 42 ha (104 ac) in Franklin County.

This unit includes all of Phipps Preserve (owned by The Nature Conservancy) and any emerging sandbars from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL-14: Hagens Cove. 486 ha (1200 ac) in Taylor County.

The majority of the unit is within Big Bend Wildlife Management Area. This unit includes all of Hagens Cove and extends from MLLW on north side of Sponge Point to MLLW on south side of Piney Point. The eastern boundary of this unit ends (0.20 mi) west of SR 361. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

General locations of the designated critical habitat for the Wintering Piping Plover.



Distance: Miles



Legend

- ⊙ City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Units: 15, 16, 17, 18 and 19

Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Units 15, 16, 17, 18, & 19

Unit FL-15: Anclote Key and North Anclote Bar. 146 ha (360 ac) in Pasco and Pinellas Counties.

The majority of the unit is within Anclote Key State Preserve. This unit includes all of North Anclote Bar to the MLLW and the north, south and western sides of Anclote Key from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL-16: Three Rooker Bar Island. 76 ha (188 ac) in Pinellas County.

The majority of the unit is within Pinellas County Aquatic Preserve. This unit includes all the islands and emerging sandbars of this complex to MLLW.

Unit FL-17: North Honeymoon Island. 45 ha (112 ac) in Pinellas County.

The majority of the unit is within Honeymoon Island State Recreation Area. This unit includes from Pelican Cove north to the far northern tip of Honeymoon Island. It includes the western shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur or the MLLW on the eastern shoreline.

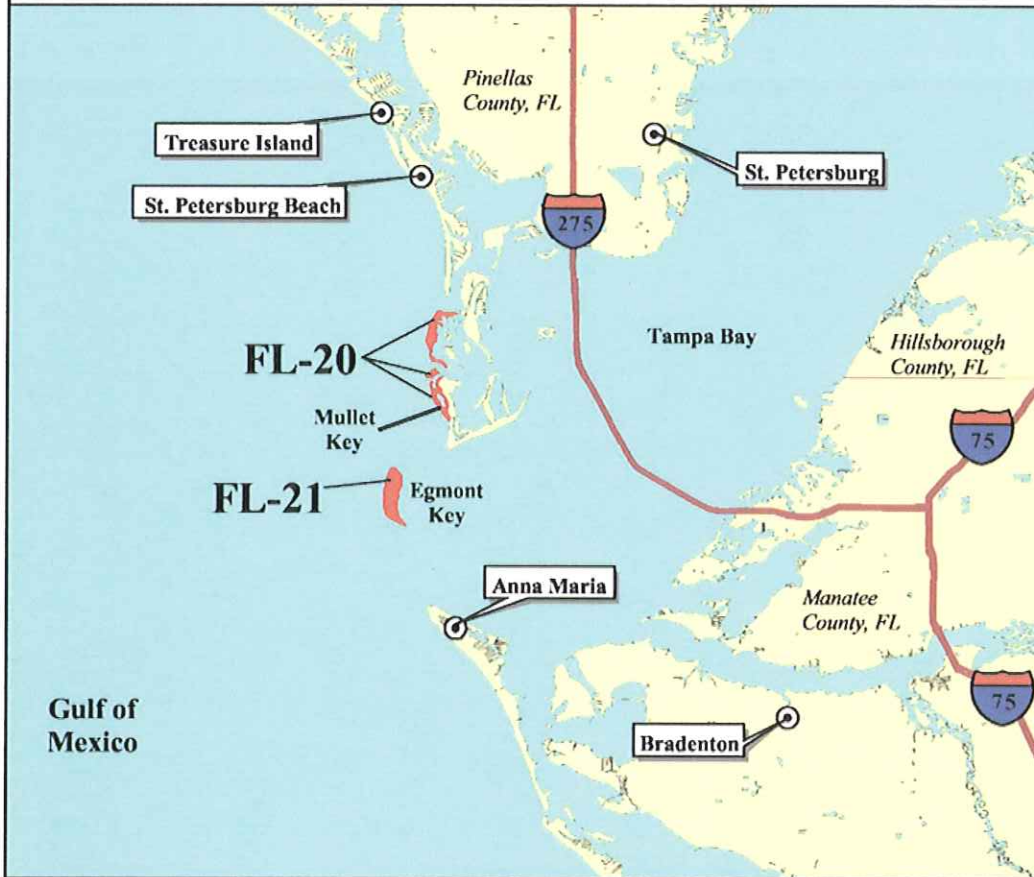
Unit FL-18: South Honeymoon Island. 28 ha (70 ac) in Pinellas County.

The majority of the unit is private land. This unit includes the southern end (southern-most 0.32 km (0.20 mi) on western side) of Honeymoon Island and encompasses the far southeastern tip and includes any emerging islands or sandbars to Hurricane Pass. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

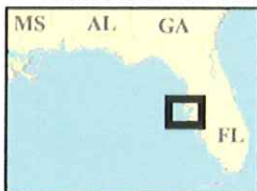
Unit FL-19: Caladesi Island. 120 ha (296 ac) in Pinellas County.

The majority of the unit is within Caladesi Island State Park. This unit extends from Hurricane Pass to Dunedin Pass on the Gulf of Mexico side. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

General locations of the designated critical habitat for the Wintering Piping Plover.



General Area



Distance: Miles



Legend

- ⊙ City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Units: 20 and 21

Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Units 20 & 21

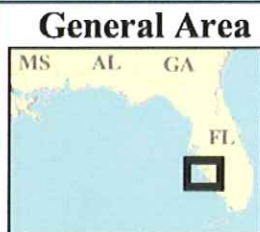
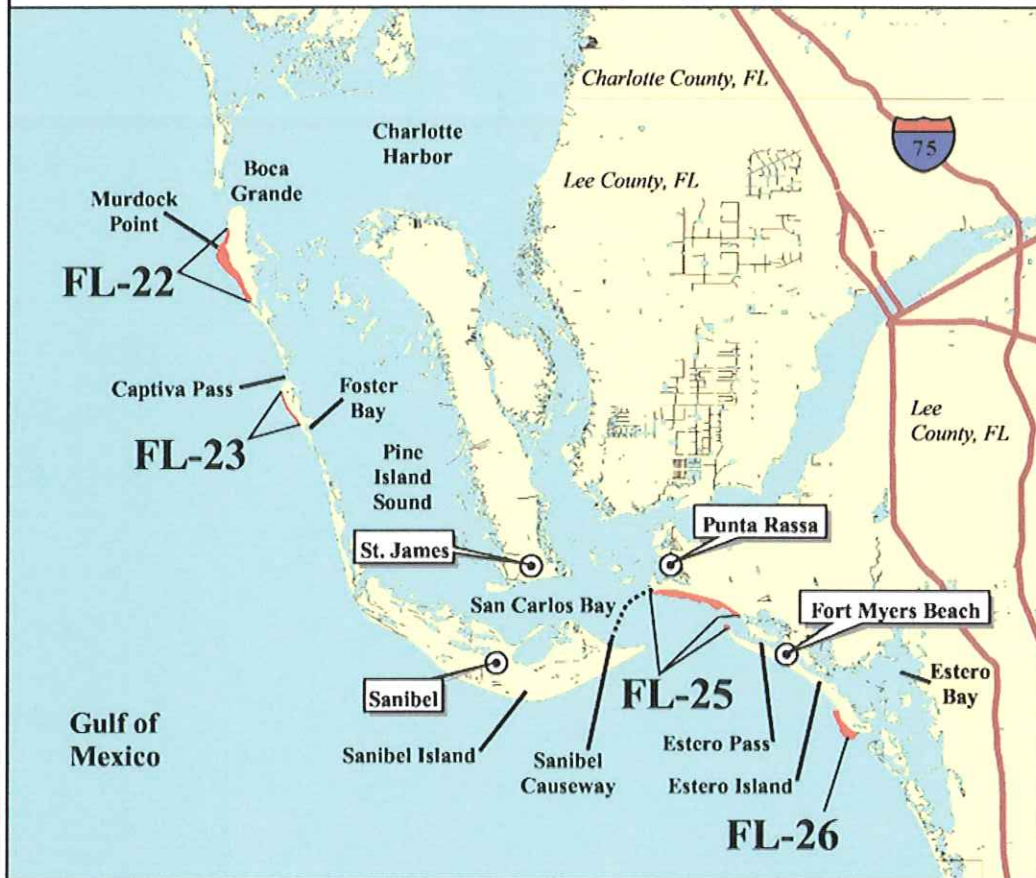
Unit FL-20: Shell Key and Mullet Key. 190 ha (470 ac) in Pinellas County.

The majority of the unit is within Fort Desoto Park. This unit includes the Shell Key Island complex. It also includes the northwest portion of Mullet Key including the western shorelines from Bunces Pass extending south, stopping 1.4 km (.86 mi) north of Ft. Desoto County Park pier. It includes from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL-21: Egmont Key. 153 ha (377 ac) Hillsborough County.

The majority of the unit is within Egmont Key National Wildlife Refuge. This unit includes the entire island to MLLW.

General locations of the designated critical habitat for the Wintering Piping Plover.



Distance: Miles
0 5 10



Legend

- ⊙ City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Units: 22, 23, 25 and 26

Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Units 22, 23, 25, & 26

Unit FL-22: Cayo Costa. 175 ha (432 ac) in Lee County.

The majority of the unit, including its northern and southern boundaries, is within Cayo Costa State Park, and nearly all of the remaining area is in the Cayo Costa Florida Conservation and Recreation Lands (CARL) acquisition project. This unit begins at the northern limit of sandy beaches at the northern end of the island, extends through Murdock Point, which at present has a sandbar and lagoon system, and ends at the former entrance to Murdock Bayou. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL-23: North Captiva Island. 36 ha (88 ac) in Lee County.

The unit is within the Cayo Costa CARL land purchase project. This unit includes the western shoreline extending from 0.80 km (0.50 mi) south of Captiva Pass to approximately Foster Bay. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

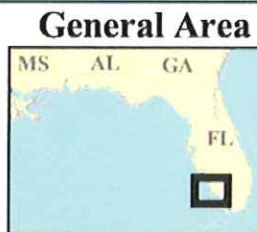
Unit FL-25: Bunche Beach. 187 ha (461 ac) in Lee County.

This unit is mostly within a CARL Estero Bay acquisition project. Bunche Beach (also spelled Bunch) lies along San Carlos Bay, on the mainland between Sanibel Island and Estero Island (Fort Myers Beach), extending east from the Sanibel Causeway past the end of John Morris Road to a canal serving a residential subdivision. The unit also includes the western tip of Estero Island (Bodwitch Point, also spelled Bowditch Point), including Bowditch Regional Park, operated by Lee County and, on the southwest side of the island facing the Gulf, the beach south nearly to the northwesterly intersection of Estero Boulevard and Carlos Circle. It includes land from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur or, along the developed portion of Estero Island.

Unit FL-26: Estero Island. 86 ha (211 ac) in Lee County.

The majority of the unit is privately owned. The unit consists of approximately the southern third of the island's Gulf-facing shoreline starting near Avenida Pescadora to near Redfish Road. The unit excludes south-facing shoreline at the south end of the island that faces Big Carlos Pass rather than the Gulf. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

General locations of the designated critical habitat for the Wintering Piping Plover.



Distance: Miles



Legend

- ⊙ City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Unit: 27

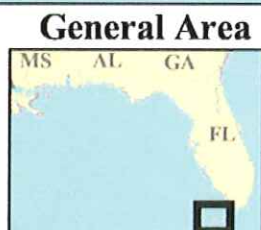
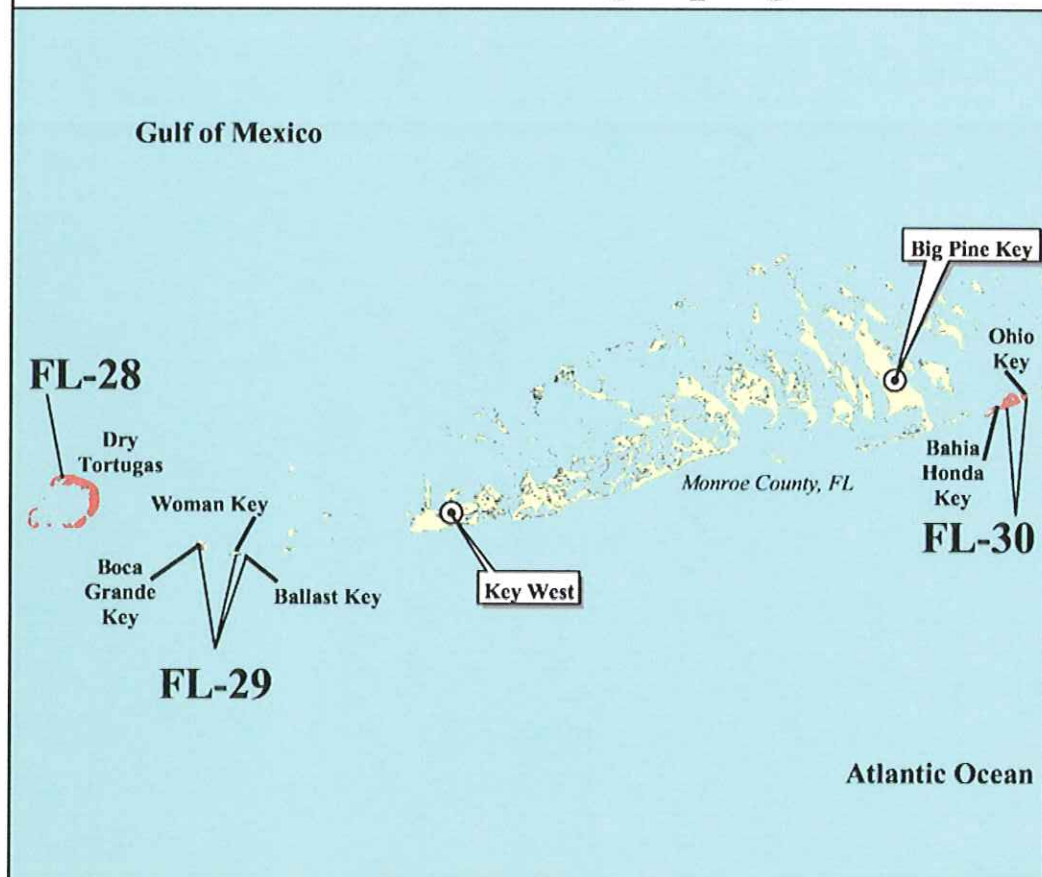
Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Unit 27

Unit FL-27: Marco Island. 245 ha (606 ac) in Collier County.

Most of the unit is at the Tigertail Beach County Park. The unit's northern border is on the north side of Big Marco Pass, including Coconut Island and all emerging sand bars. On the south side of Big Marco Pass, the boundary starts at the north boundary of Tigertail Beach County Park and extends to just south of the fourth condominium tower south of the County Park. The placement of the southern boundary assures that the unit includes all of Sand Dollar Island, the changeable sandbar off Tigertail Beach. The western boundary includes all the sand bars in Big Marco Pass but excludes Hideaway Beach. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

General locations of the designated critical habitat for the Wintering Piping Plover.



Distance: Miles



Legend

- City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Units: 28, 29 and 30

Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Units 28, 29, & 30

Unit FL-28: Marquesas Keys. 2,937 ha (7,256 ac) in Monroe County.

The unit comprises the roughly circular atoll that encloses Mooney Harbor, including Gull Keys and Mooney Harbor Key. The entire unit is within Key West National Wildlife Refuge. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

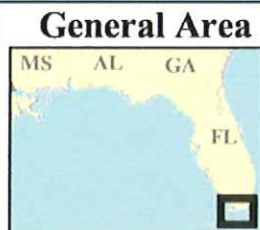
Unit FL-29: Boca Grande/Woman/Ballast Keys. 56 ha (138 ac) in Monroe County.

These Keys are east of the Marquesas Keys and west of Key West. Boca Grande and Woman Keys are within Key West National Wildlife Refuge. Ballast Key is privately owned. This unit consists only of sandy beaches and flats between the MLLW and to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL-30: Bahia Honda/Ohio Keys. 372 ha (918 ac) in Monroe County.

This unit comprises Bahia Honda Key (including a small island off its southwest shore), which is almost entirely owned by Bahia Honda State Park, plus Ohio Key, which is privately owned. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

General locations of the designated critical habitat for the Wintering Piping Plover.



Distance: Miles

0 4 8



Legend

- City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Units: 31 and 32

Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Units 31 & 32

Unit FL-31: Lower Matecumbe Key. 19 ha (48 ac) in Monroe County.

Part of the unit is at Anne's Beach Park, an Islamorada Village Park. The remaining parts are at Sunset Drive (Lower Matecumbe Beach) and at Costa Bravo Drive (Port Antiqua Homeowners Beach) on the Florida Bay side of the island. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL-32: Sandy Key/Carl Ross Key. 67 ha (165 ac) in Monroe County.

This unit consists of two adjoining islands in Florida Bay, roughly south of Flamingo in Everglades National Park. The entire area is owned and managed by the National Park Service. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

General locations of the designated critical habitat for the Wintering Piping Plover.



General Area



Distance: Miles



Legend

- City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Unit: 33

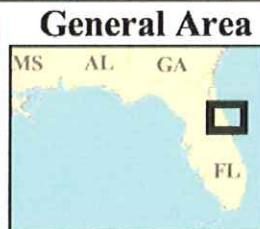
Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Unit 33

Unit FL-33: St. Lucie Inlet. 114 ha (282 ac) in Martin County.

The unit includes a small area south of the jetty on the north shore of St. Lucie Inlet, from the jetty west 0.42 km (0.26 mi). While the two sides of the inlet are privately owned, the great majority of the unit is on public land in the Saint Lucie Inlet State Preserve, administered by Jonathan Dickinson State Park. It begins on the sandy shoreline south of Saint Lucie Inlet and extends along the Atlantic Ocean shoreline 2.6 km (1.6 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. The unit does not include sandbars within the inlet.

General locations of the designated critical habitat for the Wintering Piping Plover.



Distance: Miles

0 4 8



Legend

- ⊙ City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Unit: 34

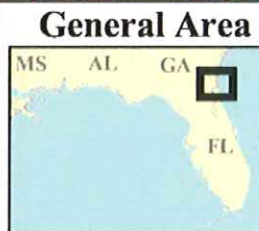
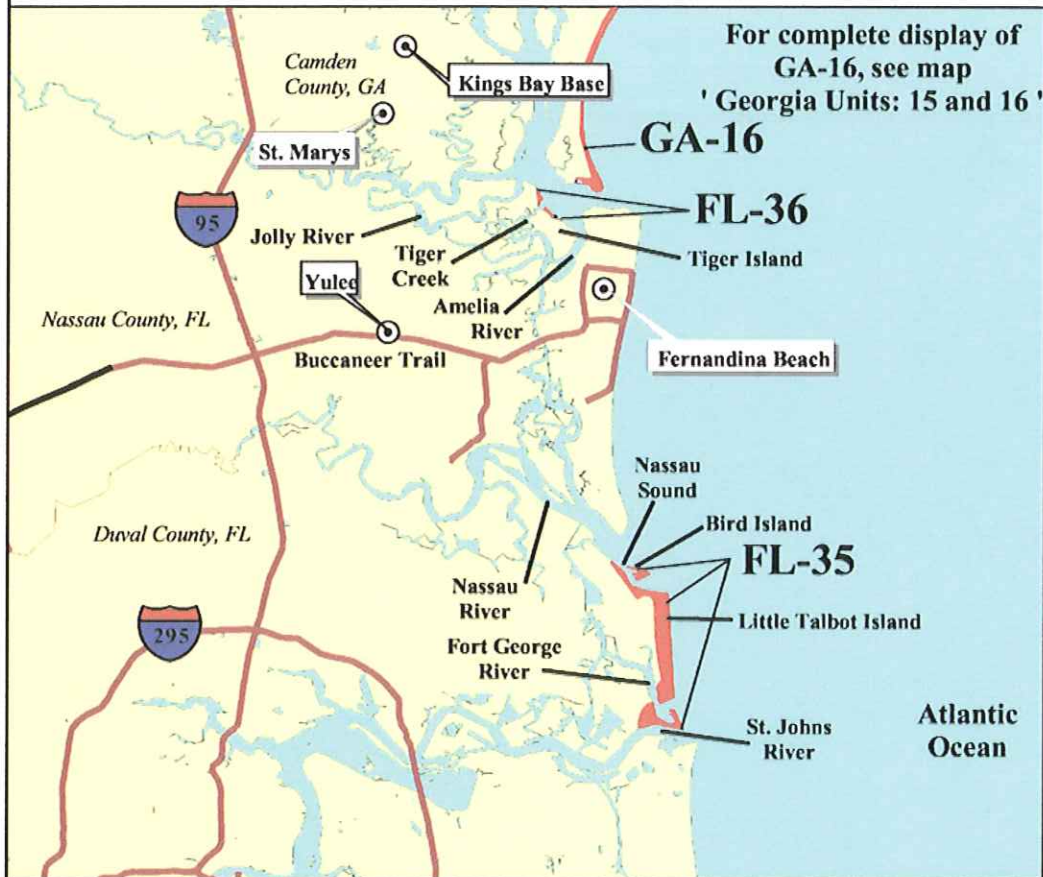
Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Unit 34

Unit FL-34: Ponce de Leon Inlet. 68 ha (168 ac) in Volusia County.

The majority of the unit is within Smyrna Dunes Park and Lighthouse Point Park. This unit includes shoreline extending from the jetty north of Ponce de Leon Inlet west to the Halifax River and Inlet junction. It includes shoreline south of Ponce de Leon Inlet from the inlet and Halifax River junction, extending east and south along the Atlantic Ocean shoreline 1.2 km (.70 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

General locations of the designated critical habitat for the Wintering Piping Plover.



Distance: Miles

0 5 10



Legend

- ⊙ City / Town
- Major Road / Highway
- Land
- Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where Wintering Piping Plover critical habitat has been designated. Included within the designation of critical habitat are all land areas to the mean lower low water. Refer to the narrative unit descriptions as the precise legal definition of critical habitat.

Florida Units: 35 and 36

Some locations have been slightly enlarged for display purposes only.

Narrative Unit Description – Florida Units 35 & 36

Unit FL-35: Nassau Sound- Huguenot. 950 ha (2347 ac) in Duval County.

The majority of the unit is within Big Talbot Island State Park, Little Talbot Island State Park, and the Timucuan Ecological and Historical Preserve. This unit includes all emergent shoals and shoreline east of Nassau River Bridge and extends to the inlet of the St. John's River. Amelia Island and the northern 2.7 km (1.7 mi) shoreline along Talbot Island are not included. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL-36: Tiger Islands. 53 ha (130 ac) in Nassau County.

This unit is privately owned. This unit extends from the mouth of Tiger Creek and runs north along Tiger Island 0.8 km (0.5 mi) and south along Little Tiger Island 1.4 km (0.9 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. Emerging sandbars to MLLW are also included.

Appendix C
Shorebird Survey Guidelines
And Data



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Piping and Snowy Plover Non-breeding Season Survey Guidelines*

June 2007

*In coordination with the Florida Fish and Wildlife Conservation Commission, we recommend these guidelines for conducting piping and snowy plover non-breeding season surveys. These guidelines combine the survey protocol from the International Piping Plover Census and the International Shorebirds Survey (ISS). Please note that these guidelines only pertain to routine plover population monitoring and that a separate set of guidelines may be recommended for the purposes of evaluating potential project impacts.

1. Sites should be selected based on geographic features, suitability of habitat, and ability for you to adequately and consistently survey the site.
2. We have prepared a survey form for your use (enclosed). We also have the form in an Excel file if you need it. Let us know.
3. Monitoring should be conducted July 15 through May 15 which mostly follow ISS census dates listed below. The ISS schedule usually results in three surveys per month. If this is not feasible, try to do at least two surveys per month on the ISS census dates. Surveys should be conducted on ISS dates plus or minus 2 days (example: a survey scheduled for the 15th could be conducted on any day from the 13th through the 17th.)

Spring Migration

February 25
March 5
March 25
April 5
April 15
April 25
May 5
May 15

Fall Migration

July 15
July 25
August 5
August 15
August 25
September 5
September 15
September 25
October 5

Winter

October 15
October 25
November 5
November 15
November 25
December 5
December 15
December 25
January 5
January 15
January 25
February 5
February 15

4. To the extent possible, surveys should be conducted when birds are feeding. The best time is at low tide, but surveys can also be conducted on a falling or rising tide provided that the feeding areas are not completely covered. During high tide, birds will be roosting. Although piping plovers often roost near feeding areas, the birds will be much more difficult to locate.
5. If conducting the surveys by ATV or vehicle, driving speeds should be limited to 5 mph (8 mph) so that birds may be more easily observed. Avoid driving on feeding areas (e.g., flats) during low tides and avoid driving over the wrack line or areas of dense seaweed which provide food and cover for shorebirds.
6. Do not drive on the upper beach, in the dunes, or over beach vegetation.
7. If beach scarps or high tides require driving above the high tide line, avoid those areas with known sea turtle nests or shorebird breeding areas (combined nesting seasons for turtles and shorebirds are from February through October 31).
8. Avoid conducting surveys during poor weather conditions (e.g., high winds, rain).
9. Negative data is as important as positive data. Indicate when you have surveyed and no birds were observed.
10. Although piping and snowy plovers are the target species for the surveys, any additional observations of other species will help us to identify shorebird concentration areas and management needs.
11. The FWS and the FWC would appreciate receiving copies of your survey data. Please provide the information to the following individuals:

Patty Kelly
U.S. Fish and Wildlife Service
1601 Balboa Avenue
Panama City, FL 32405
(850) 769-0552 x228
Fax (850) 763-2177
Patricia_Kelly@fws.gov

John Himes
Florida Fish and Wildlife Conservation
Commission
3911 Highway 2321
Panama City, FL 32409-1658
(850) 265-3676
Fax (850) 747-5690
John.Himes@MyFWC.com

Above all, have fun and please try and minimize disturbance to the birds!

Piping Plover and Snowy Plover Survey Results in FL.

Surveyor(s) name: _____ Date: _____
 Location: _____ start GPS _____ end
 GPS _____
 Ownership if known: public _____ private _____
 Time surveyed: from _____ to _____ Temperature: _____ C° or F° _____
 Tide stage: low _____ Mid _____ High _____ (rising _____/falling _____)
 Disturbance: Number of people on beach _____ Number of dogs leashed _____ unleashed _____

of Piping plovers seen: _____
 Circle location: dunes foredune mid-beach tidal zone bay shoreline mudflat other _____
 Bands seen: Right Leg _____ Left Leg _____
 GPS _____
 Bands seen: Right Leg _____ Left Leg _____
 GPS _____

of Snowy plovers seen: _____
 Circle location: dunes foredune mid-beach tidal zone bay shoreline mudflat other _____
 Bands seen: Right Leg _____ Left Leg _____
 GPS _____
 Bands seen: Right Leg _____ Left Leg _____
 GPS _____
 Bands seen: Right Leg _____ Left Leg _____
 GPS _____
 Bands seen: Right Leg _____ Left Leg _____
 GPS _____

of Red Knots seen: _____
 Circle location: dunes foredune mid-beach tidal zone bay shoreline mudflat other _____
 Bands seen: Right Leg _____ Left Leg _____
 GPS _____
 Bands seen: Right Leg _____ Left Leg _____
 GPS _____

Other Species Seen:	Number:	Comments:
Black-bellied Plover		
American Golden Plover		
Wilson's Plover		
Semipalmated Plover		
Killdeer		
American Oystercatcher		
Greater Yellowlegs		
Lesser Yellowlegs		
Solitary Sandpiper		
Willet		
Spotted Sandpiper		
Whimbrel		
Marbled Godwit		
Ruddy Turnstone		
Sanderling		

Semipalmated Sandpiper		
Western Sandpiper		
Least Sandpiper		
White-rumped Sandpiper		
Baird's Sandpiper		
Pectoral Sandpiper		
Dunlin		
Stilt Sandpiper		
Peep sp.		
Short-billed Dowitcher		
Long-billed Dowitcher		
Other:		