United States Department of the Interior

FISH AND WILDLIFE SERVICE
1208-B Main Street
Daphne, Alabama 36526

IN REPLY REFER TO:
2014-F-0500

MAY 16 2014

Memorandum

To: Deputy Case Manager, Deepwater Horizon, Department of the Interior Natural Resource Damage Assessment and Restoration (NRDAR)

From: Field Supervisor, Alabama Ecological Services Field Office, Alabama

Subject: Informal Consultation/Conference Report and Revised Biological Opinion for Issuance of an Incidental Take Permit Under Section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, for Gulf State Park Infrastructure Improvements and Restoration, Gulf Shores, Alabama (TE-072831-3)[1]

As set forth in your cover memorandum, the contents of which are described more fully below, the proposed project includes infrastructure and habitat enhancements of Gulf State Park (GSP or the Park), Baldwin County, Alabama, and is part of a suite of early restoration (Early Restoration or ER) projects that agencies, acting as natural resource trustees (Trustees) under the Oil Pollution Act of 1990, have proposed in connection with the Deepwater Horizon oil spill. These Trustees include, among others, the Department of the Interior, acting through U.S. Fish and Wildlife Service (the Service) and other Bureaus, as well as the State of Alabama. Early Restoration is being pursued pursuant to an April 2011 agreement among Trustees and BPXP, a responsible party for the oil spill, while a natural resource damage assessment (NRDA) for the oil spill is ongoing.

The proposed project includes a number of elements, described in more detail below, to be implemented in GSP. Among the elements for the proposed project is the construction of a lodge and convention center (Lodge and Convention Center or Lodge Complex or Lodge and Convention Facility). Construction of this element has been proposed by the State, through the Alabama Department of Conservation and Natural Resources (ACDNR), in the past, along with other improvements in GSP. In particular, in July 2004, the State of Alabama, through the Alabama Department of Conservation and Natural Resources (ADCNR), submitted a habitat

[1] Note parts of the project were previously known as "Gulf State Park Hotel and Convention Center Demolition and Reconstruction between Gulf Shores and Orange Beach, Baldwin County, Alabama," based on the title provided in a 2004 Habitat Conservation Plan. The project as currently envisioned in an updated Habitat Conservation Plan is entitled "Gulf State Park Infrastructure Improvements and Restoration." In the draft Plan issued by the Trustees (see cover letter) that project is known as the Gulf State Park Enhancement Project.

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conservation plan (HCP) under Section 10 of the Endangered Species Act, for its proposed action of the "replacement, construction, occupancy, use, operation, and maintenance of the proposed new Gulf State Park Hotel/Convention Center, lodging facilities, and parking... and the replacement of and subsequent development of a new Beach Pavilion and Amphitheater." (HCP 2004). The HCP covered the endangered Alabama beach mouse (*Peromyscus polionotus ammobates*) (ABM) at Gulf State Park (GSP) and three species of sea turtles, as more specifically described below. The HCP proposed, among other things, construction footprint reduction, and habitat enhancement and restoration for ABM habitat. ACDNR sought an incidental take permit (ITP) under Section 10(a)(1)(B) for take of the ABM.

The Service reviewed the HCP and the request for the ITP and in December 2004 issued its "Biological Opinion for the Issuance of an Incidental Take Permit...for Gulf State Park Hotel and Convention Center Demolition and Reconstruction." In the BO, the Service evaluated the effects of the action described in the HCP on the ABM, three endangered or threatened species of sea turtles (green, loggerhead, and Kemp's ridley), and the threatened piping plover under Section 7 of the ESA. As discussed below, the BO found that the action proposed in the HCP would result in incidental take of ABM, but would not likely adversely affect the other species. The Service further found that the take would not result in jeopardy to ABM. On December 27, 2004, the Service issued an ITP for ABM based on the HCP.

On April 6, 2005, the Service issued a minor modification of the ITP (TE-072831-1) to adjust the footprint of the Gulf State Park beach pavilion (Pavilion) and parking lot. In 2006, ACDNR sought to adjust the lodging and convention footprint and to replace the pier (the Pier) on the property. The Service issued an amended biological opinion and conference report (for proposed ABM critical habitat) and issued a minor modification of the ITP, dated December 22, 2006 (TE-072831-2). In addition to adding a Conference Report (CR) for proposed critical habitat for the Alabama beach mouse, the amendment found that a lower level of incidental take of ABM would occur than allowed under the original consultation and amended the BO accordingly.

Under the various ITPs, and associated HCP, ACDNR has removed the remnants of the original lodging and convention improvements, which had been destroyed by Hurricanes Ivan and Katrina, constructed a new beach pavilion and parking area (removing the prior pavilion and parking area), constructed a new fishing pier and parking (removing the prior pier and parking area), and completed the required ABM habitat enhancement and restoration. The last issued ITP (TE-072831-2) and its associated HCP are still in force and effect. If the proposed project is not ultimately selected by the Trustees and funded as Early Restoration, the construction of the Lodge and Convention Center could still move forward as currently proposed, following a minor modification to the ITP (TE-072831-3) to include components of the revised BO.

As stated above, this memorandum is in response to your April 16, 2014, memorandum requesting our review of the proposed project in GSP. You also requested our concurrence that: (1) the existing ITP for GSP regarding the ABM and its critical habitat does not need modification and continues to be valid for the proposed project; (2) the proposed project is not

likely to adversely affect three species of sea turtles (loggerhead (*Caretta caretta*), green (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii*)), piping plover (*Charadrius melodus*), and red knot (*Calidris canutus rufa*) or gopher tortoise (*Gopherus polyphemus*) if listed; and (3) no adverse modification or destruction of Alabama beach mouse critical habitat or proposed loggerhead critical habitat will occur due to the proposed project (Table 1). This response documents our review of the proposed project, not only under the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.), as amended (ESA), but also under the Bald and Golden Eagle Protection Act (BGEPA) of 1940 (16 U.S.C. 668-668c) and the Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. 703–712).

The findings and recommendations in this consultation are based on information found in: (1) your April 16, 2014, memorandum requesting our review and concurrence with the proposed project; (2) the letter dated February 18, 2014 from Mr. Gunter Guy, Commissioner ADCNR; (3) a revised Habitat Conservation Plan dated March 2014 (HCP 2014); (4) a Dune Restoration and Management Plan dated March 2014; (5) the Draft Phase III Early Restoration Plan/Programmatic Environmental Impact Statement dated December 2013; (6) information used in previous consultations, reviews, and determinations involving components of the proposed project; and (7) other information available to us. A complete administrative record of this consultation may be requested from the Alabama Ecological Services Field Office (AFO).

Summary of This Document

This document represents a revised informal consultation and conference report and a third amendment to the BO. This document incorporates changes to: (1) the project description and conservation measures (due to project modifications associated with development of the project as a proposed project for Early Restoration in connection with the Deepwater Horizon Oil Spill, as explained in your memo), and (2) status and baseline of the Alabama beach mouse.

Table 1. Species and CH evaluated for effects from the proposed project and determinations in cover letter.

SPECIES or CRITICAL HABITAT	**DETERMINATION***
Alabama Beach Mouse (*Peromyscus polionotus ammobates*)	AA, see BO below.
Alabama Beach Mouse Critical Habitat	NAMD
Green sea turtle (*Chelonia mydas*)	NLAA
Loggerhead sea turtle (*Caretta caretta*)	NLAA
Loggerhead Proposed Critical Habitat	NAMD, if designated
Kemp's ridley sea turtle (*Lepidochelys kempii*)	NLAA
Piping plover (*Charadrius melodus*)	NLAA
Red knot (*Calidris canutus rufa*)	NLAA, if listed
Gopher tortoise (*Gopherus polyphemus*)	NLAA, if listed

*AA= May Adversely Affect; NAMD = No adverse modification or destruction; NLAA = Not Likely to Adversely Affect; NE = No Effect

We concur with your determinations and as such this document transmits our decision and justifications in support of:

- An Informal Consultation for three species of sea turtles and piping plover,
- A Conference Report for the gopher tortoise, red knot and proposed critical habitat for loggerheads, and
- An amendment/revision of the Service's BO and Conference Report based on our review of the project as proposed.
- Concurrence that an administratively modified ITP for the project as modified for *Deepwater Horizon* Early Restoration would be necessary. We request an administrative modification to the ITP (TE-07831-3) to officially include components of the revised BO included here for your convenience.

DESCRIPTION OF THE ACTION

The proposed project is located in Gulf State Park in the city of Gulf Shores in Baldwin County, Alabama. The 6,150-acre park is adjacent to the Gulf of Mexico and includes both white sand beaches and backcountry areas. Orange Beach is located to the east. Access to the park is provided by Alabama State Roads (SR) 182 and 135. The Park is approximately 49 miles from Mobile, Alabama, and approximately 33.7 miles from Pensacola, Florida.

The Action Area (AA) has two parts and is located in Sections 21 and 22 of Township 9 South, Range 4 East between AL 182 and the Gulf of Mexico and to the north of AL 182 and is bounded by the towns of Gulf Shores, AL to the west and Orange Beach, AL to the east (Figure 1). For the Gulf-side activities (i.e., the HCP AA), the coastal construction line is the southern boundary, and the Alabama Department of Transportation right-of-way (ROW) is the northern boundary. The HCP AA includes 179 acres, 41.1 for the project footprint and 137.9 for the remainder of the HCP AA. The Visitor Enhancements (Trails) and Research Center will occur on approximately 33 acres North of AL 182 (North AA).

HCP AA

- 41.1 acre HCP Footprint (10.3 acres fishing Pier + 9.2 acres Interpretive Center/Beach Pavilion + 21.6 acres Lodge Complex), and
- 137.9 acres for the area of indirect effects from construction within the HCP Footprint and areas of dune restoration/enhancement.

North AA

- Research and Education Center (0.44 acres)
- Visitor Enhancements including trails (32.6 acres).

The proposed project was issued an ITP in 2004 for the construction and operation of a Pier, Pavilion, and associated parking, construction and operation of a Lodge, Conference Facility, and required habitat restoration and enhancement in the HCP AA. The Pier, Pavilion, associated parking, and the required habitat restoration and enhancement have been completed. Therefore, this amendment/revision focuses on the construction and operation of a Lodge, Conference Facility, and Interpretive Center behind the primary dune, the construction of dune walkovers from these facilities onto the beach within the HCP AA, and additional habitat restoration or enhancement. The proposed project also includes the construction and operation of a Research Center and additional Visitor Enhancements (including trails) in Gulf State Park, north of Alabama State Roads (SR) 182 in the North AA.

Rebuilding the Gulf State Park Lodge and Conference Center

The original Gulf State Park Lodge and Conference Center was built on essentially the same site as currently proposed for rebuilding. The facility was destroyed in 2004 by Hurricane Ivan. The new facilities will be rebuilt as a 'green' overnight stay and meeting facility. Building design and construction will be undertaken with the goal of certification under the LEED and/or Living Building Challenge programs, so as to minimize the facility's impact on the environment and establish it as a model for regionally-appropriate coastal zone design. The new building would provide state-of-the-art meeting facilities, overnight accommodations, and other amenities in a natural environment. There will be approximately 350 rooms at the Lodge, with meeting space capable of accommodating approximately 1,500 people.

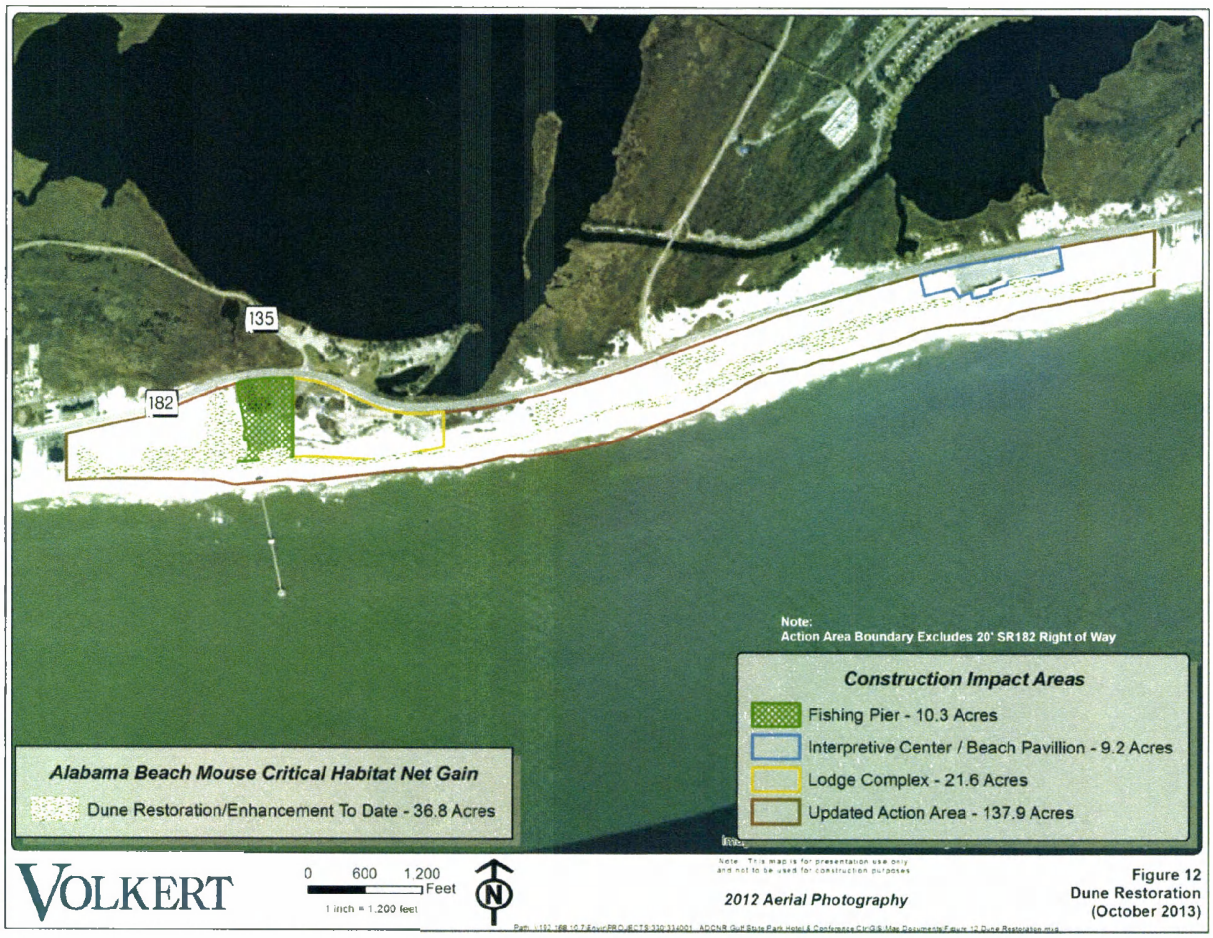


Figure 1. Gulf State Park Action Area and features built and HCP ITP Footprint (Fishing Pier = bright green polygon, Interpretive Center/Beach Pavilion = blue polygon, Lodge Complex = yellow polygon, extent of potential indirect effects within HCP action area = red polygon; completed dune restoration/ enhancement = dark green polygons).

Interpretive Center

The Park's environmental education and research programs for youth groups and adult visitors would be expanded to promote improved understanding of the ecological services provided by Alabama's limited and unique coastal natural resources. The expansion of environmental programs for visitors would be accomplished through several key improvements. An interpretive center (Interpretive Center) would be constructed adjacent to the existing beach Pavilion with meeting and classroom space and indoor and outdoor exhibits devoted to ecosystems and the ecological services they provide. Outdoor exhibits will focus on ecosystem stewardship and will include dune enhancement integrated with an interpretive boardwalk. Visitor orientation and interpretive exhibits would be incorporated into all public spaces, using the Interpretive Center as well as the Lodge and Conference Center to highlight the natural history of Alabama's coastal areas—especially marine and dune systems located within the Park.

Ecological Restoration and Enhancement of Degraded Dune Habitat[2]

Ecological restoration and enhancement would target degraded dunes adjacent to the proposed re-established lodge and to the west of the existing beach pavilion. The dune restoration/enhancement zone would be approximately 137.9 acres in the HCP AA, within which approximately 50 acres of dunes and corridors would be restored or enhanced. Restoration/enhancement would include creation of sand movement corridors at strategic locations to allow for the natural buildup of dunes behind the existing man-made berm. Selection of locations for sand movement corridors would be based on several factors including existing breaks and established vegetation. This selection would also include coordination with the Service immediately prior to work commencing. The dunes would then be restored and enhanced by planting native vegetation such as sea oats (*Uniola paniculata*), sand oaks (*Quercus geminata*) and/or seaside bluestem (*Schizachryrium maritimum*). Dune vegetation would stabilize existing dunes and allow for sand accretion, thus increasing the areal coverage of dunes.

North AA

Research and Education Center (Figure 2a)

The Park's existing environmental education facilities would be expanded, including construction of a research and education facility. The proposed facility will be constructed on 0.44 acres of land adjacent to the Park's existing nature center with classrooms and laboratories, and overnight and eating facilities in order to support a year-round program of K-12 environmental education focused on improved scientific understanding of Alabama's Gulf coast ecosystems. This facility will be located north of highway 182 in an area of mowed grass adjacent to existing facilities and parking. No candidate, proposed, or listed species nor proposed or designated critical habitats occur within or near this area; therefore, this portion of the project will not be discussed further in this document.

Visitor Enhancements (Figure 2b)

Various visitor enhancement elements would be implemented, including construction of recreational trails throughout the Park for walkers, runners, cyclists, and other users that provide a greater interconnection with the existing trail system. The proposed trail enhancements are extensions of existing trails that would create loops and provide increased recreational opportunities and encourage the use of the trails as transportation between various Park amenities. There would be approximately 13 miles of improvements with approximately 9.5 miles of new trails and approximately 3.5 miles of enhanced trails. Trail enhancements may also include overlooks, interpretive kiosks and signage, rest areas, bike racks, bird watching blinds, or other visitor enhancements. A 20-foot buffer surrounds the trail to serve at the AA boundary for the spatial extent of potential direct and indirect effects for a total of 32.6 acres within this portion of the North AA. The species of concern that occur within this area are the Gopher tortoise, a candidate species, the Alabama beach mouse, an endangered species, and bald eagles, a recovered/protected species. The trails will be placed in areas that avoid impacts to these species.

[2] All habitat restoration/enhancement required by the existing HCP and ITP is complete. No additional habitat restoration/enhancement is required to fulfill the obligations of the HCP and ITP. The restoration/enhancement activities proposed here are a part of the Early Restoration actions. These restoration/enhancement activities are not required within the ITP in order to construct or operate any of the facilities including the Lodge and Conference Center, Interpretive Center, or walkovers under the existing HCP and ITP.

Figure 2a. Location of the Research and Education Center in the North AA.

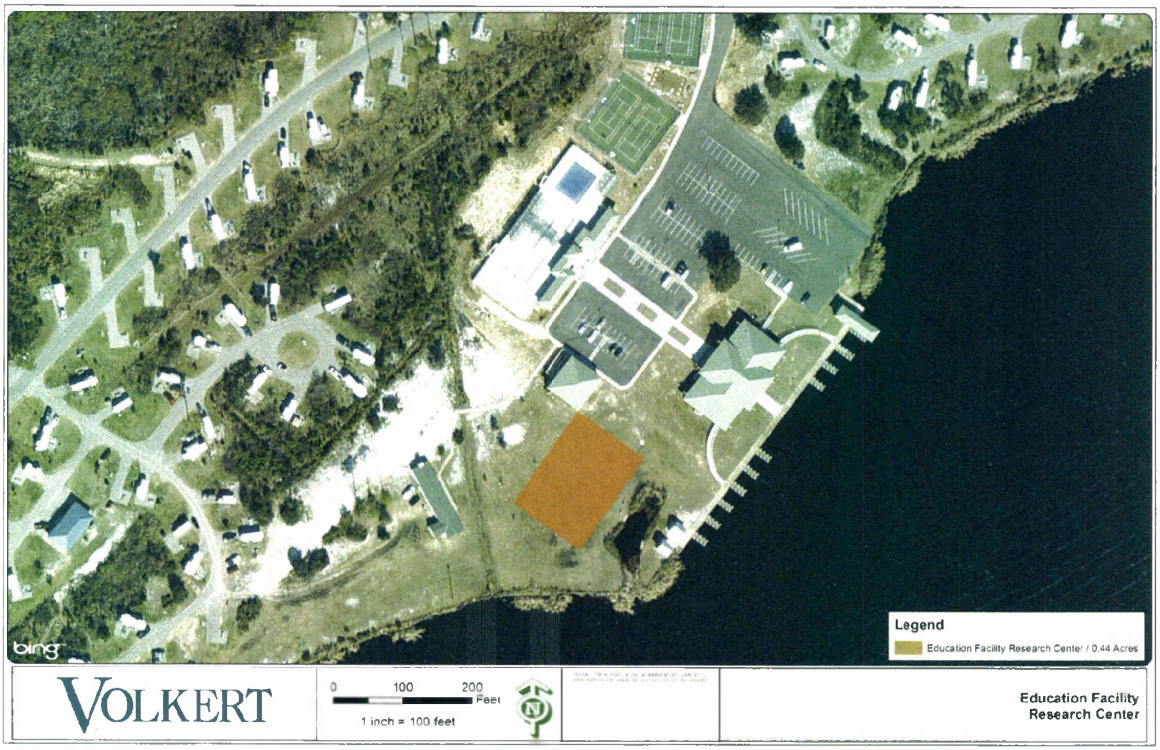


Figure 2b. Proposed visitor enhancements (trails) north of AL 182.

Conservation Measures

The following measures are summarized based on the revised HCP, the Dune Restoration and Management Plan, both dated March 2014, the letter dated February 18, 2014 from Mr. Gunter Guy, Commissioner, ADCNR, and meetings between the Service and project proponents. The conservation measures are designed to avoid or minimize effects to the species documented in Table 1. The HCP and/or Dune Restoration and Management Plan may need additional revisions over time (e.g., to accommodate changes in lighting technologies or sampling techniques) that benefit species. Therefore, where conservation measures reference "see HCP for details" the reader should reference the most recent version of the HCP. These measures are non-discretionary and failure to implement them as written could result in non-compliance with this consultation and associated Incidental Take Permit.

Construction of the Lodge, Conference Facility, and Interpretative Center

- No Work will occur on (except walkovers) or Gulfward of the Coastal Construction Line.
- The construction area will be trapped for ABM the week prior to construction (see HCP for details). Should burrows with mice be encountered during construction, work at and around the burrow (radius of at least 50 feet from the point of observation) shall temporarily cease. The Service will be notified immediately and can, within a 72 hour period, relocate as many mice as feasible from the area of observation. If circumstances indicate such capture is infeasible, the Service will advise the applicant to proceed providing advice as to any reasonable modification of construction technology, procedure, or timing that will reduce or avoid further localized adverse effects on the mice in the area of disturbance. See the HCP and terms and conditions of this BO for instructions for handling dead or injured mice.
- Use of temporary lighting during nighttime hours would be minimized during construction, wildlife-friendly lighting will be incorporated where possible.
- The construction limits of the project area will be clearly marked for the duration of construction, with a continuous fence, cable, or other substantial marking device. Signage will be posted at intervals of no less than one hundred feet along its limits inside the fence, with each sign to include the following or essentially similar language "Absolutely no construction activity or other entry permitted beyond this point. For further information, contact construction superintendent's office."
- No fencing will be installed that may impede sea turtle movement, except that specifically designed to exclude turtles from walkover construction areas during their construction.
- Construction waste and debris will be stored, disposed of, monitored, and maintained in a manner such that rodents and predators are not attracted to the area (see HCP for details).
- A landscaping plan will be prepared and submitted to the Service for approval.

Operation and Maintenance of Gulf State Park

- A lighting plan for currently proposed and future structures at Gulf State Park will be developed and submitted to the Service for review and approval.
    - The lighting plan will describe how direct and indirect illumination of sea turtle and ABM habitats will be minimized including minimization of light overspill and brightness from interior spaces and windows and outdoor areas. The lighting plan may include a combination of: low pressure sodium lights, fully shielded fixtures, amber LED bulbs, fully shielded street lights, wildlife-friendly windows, and other new wildlife-friendly lighting technologies as they are developed. All lighting plans will use

the information contained in the Service's "Recommended Measures to Minimize Lighting Impacts to Wildlife Habitat" document (see HCP).
    - Directional outdoor floodlights or other lights that illuminate the primary dunes lying south of the property, the wet beach seaward of such dunes, or any portion of the Gulf of Mexico will not be installed upon nor used on the property.
    - The light emitting and/or reflecting portions of any light sources (including bulbs, tubes, reflectors, or globes) on the property shall be shielded or recessed, such that no portion of the cone or beam of light from any such sources is directed toward any area south of the crest of the primary dune.
- The practice of accessing and using the beach areas with off-road capable vehicles will be eliminated except for park personnel and emergency vehicles. Low impact beach driving guidelines (including minimizing vehicle access, the number of trips per day, accessing after sea turtle nesting monitoring has occurred each day during nesting season, avoidance of marked seat turtle and bird nesting areas, and using low impact vehicles/tires) will be implemented for non-emergency needs.
- Where necessary, approved fencing, or signage will be installed to funnel pedestrian traffic to utilize existing vehicle trails.
- Beach access points will be limited to those necessary. The approved beach accesses will consist of a path wide enough to accommodate the vehicle(s) that will be used by Park personnel. Currently, beach access by vehicles is limited to six locations: two at the Pier, one at the eastern edge of the old Lodge site, and two at the Pavilion and one at the western end of the Park. Vehicular access points are subject to fire marshal approval of the site plan. If the fire marshal requires a different location or type access than the existing locations a minor (informal) change may be required.
- Predators will be controlled.
    - No free-roaming cats shall be allowed as pets, or otherwise, at Gulf State Park. If, during routine monitoring and reporting, surveys disclose the presence of cats and/or cat tracks in the developed parts of the project, immediate control measures will be instituted.
    - In addition to cats, trapping efforts will include the red fox and coyote. Any trapped predators will be taken to the local animal control facility.
    - Dogs shall be restricted to developed areas of the park only and not allowed in dune or beach habitat. Park guidelines require dogs to be on leashes at all times.
    - Restrictions for the property will prohibit visitors or others, from supporting the presence of domestic or free-roaming, feral cats by providing food, shelter, or any other life-supporting elements.
    - Means of control will be established, funded, and carried out by the Park. Results will be reported during normal reporting cycles to the Service.
- Refuse management is intended to prevent house mice from being introduced into Gulf State Park. However, if house mice are determined to exist, a house mouse trapping and extermination effort will be initiated and continued until control over house mice has been established.
- Walkways at the Interpretive Center will require sand maintenance and will be maintained using minimally invasive measures and in coordination with the Alabama Field Office.
- Waste receptacles for visitor use will be maintained in a manner such that rodents and predators are not attracted to them.

- Property fences will be of specific design so as to not fragment habitat or impede species movement and will be regularly inspected and maintained (see HCP for details).

Walkovers

- Restrict dune walkover construction to the period outside sea turtle nesting season (May 1-October 31).
    - If dune walkover construction is necessary within nesting season, surveys for sea turtle nests will be completed prior to initiation of construction. If nests are found, construction will be delayed until the nest has hatched. If no nests are found, the construction area will be fenced such that turtles cannot enter the area to nest during construction. Fencing will be removed immediately on the completion of walkover construction.
- Construction will occur during daylight hours only. No equipment may be used for dune walkover construction or new walkover maintenance except that which is essential to these purposes.
- All dune walkover construction activities will be conducted in a "top-down" manner in order to prevent further degradation of the dunes. Any disturbed areas outlying the outer edges of the walkovers will be restored.
- Follow the most current version of the Service's beach driving guidelines for use of vehicles and machinery during construction.
- Walkovers will be constructed on the smallest footprint/design that achieves project goals to reduce physical restrictions and shaded sand to the maximum extent practicable. Walkover alignment will be established in coordination with and approval by the Service and the Alabama Department of Environmental Management (ADEM).
- New walkovers will be constructed in accordance with all state and local laws and will also take into account optimal dune height during planning (i.e., new walkovers will be built approximately 5 feet above optimal dune height rather than existing grade such that sand maintenance is not necessary).
- Existing walkovers will be maintained as follows:
    - Consider raising the walkovers such that maintenance isn't needed and identify optimal dune height in coordination with the Service;
    - Until walkovers are raised and prior to maintenance, a permitted biologist will survey for mice burrows and tracks. Burrows and tracks will be flagged and avoided where possible.
    - If avoidance isn't possible, a permitted biologist will trap and relocate the mice from the area and the area to be maintained will be fenced such that mice cannot re-enter the area during maintenance (see HCP for details). After initial maintenance, the fencing will be removed and the walkovers will continue to be maintained using the smallest tools available such that the boardwalk allows mice to transit the area (i.e., maintain connectivity) but does not have suitable burrow habitats (that would be disturbed during maintenance). These procedures will avoid unnecessary disturbance.
    - When the walkovers need to be repaired or replaced, they will be installed in accordance with state and local laws and use the currently existing (as of the date of this consultation) or optimal dune height (as determined in coordination with the Service) as a baseline to apply the clearance above grade requirement. This measure will avoid the future need for sand maintenance adjacent to walkovers.

- Unmanaged foot traffic through dune structures, which destroys dune vegetation and leads to dune degradation and erosion, will be controlled by construction and use of the dune walkovers.
- Educational signage will be placed and maintained at walkovers and other locations to advise visitors of sea turtles and means to avoid them (see HCP for details).

Dune Restoration/Enhancement

- A program for monitoring, protecting, enhancing, and maintaining dunes within Gulf State Park will be implemented as described in the HCP, including the development and implementation of a Dune Restoration and Management Plan. Reporting requirements are also defined in the HCP.
- Alabama Department of Conservation and Natural Resources (ADCNR) will work with the Service to determine the timing, construction methods, location, and dimensions for the proposed corridors and dune enhancement activities.
- If ABM are present based on surveys conducted in the area for restoration or enhancement, they will be captured and relocated by a permitted biologist if necessary as determined by the Service.

Visitor Enhancements

- Gopher tortoise, Alabama beach mouse, and bald eagle nest surveys will be conducted in the area for the trails and interpretive signs. Tortoise and beach mouse burrows, and bald eagle nesting areas (following the Service's 2007 National Bald Eagle Management Guidelines) will be marked with flagging and their locations mapped.
- The flagging and mapping will be used to design the trail and sign locations to avoid any tortoise burrows and prevent obstacles between burrows.
- Pre-construction site visits will be conducted by ADCNR (or their representatives) in coordination with the Service to ensure the enhancements avoid ABM habitats and bald eagle nesting areas.

Informal Consultation and Conference Report

Sea turtles

In general sea turtles can be found in the near shore waters and in some of the estuaries in Alabama. While five species (loggerhead, green, Kemp's ridley, hawksbill and leatherback) of sea turtles have been documented in Alabama waters, only loggerhead, green, and Kemp's ridley have been documented to nest on Alabama's Gulf side beaches. The primary nesting species and the most likely to be impacted by the proposed project is the loggerhead. An average of 5 nests (2008-2012) are laid on the Gulf Shores unit of Gulf State Park beaches each year (Service 2013a). Kemp's ridleys and greens nest in very low numbers in Alabama. Volunteers from Share-the-Beach and USFWS personnel in Alabama conduct annual sea turtle nest monitoring surveys following methods described in the Alabama Sea Turtle Conservation Manual (USFWS 2008a). Daily morning nesting surveys are conducted on all of Alabama's beaches from May 1 through August 31 primarily on foot beginning 30 minutes after sunrise and ending by 9:00am. Nests are detected by observing nesting turtle tracks and sand mounds. Consistent nesting surveys provide opportunity for nest protection and data collection contributes to knowledge base for loggerheads in the northern Gulf of Mexico Recovery Unit of the NW Atlantic Ocean Distinct Population Segment.

Construction of the walkovers during the sea turtle nesting season could cause take of nesting sea turtles, their nests, or emerging hatchlings as a result of boardwalk support piling installation or equipment or material storage. Sea turtles could be directly and indirectly affected by the construction of dune walkovers and construction and operation of the Lodge and Conference facility and Interpretative Center. Construction and operation of the Research Center will not affect sea turtles, as the construction will not occur in or near sea turtle habitat.

Constructing walkovers will include: use of vehicles and machinery to build the walkover and to mechanically auger holes into the beach to support pilings for the boardwalk. Once completed, walkovers will physically shade sand. The use of vehicles and machinery can compact sand thereby changing the compaction of the sand which can interfere with turtle nesting. Augering deep holes could disturb a nest and kill eggs if dug directly into the nest or nearby where the nest collapses, or the temperature and moisture levels of the sand are changed due to the movement of sand near a nest. Temperature and moisture levels control gender and respiration of eggs and hatchlings within the nest. Physically shading sand can also change temperature and moisture levels, and walkover pilings could physically restrict nesting of sea turtles.

Though all construction and staging for the Lodge, Conference Facility, and Interpretative Center will be conducted behind the existing primary dune/berm line which is not within sea turtle habitat, construction may occur during evening hours which may affect sea turtles. Also operation, human occupancy, and recreational use of the facilities can result in direct and indirect effects to sea turtles.

Recreational uses of the dune systems can cause dune erosion and the loss of habitat required for sea turtle nesting. Visitor use of beaches can adversely affect nesting sea turtles, incubating egg clutches, and hatchlings (National Research Council 1990). The most serious threat caused by increased human presence on the beach is the disturbance of nesting females. Beach disturbance can cause turtles to shift their nesting beaches, delay egg-laying, and select poor nesting sites (Murphy, 1985). Sea turtles are most prone to human disturbance during the initial phases of nesting, from the point of emergence from the water through egg-cavity excavation (Hirth and Samson 1987; Witherington and Martin, 2003).

Further, human occupancy of the project may create a likelihood of injury or death to sea turtle hatchlings through collapse of nests by foot traffic, crushing developing embryos, or entombing emerging hatchlings. One of the most critical acts that a hatchling sea turtle must accomplish takes place immediately after it emerges from the nest. Under natural conditions, hatchlings that have just emerged from the sand crawl in a frenzy directly from nest to the sea. Hatchlings that are impeded from reaching the sea, or that have their sea finding disrupted by unnatural stimuli, often die from exhaustion, dehydration, predation, and other causes. The potential for human disturbance of hatchlings is even greater than with adult turtles because of the small size of the hatchlings and the large number of hatchlings on the beach.

Artificial lighting resulting from coastal development (including construction) can result in disorientation (loss of bearings) and mis-orientation (incorrect orientation) of nesting and hatchling sea turtles (Witherington and Martin, 2003; Witherington and Bjorndal, 1991). Visual cues are the primary sea-finding mechanism for hatchlings (Mrosovsky and Carr, 1967; Mrosovsky and Shettleworth, 1968; Nelson, 1988; MacPherson, 1998). Lights along the beach may deter female turtles from coming ashore to nest, disorient females trying to return to the surf after nesting, and disorient and mis-orient emergent hatchlings on developed and adjacent non-developed beaches. Any

source of bright, direct lighting can profoundly affect the orientation of hatchlings, both during the crawl from the beach to the ocean and thereafter, as they begin swimming offshore. Inappropriate lighting of the Lodge and Conference Facilities could alter nesting or hatching sea turtle behavioral patterns. Lighting of the natural habitat around buildings and facilities might subject nesting sea turtles or hatchlings to increased predation as well.

While all these adverse effects could occur, the project includes conservation measures to avoid or minimize the effects to sea turtles. Because of the conservation measures listed above we concur with your determination that the proposed project may affect, but is not likely to adversely affect, loggerhead, green, or Kemp's ridley sea turtles.

Proposed Loggerhead Critical Habitat

The Service proposed to designate critical habitat for the Northwest Atlantic Ocean Distinct Population Segment of the loggerhead sea turtle on March 25, 2013. In total, 739.3 miles of loggerhead sea turtle nesting beaches are proposed for designation as critical habitat in North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi. The proposed critical habitat includes: the areas that are extra-tidal or dry sandy beaches from the mean high water line to the toe of the secondary dune that are capable of supporting a high density of nests or serving as an expansion area for beaches with a high density of nests and that are well distributed with each State or region within a State and representative of total nesting to be a physical or biological feature for the species. Additionally, the natural coastal processes or activities that mimic these processes (particularly the dynamic process of erosion and accretion) are also identified as a physical or biological feature for this species. The Primary Constituent Elements (PCEs) are the specific elements of the physical or biological features that provide for a species' life history processes and are essential to the conservation of the species. PCEs for loggerhead proposed critical habitat include:

- Suitable nesting beach habitat that:
    - has relatively unimpeded nearshore access from the ocean to the beach for nesting females and from the beach to the ocean for both post-nesting females and hatchlings, and
    - is located above mean high water to avoid being inundated frequently by high tides.
- Sand that:
    - allows for suitable nest construction,
    - is suitable for facilitating gas diffusion conducive to embryo development, and
    - is able to develop and maintain temperatures and moisture content conducive to embryo development.
- Suitable nesting beach habitat with sufficient darkness to ensure that nesting turtles are not deterred from emerging onto the beach and hatchlings and post-nesting females orient to the sea.

The proposed project is adjacent to the proposed critical habitat within the Northern Gulf of Mexico Recovery Unit which consists of 135.5 miles of shoreline in the Florida panhandle, Alabama, and Mississippi. Only the walkovers will be constructed within proposed critical habitat. As described above for sea turtles, construction within critical habitat could alter access and sand compaction (relative to suitability for nest construction, gas diffusion, temperature, and moisture). If construction occurs at night, artificial lighting may affect beach darkness. Operation of the proposed project may

also result in changes to beach darkness and sand compaction from visitor use and driving on the beach.

Walkover construction will be short-term and will not last more than one season. Only the area directly under the walkovers would be permanently unavailable. While the exact footprint of the walkovers has not yet been defined, it is expected to represent an insignificant and discountable fraction of the total proposed critical habitat within the Northern Gulf of Mexico Unit. In addition, the conservation measures listed above are expected to further minimize impacts within proposed critical habitat such that sand compaction, turtle access, and beach darkness are not substantially changed near the project site or within the Northern Gulf of Mexico Unit as a whole. Therefore, we concur that the proposed project will not adversely modify or destroy[3] critical habitat for the loggerhead sea turtle, if designated.

Piping Plover

The piping plover is a small, sand-colored, robin-sized shorebird. 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) (Service 1988, 1996, 2003). Piping plovers migrate to the Gulf coast from each of the three breeding populations to winter (i.e., forage, loaf, other non-breeding activities) spending up to 10 months of their life cycle on their migration and winter grounds, generally July 15 through as late as May 15. No breeding occurs along the Gulf coast. For the Northern Gulf Coast, the overwintering populations are considered threatened. Wintering plovers are dependent on a mosaic of habitat patches and commonly make local movements (i.e., cross-inlet movements as well as occasional movements of up to 18 km (11 miles) (Maddock et al. 2009) among these patches depending on local weather and tidal conditions for foraging. These habitat mosaics used for foraging include moist substrate features such as intertidal portions of ocean beaches, washover areas, mudflats, sand flats, algal flats, shoals, wrack lines, sparse vegetation, shorelines of coastal ponds, lagoons, ephemeral pools, and areas adjacent to salt marshes (Service 2001).

While Gulf State Park is within the broad wintering area, few piping plover have been observed using the beaches at Gulf State Park. Only 6 sightings of piping plover have been reported between 2006 (1 at Gulf State Park Lake Shelby) and 2013 (5 on SR 182 east of Gulf State Park) at the birding website (www.ebird.org).

Construction and operation of the Lodge, Conference Facility, and Interpretative Center could affect the piping plover as human disturbance including construction and recreation, vehicle use, and the presence of predators and domestic pets disrupt piping plover and other shorebird species. Intense human disturbance (including long-term or repeated disturbance) in shorebird winter habitat can be functionally equivalent to habitat loss if the disturbance prevents birds from using an area for a significant amount of time (Goss-Custard et al. 1996) which can lead to roost abandonment and local population declines (Burton et al. 1996). However, if nearby suitable habitats are not experiencing the intense human disturbance, these effects may be reduced in that individuals have a nearby area to use during the activity. Disturbance can also cause shorebirds to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances (Johnson and Baldassarre 1988, Burger

[3] Please note that we have not relied on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 Code of Federal Regulation (C.F.R.) 402.02; instead, we have relied on the statutory provisions of the ESA.

1991, Burger 1994, Elliott and Teas 1996, Lafferty 2001a, 2001b, Thomas et al. 2002) which can limit the local abundance of piping plovers (Zonick and Ryan 1996, Zonick 2000). Shorebirds that are repeatedly flushed in response to disturbance expend energy on costly short flights (Nudds and Bryant 2000) and may not feed enough to support migration and/or subsequent breeding efforts (Puttick 1979, Lafferty 2001b).

If piping plovers are present and disturbed during the proposed project, we would expect the plovers to move to nearby suitable habitat. Localized movements to optimize foraging and resting are anticipated as a normal behavior. In addition, the conservation measures proposed for sea turtles will also avoid or minimize the potential effects (described above) to piping plover. Due to the low likelihood of species presence, normal localized movements for foraging and resting, and the implementation of the conservation measures above, we concur with your determination that the proposed project may affect, but is not likely to adversely affect, piping plover. There is no critical habitat for piping plover designated in the vicinity of the Park; therefore none will be adversely modified or destroyed.

Red Knot

There are six subspecies of red knot (*Calidris canutus*); however, only one subspecies (*C. c. rufa*) is currently proposed for listing and occurs on the Gulf coast. All of the following information regarding red knot is summarized from the Species Assessment and Listing Priority Assignment Form (USFWS 2011) and proposed listing rule (78 FR 60024) and is in reference to the rufa red knot, unless otherwise stated. The red knot is a medium-sized shorebird which ranges during migration from the Atlantic and Gulf of Mexico coasts of North, Central, and South America, from the Canadian arctic to the southernmost extent of South America. Breeding occurs within the central Canadian high arctic. Southward migration from arctic breeding areas begins in mid-July, stopping at various locations along the Atlantic coast to feed and rest. Red knots would generally be expected to "stopover" along the Gulf coast from late July through October, then continue their fall migration to their primary wintering grounds, or remain on the Gulf coast for the winter. During the spring migration, red knots begin moving northward along the Atlantic coast of South America in late February or March. The northward migration is very rapid. Red knots complete their pass along the Atlantic coast of the United States from the middle to the end of May. Known spring stopover areas are along coastal Virginia and Delaware Bay in Delaware and New Jersey, where the birds are present in mid-to late May in high abundance (i.e., approximately 90 percent of the entire population may be present in the Delaware Bay in a single day). After a few weeks during the spring stopover on the mid-Atlantic Coast, the red knot may make additional stops in southern Canada and then return to their breeding grounds in the Canadian artic. In the United States, the red knot is found principally in intertidal marine habitats, especially near coastal inlets, estuaries, and bays, or along restinga formations[4]. Wintering and migration habitats within the United States are used for resting and foraging. In the Southeastern United States, red knots commonly forage on bivalves, gastropods, and crustaceans along sandy beaches, tidal mudflats, salt marshes, and peat banks.

While Gulf State Park is within the broad wintering area for red knot, observations from www.ebird.org are limited. The number of red knot sightings in the ebird.org records indicate that 17 individuals have been recorded from 1981 (2 sighted at Alabama Point) to 2013 (2 sighted at Lake Shelby in the Gulf State Park, Alabama). These observations suggest that the red knot is an infrequent visitor to Alabama beaches and even less so to Gulf State Park.

[4] A restinga formation is an intertidal shelf typically formed of densely-packed dirt blown by strong, offshore winds.

Potential effects from the Lodge, Conference Facility, and Interpretative Center to red knot are identical to those discussed above for piping plover and are not repeated here. If red knots are present and disturbed during the proposed project, we would expect the knots to move to nearby suitable habitat. As with piping plover localized movements to optimize foraging and resting are anticipated as a normal behavior. In addition, the conservation measures proposed for sea turtles will also avoid or minimize the potential effects to red knot. Due to the low likelihood of species presence, normal localized movements for foraging and resting and the implementation of the conservation measures above, we concur with your determination that the proposed project may affect, but is not likely to adversely affect, the red knot, if listed. Critical habitat has not been proposed or designed for the red knot; therefore none will be adversely modified or destroyed.

Gopher Tortoise

The gopher tortoise does not occur in dune or beach habitats and will not be affected by the construction or operation of the Lodge, Conference Facility, and Interpretative Center. The trails and interpretive signs will be constructed in upland scrub and near freshwater wetlands north of Alabama Highway 182 (portion of the North AA). The upland scrub habitat supports gopher tortoise, a candidate species. Two conservation measures are proposed to protect the gopher tortoise: (1) survey the area for the trails and interpretive signs and mark gopher tortoise burrows with flagging and map their locations; and (2) use the flagging and mapping to design the trail and sign locations to avoid any burrows. Because of these two conservation measures, we concur that the construction of the trails and trail improvements will not affect the gopher tortoise, should it be listed.

No other candidate, proposed, or listed species or designated or proposed critical habitats are known in North AA.

Conclusion – Informal Consultation and Conference Report

For the reasons outlined above, we concur with your determination that the project, as proposed, may affect, but is not likely to adversely affect, loggerhead, green, or Kemp's ridley sea turtles and piping plover.

We also concur that the project may affect, but is not likely to adversely affect, red knot if listed and we anticipate no effects from the proposed project to gopher tortoise if listed. We further concur that the project, as proposed, will not adversely modify or destroy critical habitat for loggerhead sea turtle if designated. This concludes the informal consultation and conference report for Gulf State Park. You may ask the Service to confirm the conference report as an informal consultation if species are listed or critical habitat is designated. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference report as the informal consultation on the project and no further section 7 consultation will be necessary.

These species, proposed critical habitat, and the North AA will not be considered further in the Formal Consultation.

Formal Consultation – Consultation History

January 15, 2002: Contacted by Volkert Engineering, Brett Gaar, regarding a habitat conservation plan (HCP).

June 19, 2002: Meeting with Volkert Engineering - preliminary pre-application meeting.

August 20, 2002: Meeting with Brett Gaar, Volkert. They are preparing an HCP and Environmental Assessment (EA). Plan to be presented to the Governor for approval on 8-23-02. Final plans not yet determined.

September 17, 2002: Notified by Volkert that the Pavilion needed to be removed. Discussion of impacts, permit requirements, whether Incidental Take Permit (ITP) would be required or could Alabama State Collection Permit be used.

September 30, 2002: Meeting with Volkert, Alabama Department of Conservation and Natural Resources (ADCNR). Pavilion removal will be done under ADCNR recovery action permit because it is hazardous to the public. Minimal impact, restoration, methods to avoid take discussed.

October 10, 2002: Meeting with Volkert to discuss alternatives, Critical Habitat (CH) which has constituent elements of CH, Alabama beach mouse (ABM) trapping information for Gulf State Park (Gulf State Park) HCP.

December 11, 2002: Meeting with Volkert, regarding data needs for HCP and draft EA.

December 16, 2002: Site visit to Gulf State Park between Celeste South and Brett Gaar to identify CH which has the constituent elements of CH.

January 21, 2003: Telephone conference with Brett Gaar and Scott Jackson, with Volkert, regarding 5-Point policy for HCPs, trapping information for Gulf State Park, questions about completion of HCP.

January 28, 2003: Meeting with Volkert and Bill Lynn, Panama City, to discuss previous trapping data and trap lines at Gulf State Park.

January 30, 2003: Telephone conversation with Scott Jackson, Volkert, discussion of HCP and mapping of habitat.

February 20, 2003: Telephone conversation, Scott Jackson, Volkert, regarding draft HCP.

March 3, 2003: Meeting at Gulf State Park with Scott Jackson and Hugh Branyon regarding plans for Convention Center.

March 5, 2003: Site visit to Gulf State Park for habitat mapping.

March 11, 2003: Meeting with Scott Jackson and Brett Gaar to discuss HCP alternatives.

May 7, 2003: Receipt of Gulf State Park Application for ITP, HCP.

May 12, 2003: ITP application and HCP forwarded to Southeast Regional Office.

December 10, 2003: Draft EA, with field office comments included, received from Volkert.

December 13, 2003: ADCNR Application to Army Corps of Engineers (ACOE) for Gulf State Park Hotel and Convention Center.

June 26, 2004: Comments furnished by Southeast Regional Office.

July 26, 2004: Solicitor review of HCP and draft EA.

July 30, 2004: Comments/additional information added to EA

August 30, 2004: Solicitor Comments incorporated into revised EA

September 15, 2004: Notice of availability of the HCP and EA was published in the Federal Register with a 30-day comment period for public comment.

December 22, 2004. The Service issued the intra-Service Biological Opinion for the Issuance of an Incidental Take Permit Pursuant to Section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, for Gulf State Park Hotel and Convention Center Demolition and Reconstruction between Gulf Shores and Orange Beach, Baldwin County, Alabama (TE-072831-0).

December 23, 2004. The Service issued the Incidental Take Permit (ITP) TE-072831-0 to Gulf State Park, Baldwin County, Alabama.

April 6, 2005: The Service issued a minor modification of ITP TE-072831-1 signed by Acting Deputy Regional Director for adjusting footprint of the Gulf State Park beach pavilion and parking lot.

March 14, 2006: Received draft lighting plan for proposed replacement of Gulf State Park fishing pier.

March 31, 2006: Received Army Corps of Engineers Permit Notice for Application SAM-2006-612-JAM to replace hurricane damaged Gulf State Park fishing pier.

April 11, 2006: Alabama FO sent request to Army Corps of Engineers to hold permit application SAM-2006-612-JAM in abeyance pending our concurrence with a sea turtle friendly lighting plan for the pier and revision to Gulf State Park's habitat conservation plan (HCP/ITP) to include revising the Gulf State Park hotel and convention center construction footprint, and demolition and reconstruction of the fishing pier. 2006-FA-0156

April 12, 2006: Reconnaissance visit to Pensacola Pier for viewing sea turtle friendly lighting.

April 14, 2006: Received recommendations on Gulf State Park pier lighting plan from Lorna Patrick, Panama City FO.

April 18, 2006: First meeting with Gulf State Park, Federal Emergency Management Agency, Alabama Department of Conservation and Natural Resources (ADCNR), Service (Service– Alabama and Panama City FOs) on Gulf State Park's changes to proposed convention center/hotel/pier replacement and provided hard copy of Service (Lorna Patrick, Panama City FO) recommendations.

May 9, 2006: E-mailed copy of Service recommendations on lighting plan to Thompson Engineering.

May 18, 2006: Second meeting with Gulf State Park, ADCNR, Service to discuss details of Service recommendations for pier lighting plans.

June 19, 2006: Received request from ADCNR for demolition of land portion of Gulf State Park pier.

June 19, 2006: Received request dated June 16, 2006, from ADCNR for modification to HCP/ITP to include adjustment of building footprint of proposed hotel and convention center, and pier replacement.

July 7, 2006: Received revised draft lighting plan for Gulf State Park pier from Thompson Engineering.

July 11, 2006: Express mailed copy of revised pier lighting plan to Lorna Patrick, Panama City FO.

July 18, 2006: Received lighting plan comments from Lorna Patrick.

July 38, 2006: E-mailed a few remaining questions on lighting plan to Thompson Engineering.

July 31, 2006: Received response from Thompson Engineering.

August 8, 2006: Sent correspondence to Thompson Engineering and Gulf State Park concurring final lighting plans for pier. 2006-TA-0542

August 8, 2006: Sent correspondence to ADCNR concurring with demolition of land portion of pier. 2006-TA-0816

September 6, 2006: Sent HCP/ITP TE-072831-1 modification package to the Southeast Regional Office to initiate amendment including application, letter requesting modification, and map of revised plan.

November 15, 2006. The Service issued an amendment to the Biological Opinion and Conference Report for the Issuance of an Incidental Take Permit Pursuant to Section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, for Gulf State Park Hotel and Convention Center Demolition and Reconstruction between Gulf Shores and Orange Beach, Baldwin County, Alabama

December 22, 2008. The Service issued a minor modification of ITP TE-072831-0 to accommodate changes to the pier and project footprint.

April 2013: Will Brantley, Carl Ferraro, Brett Gaar met with Bill Lynn and Bill Pearson to introduce the park enhancements projects as proposed for early restoration.

October 2013: Bill Lynn provided Alabama beach mouse (ABM) trap data for Gulf State Park.

February 2014 – A site visit was conducted with Holly Herod, Bill Lynn, Will Brantley, Brett Gaar, Amy Hunter, and Laurel Jennings. In addition Bill Lynn provided Native Plant List species to be incorporated in updated HCP. A revised draft HCP was submitted for review and comment.

February – April 2014 coordination meetings/calls with FO and Regional Office on updates to the HCP and Dune Management Plan. Revised final HCP and Dune Management Plan were submitted.

April 2014 – Received memorandum requesting consultation from Deputy Case Manager, Deepwater Horizon Department of Interior Natural Resource Damage Assessment and Restoration.

BIOLOGICAL OPINION

The proposed action formerly consisted of the demolition, replacement, occupancy, use, operation, and maintenance of Gulf State Park Hotel and Convention Center, lodging facilities, beach pavilion, amphitheater, and parking areas. As stated previously, the original BO was issued on December 22, 2004, for the proposed Gulf State Park (Gulf State Park) Hotel and Convention Center Demolition and Reconstruction. The ITP (TE-072831-0) was issued on December 23, 2004. Under the original BO and ITP, the fragments of structures remaining after hurricanes Ivan in 2004 and Katrina in 2005, were demolished.

On April 6, 2005, the Service issued a minor modification of the ITP (TE-072831-1) to adjust the footprint of the Gulf State Park beach pavilion and parking lot. The new Pavilion and associated parking lot was built shortly thereafter. A subsequent modification of the ITP (TE-072831-2) and amendment to the BO was completed on November 15, 2006. In addition to adding a Conference Report (CR) for proposed critical habitat for the Alabama beach mouse, the amendment found that a lower level of incidental take of Alabama Beach mouse would occur than allowed under the original consultation and amended the BO accordingly. Work completed under this amendment included construction of the new Pier and associated parking areas. Under the previous consultations and ITP, a total of 22.7 acres of habitat restoration/enhancement for the Alabama beach mouse was required and has been fulfilled by Gulf State Park.

Therefore, this document represents the third amendment or revision to the BO and incorporates changes to the project description; conservation measures updates (e.g., new lighting technologies and walkover maintenance); updates the status and baseline of the Alabama beach mouse; updates geospatial errors; and analyzes these changes in regards to effects on the ABM and its critical habitat. This third amendment or revision of the BO supersedes all previous consultations. The revised HCP and subsequent modified ITP (TE-072831-3) are the operative documents.

DESCRIPTION OF PROPOSED ACTION

The project location, description of the action, and conservation measures are described above and are not repeated here.

STATUS OF THE SPECIES/CRITICAL HABITAT

Below is a summary of the life history and ecology of the Alabama beach mouse relevant to the proposed project. Appendix A contains a detailed discussion from which this summary was developed.

Species and Critical Habitat Description

Alabama beach mouse (*Peromyscus polionotus ammobates* or ABM) is a sub-species of the old-field mouse (*P. polionotus*). ABM is a small, white to sand-colored rodent that spends its entire life in primary, secondary, and scrub dunes.

Current range
ABM are restricted to the sandy dune system from Fort Morgan Peninsula to Gulf State Park, just west of Perdido Pass, Baldwin County, Alabama. This range is not contiguous due to habitat fragmentation from coastal development. In addition, not all areas identified as suitable ABM habitat are of equal value to the species, and ABM use of various habitat types may change over time (*e.g.*, season, predation and competition pressures, population densities, and weather conditions).

Listing history/Legal status
The ABM was listed as endangered under the ESA in 1985 and the species is still considered endangered throughout its range.

Critical Habitat Description and Primary Constituent Elements (PCEs)
Critical habitat was designated in 1985 at the time of listing and subsequently revised on January 30, 2007 (72 FR 4329). In the final rule, the Service identified 1,211 acres in five units that met the standard for CH (Table 2). Approximately 192 acres of Gulf State Park is critical habitat Unit 5 (Figure 3).

A Primary Constituent Element (PCE) is a physical and biological feature which is considered essential to the conservation of the subspecies. The Service identified the following PCEs in the revised CH for the ABM:

1. Continuous mosaic of primary, secondary and scrub (*i.e.*, interconnected frontal and tertiary dunes, and interior scrub) vegetation and dune structure, with a balanced level of competition and few or no competitive or predaceous nonnative species present, that collectively provide foraging opportunities, cover and burrow sites;
2. Frontal 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 (*i.e.*, tertiary dune/suitable interior scrub) dunes, generally dominated by scrub oaks (*Quercus spp.*), 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. Unobstructed habitat connections that facilitate genetic exchange, dispersal, natural exploratory movements, and recolonization of locally extirpated areas;
5. 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.

Activities that impact the Primary Constituent Elements
Activities that impact the PCEs are those that alter: the connectivity of the dune system (including primary, secondary, tertiary dune and scrub habitats); the dune in such a way that burrow sites, foraging opportunities and protection from predators or hurricanes/tropical storms are limited; the natural light regime in such a way that nocturnal ABM behaviors are modified. Such anthropogenic activities include coastal development that removes or fragments the dune system (i.e., no corridors between dune types or scrub), lowers dune height (i.e., reduces the ability of the dune system to provide hurricane protection), removes native vegetation; plants, maintains, or fails to remove non-native vegetation; increases predators; or adds artificial night lighting that is not wildlife-friendly. Beach grooming and tourist activities (e.g., uncontrolled walking through the dunes) can fragment and impact dune structure and negatively affect the PCEs in a manner similar to development. Beach renourishment and dune restoration/enhancement can also affect the PCEs; however, many of these

projects are designed to create habitat with or enhance PCEs.

Life History

Beach mice are nocturnal and are the only member of the *Peromyscus* genus that dig extensive burrows within the dune system. Beach mice typically inhabit frontal dunes (*i.e.*, primary and secondary) to conduct their normal breeding, feeding, and sheltering behaviors. They also utilize tertiary dunes, especially when hurricane or storm events damage primary dunes.

Longevity and Demographics

Beach mice generally have a lifespan of about nine months, but may live as long as 20 months (Swilling 2000, Blair 1951, Rave and Holler 1992). Population turnover, as estimated by survival rates, is high and typical of microtine rodents. In general, the majority of individuals in an ABM population are replaced with new individuals within a 10 to 12-month period (Hill 1989, Rave and Holler 1992).

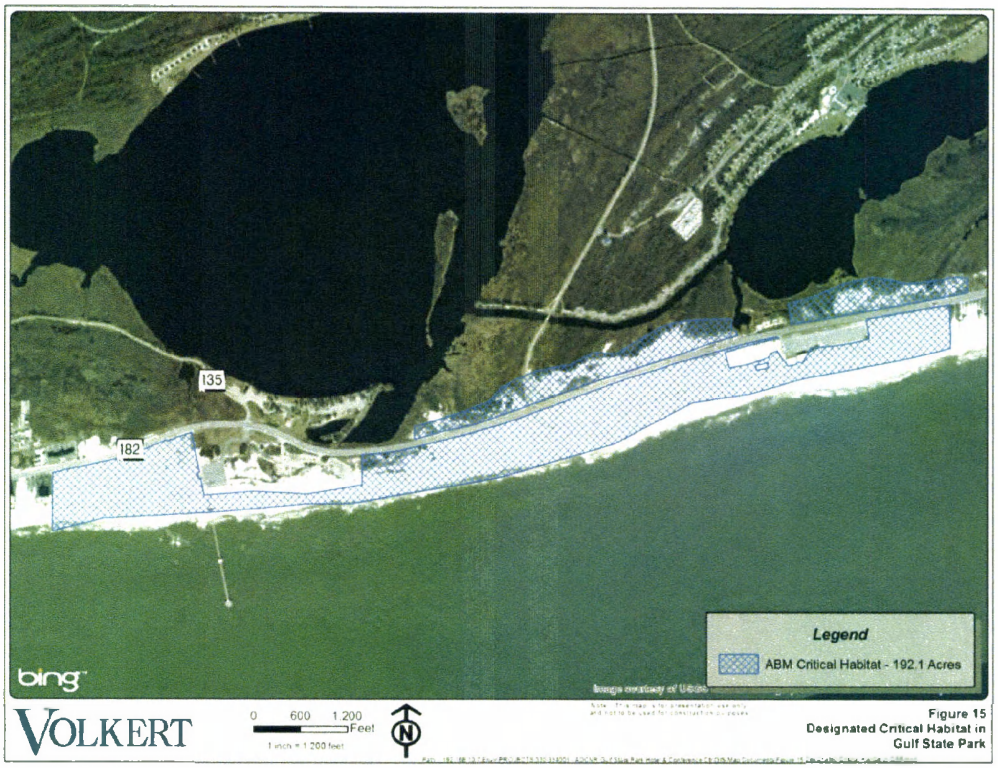
Table 2. Critical Habitat for the Alabama Beach Mouse.

Alabama Beach Mouse Critical Habitat Units	Acres	Occupied	PCEs*	Threats**
1. Fort Morgan (ABM-1)	446	Yes	1, 2, 3, 4, 5	C, R, S, T
2. Little Point Clear (ABM-2)	268	Yes	2, 3, 4	H, L, C, S
3. Gulf Highlands (ABM-3)	275	Yes	1, 2, 3, 4, 5	H, L, C, P, S, T
4. Pine Beach (ABM-4)	30	Yes	1, 2, 3, 4, 5	H, L,C, P, S
5. Gulf State Park (ABM-5)	192	Yes	2, 3	L, C, P, T, R, S
Total	1,211			

* Critical habitat numbers reference the following: (1) A contiguous mosaic of primary, secondary 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; and (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.

**Threats are defined as follows: L = artificial lighting; C = free-roaming cats; P = predators at unnatural levels; R= recreational use that may result in soil compaction, damage to dunes, and/or a decrease in habitat quality; H = habitat fragmentation and loss due to development; S = storm events causing loss of dune topography and vegetation or habitat fragmentation, impacting populations, and post-storm; T = human generated refuse

Figure 3. Alabama Beach Mouse Critical Habitat Unit for Gulf State Park as currently designated.



Reproductive Strategy, Recruitment, Seasonal Distribution Patterns, and Dispersal

Beach mice are generally monogamous; however, paired males may produce extra litters with unpaired females. Male and female beach mice are capable of breeding at an age of 25 and 35 days respectively. A female can produce a litter (average 3 to 4 mice) every month and may live long enough to breed over a period of about eight months, potentially producing an average of 24 to 32 young each year.

ABM subadults are most abundant during winter and least abundant during summer reflecting seasonal differences in breeding activity and reproductive success (Blair 1951, Hill 1989, Holler and Rave 1991, Rave and Holler 1992). Survival of newborn offspring and recruitment of subadults appear to increase in autumn and winter when food resources are more abundant (Rave and Holler 1992).

Adults may share home ranges with subadults in areas of high habitat quality (Swilling 2000). Though as densities increase or if habitat quality is lower, subadult ABM are forced to disperse into adjacent habitats. While ABM have been documented to disperse nearly a mile (Swilling 2000) mean dispersal distances are quite small (529 ft $\pm$ 858 ft (0.1 $\pm$ 0.26 mile)). Size of mean home range was an estimated 224 feet in diameter (Swilling and Wooten 2002). Because population density, reproduction and survival for ABM are simultaneously at seasonal highs during the fall/witer months, many subadults appear to be recruited into the adult population rather than disperse to adjacent habitats (Swilling and Wooten 2002).

Food Habitats

Beach mice are nocturnal (active at night) and forage for food throughout the dune system. They are opportunistic omnivores that exploit a variety of available resources, including seeds and fruits of coastal dune plants. Insects are also an important component of their diet. 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).

Predators/competitors/disease factors

ABM have a number of natural predators (snakes, owls, fox, raccoons, etc.) (Service 2009). Free-roaming and feral cats are thought to adversely affect beach mouse persistence and are considered to be the main cause of the loss of one isolated population of ABM at Ono Island. Natural predation of beach mouse populations that have sufficient recruitment and habitat availability is generally not a concern. However, excessive predation pressure from natural and non-native predators may result in the extirpation of small, isolated populations of beach mice. Extirpation is especially possible after hurricanes when both predators and prey are more concentrated in smaller and often isolated habitat patches.

There is evidence to suggest that ABM may be subject to competition for resources in areas where other rodent species (e.g., native cotton rats) are present and habitats are isolated (Service 2009). ABM are not often found in the presence of non-native mice and rats, suggesting non-native species replace ABM.

Little is known about mice disease and susceptibility to parasites (Service 2009). Although diseases and parasites have been documented in beach mice, the influence of these factors on population dynamics is unknown.

Population Dynamics (Size, Variability, and Stability)

As stated previously, populations of beach mice reach peak numbers between late autumn and early spring and likely vary due to changes in reproduction rates, food availability, habitat quality and quantity, catastrophic events (*e.g.*, hurricanes, drought or disease), and/or predation. Population size is therefore difficult to determine with accuracy due to variation in sampling designs, habitat conditions, and weather conditions during the sampling. However, what is known is that ABM populations are highly dynamic and can fluctuate broadly (Table 1 in Appendix A). These data should not be considered a population estimate.

To better understand forces driving population stability, Population Viability Analyses (PVA) were conducted. Results from several PVAs suggested that: (1) smaller populations, particularly those that are isolated and lacking higher elevation habitat, tend to be extirpated rapidly; (2) habitat connectivity is important for long-term ABM conservation; (3) invasive species (*e.g.*, cogongrass and domestic cats) can have significant effects on the long-term existence of the ABM; (4) hurricanes have the greatest effect on ABM population dynamics; and (5) habitat restoration following hurricanes may lead to a small but measurable increase in ABM viability over time under some conditions (Traylor-Holzer *et al.* 2005, Traylor-Holzer 2005, Reed and Traylor-Holzer 2006).

Status and Distribution

Reason for listing

The ABM was listed in 1985 as endangered species primarily because of habitat fragmentation, alteration, and/or loss due to coastal development (Service 1985). The threat of development-related habitat loss has continued to increase. Other factors that contributed to listing included low population numbers, habitat loss from other sources (*e.g.*, hurricanes), predation or competition by animals related to human development (cats and house mice), and the lack of regulations on coastal development. These factors continue to impact the ABM.

New Threats

Increases in sea level, temperature, precipitation and storms are expected with global climate change. Although the implications for changes to the Alabama Gulf coast are far from clear, the possible effects of global warming/sea level rise may have significant impacts on ABM habitats and populations. It is reasonable to assume that beach mouse habitat, particularly the frontal dunes, could be adversely impacted by shoreline inundation and erosion, as well as the effects of flooding and salt spray on interior dune vegetation, associated with predicted increases in sea level and/or storm activity along the Gulf coast.

Invasive species such as Cogongrass (*Imperata cylindrical*), torpedo grass (*Panicum repens*) and beach vitex (*Vitex rotundifolia*) are also a new threat to ABM habitat. These species can crowd out native plants through rapid growth, rapid vegetative production and massive fruit or seed production. Changes in plant species composition can change the structure and continuity of the habitat and its ability to support burrows or dispersal corridors. Also, these invasive plants may not produce appropriate food resources for ABM.

Invasive plants are also easily spread through mowing (AFC 2009). Frequent mowing affects small mammals by limiting movements, reducing cover, interrupting habitat formation and reducing habitat quality (Slade and Crain 2006). Frequent mowing also reduces the diversity of native vegetation, and reduces small mammal abundance and diversity (Barras, *et. al.*, 2000). Various widths of right of way containing beach mouse habitat have been maintained by local governments and the Alabama Department of Transportation (ALDOT) with tractor-attached bush hogs and mowed infrequently. However, local governments and landscaping companies are switching to commercial zero-turn style mowers. While tractor based bush hogs were limited in how low they could mow vegetation zero-turn mowers have the same mowing capabilities as regular lawn or riding mowers and can mow vegetation much lower. An increase in mowing frequency and habitat impacts have been noted (B. Lynn, pers. observation).

Range-wide trends

ABM populations are persistent and have been recovering since Hurricanes Ivan and Katrina (Service 2009). While ABM are fairly short-lived, they reproduce quickly and often. Small home ranges and dispersal distances are common. Therefore, when coastal development occurs, it is easy to isolate and fragment habitat and populations.

Since Hurricanes Ivan and Katrina, there has been a net loss of habitat from development actions. Although approximately 2,450 acres of range-wide ABM habitat remain, much of the area is subject to erosion, inundation, and/or salt spray during storm events. We expect the demand for coastal development to continue or increase. Depending on the location and density of new residential and commercial developments, adverse effects on the distribution and/or density of the ABM population could occur due to habitat fragmentation. In turn, this could exacerbate the impacts from large storm

events. If areas affected by hurricanes are connected to tertiary dune systems or areas of higher dunes, the once extirpated areas are recolonized within a few years of the hurricane demonstrating stability and persistence of the population over time. If ABM are extirpated from an area that is isolated from other populations, like Gulf State Park, natural recolonization has not been detected even after suitable habitat has been restored, indicating poor stability and persistence. However, reintroduction of ABM into Gulf State Park, has resulted in successful recolonization of all suitable habitat, further indicating that reproduction is not limited and dispersal of mice through connected habitats drives the stability of the population.

Recovery criteria

The approved recovery plan for ABM (Service 1987) does not contain recovery criteria. The recovery objectives include: stabilizing the present populations by preventing further habitat deterioration, and to reestablish populations in areas from which they have been extirpated. Downlisting to threatened can be considered when there are three distinct, self-sustaining populations in each of the original critical habitat areas (Service 1987), and a minimum of 50% of the critical habitat is protected and occupied by mice.

Analysis of the Species/Critical Habitat Likely to be Affected

The only species carried forward within this biological opinion is the Alabama beach mouse. ABM occur throughout the Gulf side portion of the HCP AA as described below under ENVIRONMENTAL BASELINE. ABM also occur within a portion of the North AA, north of AL 182; however, mice in this area are not expected to be directly or indirectly affected by the project (i.e., the proposed activities do not occur in or near mouse habitat). Therefore, only the HCP AA is discussed. The ABM population within the HCP AA would be directly and indirectly affected by the proposed project. Effects to ABM would be from loss of natural habitat due to project construction and/or permanent infrastructure and associated effects including lighting; the presence of humans using the property; beach access and use; presence of trash and refuse; predators and competition; and habitat fragmentation.

Most of the Gulf State Park lands south of AL 182 and a portion of the lands north of AL 182 are designated as ABM critical habitat (CH) (Figure 3). The majority of the actual HCP footprint[5] area was disturbed by paving, building construction, etc. prior to the listing of the species and does not exhibit the constituent elements of CH and was excluded from CH. Further, the HCP footprint area was designed in the revised HCP to avoid any critical habitat with PCEs. However, using existing GIS technology rough estimates indicate that less than 2 acres of critical habitat is actually within the HCP footprint (Figures 4a and 4b)[6].

ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated CH), and ecosystem, within the HCP AA.

[5] The HCP footprint is 41.1 acres (10.3 acres Fishing Pier + 9.2 acres Interpretive Center/Beach Pavilion + 21.6 acres Lodge Complex) within the HCP AA.

[6] There are inherent errors with incorporating different GIS layers, from different sources into one project, especially when the landscape is constantly changing (like movement of dunes, accretion and erosion of beach, etc.). Therefore, all measurements within this document should be considered estimates for the purposes of effects analysis, rather than actual on-the-ground impacts.

Status of the species/critical habitat within the action area
Gulf State Park was originally built in the 1974, prior to the listing of ABM and designation of critical habitat. ABM continued to persist at the site during the operation and management of the former lodge complex. Since original construction, the ABM populations in the HCP AA have been impacted by multiple hurricanes and feral cats, resulting in at least three extirpation events in the last three decades (Holliman 1983, Holler and Rave 1991, Service 2004a and 2005a, Volkert 2005). One such extirpation event occurred due to Hurricane Opal in 1995 and feral cat predation. In 1997, Gulf State Park implemented a successful program to remove feral cats. After this, ten ABM were reintroduced to Gulf State Park and the population had increased to about 70 individuals by 2001 (Lynn, 2001).

The reintroduced population expanded from their initial reintroduction site near the old pavilion to cover most of the available habitat in Gulf State Park by March 2004. ABM were also found west of the Gulf State Park pier as well as north of AL 182 between State Park Road 2 and the eastern boundary of the Park, extending onto private land just east of the Park boundary. However, Hurricanes Ivan in 2004 and Katrina in 2005 eliminated or severely damaged about 95-100 percent of the frontal dune system, as well as an undetermined amount of tertiary dune habitat (Service 2004b and 2005). Additional hurricane disturbance included deposition of sand and woody debris within the Action Area and a substantial reduction in coastal dune vegetation. Hurricane Ivan also caused a breach and overwash of Lake Shelby through coastal dune areas along Gulf State Park to the Gulf of Mexico.

Figure 4a. Footprints for the existing Pier and associated parking and the proposed Lodge and Conference Center in relation to Alabama Beach Mouse critical habitat (ABMCH) in red. Within the Pier Footprint there is an approximate 0.3 acres of ABMCH. Within the Lodge and Conference Center Footprint there is approximately 0.2 acres ABMCH.

Post-Ivan surveys indicated that no ABM survived the storm in Gulf State Park or the Gulf State Park Critical Habitat Unit (Service 2004b), likely due to limited food and habitat after the storm and isolation from adjacent ABM populations to the west by the new breach and development between Bon Secour National Wildlife Refuge and Laguna Key development. This breach acted as a temporary barrier to ABM remaining on Bon Secour National Wildlife Refuge which delayed ABM recolonization of Laguna Key and West Beach. By 2008, sufficient sand deposition occurred in the breach to allow ABM from Bon Secour National Wildlife Refuge to cross and recolonize Laguna Key and disperse along West Beach (BAE 2008; Barbara Allen, pers. com., May 2, 2008; Service files). Based on post-hurricane/flood observations in 2004 and 2005, trapping and tracking tube data, and a conservative flood model (ENSR 2004), the Service estimates that ABM may have occupied no more than about 841 acres of habitat on Fort Morgan Peninsula shortly after Hurricanes Ivan/Katrina and the April 2005 flood event. However, most of the ABM habitat impacted by these and more recent weather events in the area, such as Hurricanes Gustav and Ike in 2008 (Service 2008b), have been

steadily recovering (AECOM 2009a and b; Service 2009 and 2010). ABM populations are thought to be approaching pre-Ivan/Katrina abundance levels to the west of Gulf State Park, based on available trapping data (Appendix A) and recovering habitat conditions (Service 2010).

Figure 4b. Footprint for the Interpretative Center (0.1 acre within ABMCH) and existing Pavilion (0.65 acre ABMCH).

Habitat at Gulf State Park is also recovering naturally and through habitat restoration/enhancement efforts under the ITP and an Engineered Berm/Dune funded by FEMA. Through these actions, all of the breaches have been closed except the existing access points to the beach for maintenance and emergency response. Unfortunately, Gulf State Park is isolated from other ABM populations due to the surrounding development of Little Lagoon Pass, Gulf Shores, and Orange Beach. This isolation prevents natural recolonization of the HCP AA from the closest recovering ABM population habitat in West Beach. However, in the spring of 2010, Gulf State Park allowed the Service to translocate 22 ABM from Fort Morgan and Perdue Units of the Bon Secour National Wildlife Refuge. In October and November of 2010, ABM were recaptured. Unmarked mice were found indicating new recruitment into the reintroduced population (Service 2013b). Mice continued to be captured during survey events in 2012 and 2013. Based upon these survey events, the Service has determined that reintroduction success criteria are being met (i.e., the population is estimated to be more than the initial number transferred and at least 50% of suitable habitat is occupied) (Service 2013). In further support, during a February 2014 site visit, the Engineered Berm showed evidence (burrows) of active beach

mouse presence. Therefore, we assume that the Berm and restored/enhanced dune habitats within the HCP AA are reoccupied.

As described above the critical habitat within the HCP AA was greatly affected by recent hurricanes. Through natural recovery and restoration/enhancement of Gulf State Park, the AA outside of the HCP footprint is supporting some features of the PCEs such as frontal dunes with vegetation for food resources, burrow sites, and protection from predators and a natural light regime. Based on current GIS polygons[7] for the HCP footprint, we estimate less than 2 acres of the HCP footprint appears to be within designated critical habitat: 0.3 acres at the Pier; 0.2 acres at the Lodge Complex; and 0.75 acres (0.1 acres undeveloped + 0.65 acres developed) at the Pavilion (Figures 4a and 4b). At the Pier, no activities are proposed and the 0.3-acre area has been restored to dune habitat with PCEs. The HCP footprint was designed to avoid direct development in critical habitat and we believe the appearance of 0.2 acres of critical habitat within this footprint is a geospatial error. However, the proposed construction will not extend into this 0.2-acre area, which is at the eastern edge of the footprint, regardless of any critical habitat designation.

At the Pavilion, approximately 0.75 acres within the footprint of the Pavilion and the Interpretive Center appears to be designated critical habitat based upon geospatial data layers. However, this footprint was part of the original Gulf State Park structures and did not contain PCEs and was not designated as critical habitat. We believe this is also a geospatial error and does not reflect direct development of 0.75 acres of CH.

The original Biological Opinion (December 2004) analyzed an ABM population that had been reintroduced in 1998 (after Hurricane Frederick), expanded throughout the Park and then affected in September of 2004 by Hurricane Ivan. Population impacts from Hurricane Ivan were not fully understood. Therefore, the effects analysis was completed conservatively as if the Hurricane had not impacted ABM or its habitat. In November 2006, an amended Biological Opinion was issued noting that Hurricane Ivan impacted the majority of habitat through the entire range of ABM and determined there were no ABM at Gulf State Park. However, the analysis of potential affects to ABM and its critical habitat (which was proposed at the time) was completed as if there were no impacts from Hurricane Ivan and subsequent storms to the species or critical habitat. Nearly ten years after Hurricane Ivan, habitat restoration and enhancement (both anthropogenic and natural) has occurred and ABM have been reintroduced to Gulf State Park. The reintroduced population is recruiting and is assumed to occupy all suitable habitat within the Park. In summary, while the status and baseline ABM and its critical habitat has undergone changes since the original Biological Opinion and amendment; the assumption of ABM throughout suitable habitat in each of the Service's previous analyses has been constant. Therefore, the affects analysis focuses on updates to project footprints and conservation measures, and acknowledges habitat restoration.

Factors affecting species environment within the action area

As stated previously, the Gulf State Park hotel and conference facility was originally built in 1974 on the same site as the proposed project. Due to hurricane damage, the facilities needed rebuilding and the State prepared a plan for that purpose. Subsequently, the State developed an HCP, which was

[7] There are inherent errors with incorporating different GIS layers, from different sources into one project, especially when the landscape is constantly changing (like movement of dunes, accretion and erosion of beach, etc.). Therefore, all acreage measurements within this document should be considered estimates for the purposes of effects analysis, rather than actual on-the-ground impacts.

submitted to the Service. The Service completed intra-Service section 7 consultation and based on the HCP issued an Incidental Take Permit (ITP) for ABM. Under the original BO and ITP, the fragments of structures remaining after Hurricanes Ivan in 2004 and Katrina in 2005 were demolished.

On April 6, 2005, the Service issued a minor modification of the ITP to adjust the footprint of the Gulf State Park beach pavilion and parking lot. The new pavilion and associated parking lot was built shortly thereafter within the 9.2-acre footprint.

An amendment to the original BO was completed on November 15, 2006. In addition to adding a Conference Report (CR) for a proposed revision to critical habitat for the Alabama beach mouse, the amendment addressed the State's proposed lower level of incidental take of Alabama Beach mouse and the BO was amended accordingly. The Service also addressed the State's need to relocate the Park's fishing pier and associated parking lot, which had been damaged severely by Hurricane Ivan. The State sought to move both facilities into an area considered less vulnerable to storm over-wash and breaches that occurred between Lake Shelby and the Gulf of Mexico. The new pier location was moved east and the parking adjusted and these facilities are within a 10.3-acre footprint.

There are four walkovers built by Gulf State Park after the hurricanes in the HCP AA. Existing walkovers on Gulf State Park installed after the hurricane seasons of 2004 and 2005, were installed in accordance with all state and local laws (i.e., usually 5 feet above grade). However, the pre-hurricane heights of local dunes were not taken into account during the rebuilding of walkovers and the grade was fairly flat due to the hurricanes. Consequently, several walkovers require sand maintenance where dune elevation has overtaken walkovers.

The original biological opinion, the first amendment to the biological opinion, and the associated ITP required mitigation for the ABM. As of the date of this consultation, all required habitat restoration and enhancement, a total of 22.7 acres, has been fulfilled within the HCP AA by Gulf State Park. Gulf State Park also restored or enhanced an additional 14.1 acres in the HCP AA that was not required by the HCP and ITP for a total of 36.8 acres of dune restoration and enhancement to date.

There have been administrative changes to boundaries (exclusion of land not owned by Gulf State Park) and reductions in actual as built project footprints (vs planned footprints) which have resulted in changes to the acreage of the HCP AA between the initial HCP and the current HCP. Therefore, under the proposed project the overall planned footprint for *all* development on Gulf State Park within the HCP area is calculated to be 41.1 acres within the total HCP AA of 179 acres. The total HCP footprint of 41.1 acres represents a reduction in total construction footprint from the original HCP footprint, which was calculated at the time to be 44.3 acres and was subsequently amended to 42.3 acres. Currently, the Interpretive Center will be built within the Pavilion acreage and share the Pavilion parking lot. Therefore, the Lodge and Conference Center will be built within the remaining 21.6 acre footprint (41.1 acres total – 9.2 acres for the existing Pavilion, associated parking, and proposed Interpretive Center – 10.3 acres for the existing Pier and associated parking = 21.6 acres for the Lodge and Conference Center).

There are no tribal actions affecting ABM in the HCP AA. The Pavilion, Pier areas, and dune walkovers are regularly used by visitors to the Gulf coast. The presence of feral and domestic cats in the HCP AA is a continuing concern and removal of these animals is an ongoing project of Gulf State Park.

Oil spill cleanup from Deepwater Horizon occurred on the beaches at Gulf State Park. Effects from the spill and the response are still under investigation. Therefore, the scale of the impact from these activities to the ABM and critical habitat is unknown. However, mice were reintroduced during 2010 and are known to be reproducing and have dispersed from reintroduction sites to suitable habitats throughout Gulf State Park. Other than natural disasters, visitor use, walkover construction and maintenance, other infrastructure development (Pier, Pavilion, associated parking), predator control, and habitat restoration/ enhancement, no physical actions have taken place to affect the HCP AA.

In summary, ABM have persisted at Gulf State Park since its construction in 1974 without the benefit of conservation measures other than reintroductions following storm events. As surrounding development occurred, the Park habitat was isolated from other portions of the ABM population. After major storms (e.g., Hurricane Frederick and Ivan), ABM have been extirpated from Gulf State Park. However, each reintroduction effort, even in the presence of an operating Lodge and Conference Center (i.e., after Hurricane Frederick), has been successful in reestablishing a population of ABM.

EFFECTS OF THE ACTION

Factors to be considered

The ABM may still be found in suitable habitat across its historic range where other threats have been managed, controlled or ameliorated. While various population estimates have been attempted for beach mouse, the results are not reliable due to differing sample methodologies, access limitations, and data gaps. Similarly, because ABM populations tend to naturally fluctuate frequently, loss of specific habitat areas would likely impact different numbers of ABM depending on season, storm events, food supplies, and other factors.

Since impacts cannot be assessed accurately in fluctuating populations on the sole basis of number of ABM affected, a corresponding measure is the amount of ABM habitat lost due to a project, and subsequently the ABM that depend on that habitat. Based on the life history of the species, factors that appear to drive extirpation, and the success of reintroduction efforts, it appears that ABM reproduce successfully in suitable habitats. Their range and population expansion is thus only limited by the amount of suitable habitat present and the connectivity between suitable habitats. While the loss of one acre of habitat at one location can have different consequences as compared to the loss of one acre of habitat at another location (depending on connectivity, etc.), measuring habitat loss is a good surrogate for measuring effect to the ABM.

The 2004 BO evaluated impacts to ABM in terms of the HCP footprint (44.3 acres) of which only 11.3 acres was considered habitat (Table 3). After Hurricane Ivan eliminated virtually all available ABM habitat in Gulf State Park, the habitat acreage to be lost by the project was considered 0 acres. However, the 2006 amendment analyzed the project as if pre-Ivan habitat was still available which resulted in an HCP footprint based upon 42.3 acres within the HCP AA, of which 17.6 acres were considered ABM habitat pre-Hurricane Ivan. The increase in acreage of habitat impacted was due to the change in the pier location. The Lodge and Convention Center footprint were not considered habitat previously and are not considered habitat at this time due to the former development.

As documented above, development in Gulf State Park to date has resulted in a reduction of the footprint from that proposed in 2004. Using current GIS technology and estimates of impacts from implementation of the HCP to date, the project footprint within the HCP area is 41.1 acres. Of the 41.1 acre footprint, the Pier and associated parking were built on a 10.3 acre footprint. The Interpretive

Center will be built within the footprint of the Pavilion (9.2 acres). Therefore, approximately 21.6 acres remains within the HCP footprint for construction of the Lodge and Conference Center. The Lodge and Conference Center will be sited within the footprint of the former hotel and convention center site which was excluded from critical habitat.

Proximity of the action

Construction for the Lodge and Conference Center will occur on 21.6 acres and the Interpretive Center will be built within the 9.2 acre footprint of the Pavilion, all within HCP footprint for infrastructure development. The entire 41.1 acre updated HCP footprint will be under operation and management by Gulf State Park and will be analyzed for direct and indirect effects as it is adjacent to occupied habitat and critical habitat for ABM. In addition, indirect effects from the operation and management of Gulf State Park may occur throughout the HCP AA in critical habitat. Also, habitat restoration/ enhancement has occurred on (36.8 acres) within the HCP AA and an additional 50 acres of restoration/enhancement are proposed for a total of 86.8 acres enhanced for ABM within critical habitat.

Based on current GIS polygons[8] for the revised HCP footprint, we estimate less than 2 acres of the footprint appears to be within critical habitat: 0.3 acres at the Pier; 0.2 acres at the Lodge and conference facility; and 0.75 acres (0.1 acres undeveloped + 0.65 acres developed) at the Pavilion (Figures 3 and 4). Within the CH at the Pier, no activities are proposed and the undeveloped area has been restored to dune habitat. The HCP footprint was designed to avoid direct development in critical habitat. We, therefore, believe the current calculation that 0.2 acres of apparent critical habitat is contained within the proposed footprint of the Lodge and Conference Center, is a geospatial error caused by use of differing GIS tools over time and natural variability over time of beach and dune habitat. However, even if the calculation is correct, and CH is present at the eastern edge of the footprint, the proposed construction is not expected to extend into this 0.2-acre area. At the Pavilion, approximately 0.75 acres of CH appears to be designated within the footprint of the Pavilion and the proposed Interpretive Center. However, this footprint was part of the original Gulf State Park structures and did not contain PCEs and was not considered critical habitat. We believe the appearance of critical habitat in this footprint is a geospatial error caused by use of differing GIS tools over time and natural variability over time of beach and dune habitat, and does not reflect direct development of 0.75 acres of CH. Below we analyze this area as if it were designated critical habitat to err on the side of caution.

Distribution and timing of the action

The development activities may occur at any time of year. Therefore, the construction of the proposed project will occur when ABM are present or nearby since ABM currently occupy restored/enhanced habitats within the HCP AA. Although beach mice can reproduce year round, peak reproduction generally occurs in the late winter and early spring with the lowest population numbers during the summer/fall months. ABM are expected to continue to be present during operation of the proposed project as they were present during operation of the previous lodge and conference center. The ITP is valid until December 27, 2034.

[8] There are inherent errors with incorporating different GIS layers, from different sources into one project, especially when the landscape is constantly changing (like movement of dunes, accretion and erosion of beach, etc.). Therefore, all acreage measurements within this document should be considered estimates for the purposes of effects analysis, rather than actual on-the-ground impacts.

Nature and duration of the effect
Prior to any construction or maintenance, ABM will be trapped and removed from areas proposed for construction to areas of restored/enhanced habitats within Gulf State Park. The construction area will be fenced such that mice cannot reenter the area once they have been removed in order to prevent additional construction related mortality. We expect effects from capture and handling, developing a new burrow, nest, and food cache to be short-term in nature. While juvenile or newborn mice might not be able to be removed and therefore killed during the construction, we would expect relocated adults to adapt quickly and begin reproducing.

Table 3. Comparison of changes in action area, project footprint, habitat lost, habitat restoration/ enhancement, and net gain in ABM habitat through the HCP for Gulf State Park. All units are in acres*.

	HCP Footprint	**HCP area outside of Footprint**	**Total HCP AA**	**Habitat Lost****	**Habitat Improvement Proposed or Implemented**	**Net Gain in ABM Habitat**
Initial BO	44.3	137.9	182.2	11.6	14.7	+3.1
1st Amendment BO	42.3	137.9	180.2	17.6	22.7/36.8***	+19.2
2nd Amendment BO due to Early Restoration.	41.1	137.9	179.0	17.6	86.8	+69.2
Net Change due to Early Restoration Revision****	Reduced 1.2	0	Reduced 1.2	0	Increased up to 50	Increased up to 50
Total					+86.8	+69.2

* All measurements within this document should be considered estimates for the purposes of effects analysis, rather than actual on-the-ground impacts as they have been calculated using various GIS tools over time and there was considerable variation among the tools.
**Note that the individual footprints for the Pier, Pavilion, and associated parking do not equate to habitat lost (recorded in the table above from the previous analyses) because not all of the footprint was considered habitat previously and not all habitat that was within the footprint was actually lost to infrastructure.
*** HCP required 22.7 acres to mitigate for impacts to ABM. Gulf State Park actually restored 36.8 acres.
****Includes the 36.8 acres restored/enhanced under the first amendment plus up to an additional 50 acres proposed as part of the proposed Early Restoration project that is the subject of this document. The additional 50 acres are not required mitigation under the HCP and ITP but rather are proposed as part of the Early Restoration project. If the Early Restoration project is not implemented,, the additional proposed restoration/enhancement may not be implemented. The proposed infrastructure construction is still allowable under the existing ITP as the required mitigation is complete.

Following the impacts to ABM and its habitat during site preparation and construction, the construction fencing will be removed and ABM movement corridors will be established and maintained, both in an east-west direction and north-south direction. After the maintenance at existing

walkovers, sand will not be allowed to accumulate around the walkovers. This measure will prevent the need for additional maintenance so that the impact is limited to one, short-term impact only.

Approximately 36.8 acres of habitat has already been restored or enhanced for ABM on the project site. Additional dune habitat (up to 50 acres) will be restored/enhanced if the proposed project is selected and funded as an Early Restoration project. The corridors and dunes will facilitate ABM movement between old and new habitats, such that population expansion can occur and fragmentation is avoided. Properly managed ABM habitats that are interconnected are invaluable for beach mouse movements and expansion, providing greater benefit to the species than simply protecting all potential ABM habitats. Such long-term habitat management for ABM is included in the HCP and Dune Restoration and Management Plan and is expected to sustain ABM across Gulf State Park in the absence of hurricanes such that construction impacts are short-term only.

Approximately 0.3 acres of critical habitat are designed within the Pier footprint. This 0.3-acre area has been restored/enhanced and is expected to support ABM and PCEs. No other activities are proposed for this area. Though we believe the critical habitat designated within the Lodge and Conference Facility and Pavilion/Interpretative Center footprints to be a geospatial error, we have estimated the loss of this critical habitat to err on the conservative side for ABM. Approximately 0.75 acres of designated CH at the Pavilion/Interpretative Center and 0.2 acres at the Lodge Complex may be subject to permanent loss of PCEs (dune habitat with scrub vegetation) from infrastructure construction.

Disturbance frequency, intensity, and severity
Construction will be limited in frequency, intensity, and severity since mice are expected to be trapped once and released outside of the construction area. Conservation measures such as predator control, lighting and landscaping, and corridor connection are expected to minimize disturbance during operation. Reproduction of relocated mice is expected to begin within 6 months based upon previous reintroduction efforts at Gulf State Park.

No additional impacts are proposed at the pier and PCEs have been reestablished. We do not expect PCEs to reestablish within the 0.75 acres of CH at the Pavilion due to infrastructure placement. Though no impacts are expected to the eastern edge of the Lodge and Conference Facility footprint, we have assumed a loss of 0.2 acres of CH with PCEs at this location. The total acres (assuming that the area is not geo-spatial error and the area is designated critical habitat), is a small fraction (0.5%) of CH Unit 5 – Gulf State Park which is a total of 192 acres. The majority of this small fraction of habitat is between existing infrastructure between the Pavilion and the Gulf. Impacts at either the edge of the Lodge and Conference Facility footprint or at the Pavilion would not affect north-south corridors, nor would the loss of PCEs at these locations meaningfully affect east-west corridors.

Analyses for effects of the action

Beneficial effects
The amended biological opinion and ITP required 22.7 acres of habitat restoration and enhancement. This restoration/enhancement effort is complete and an additional area was restored and enhanced for a total of 36.8 acres of ABM habitat or a net benefit of 19.2 acres (Table 2). No further mitigation is required to address habitat loss and future impacts allowed under the ITP.

However, if the proposed Early Restoration project is selected, funded and implemented, it will add up to an additional 50 acres of restoration/enhancement activities for a potential total of 86.8 acres of ABM habitat. With the proposed project there will be a 69.2 acre net gain in ABM habitat (Table 2).

As a part of the habitat restoration/enhancement, north/south corridors and east/west corridors will be established across Gulf State Park. These corridors will allow for dispersal and recruitment across all of the Gulf State Park critical habitat unit and are expected to provide potential access to refugia during tropical storms and hurricanes. Restoration/enhancement activities could include establishing elevated dunes that act as refugia during severe tropical storms and potentially provide some resiliency to climate change.

Future large tropical storms or hurricanes may extirpate ABM from Gulf State Park again. However, the existing and proposed dune restoration/enhancement and management may reduce these potential effects by creating a dune system with taller dunes (i.e., better hurricane protection) and better connectivity between habitats north and south and east and west reducing the likelihood of extirpation. Also, Gulf State Park has previously demonstrated its desire to protect and recover the ABM by allowing reintroductions into Gulf State Park. If extirpation does occur, Gulf State Park would work cooperatively with the Service to help aide in its recovery goals for ABM.

New walkovers will be constructed to keep visitors out of the dune systems. These walkovers will be built such that no sand maintenance is necessary. Therefore, no uncontrolled access will be allowed in the dunes thereby protecting mice while in their burrows, and their critical habitat from erosion and loss of native vegetation.

Direct effects

The 41.1-acre 2014 HCP footprint is estimated to contain 17.6 acres of potential ABM habitat much of which has been impacted by the Pier, Pavilion, and associated parking. Impacts to suitable ABM habitat and less than 1 acre of critical habitat had and will occur from the construction of the Pavilion and proposed Interpretive Center. Little to no habitat for ABM is actually present within the footprint for the Lodge and Conference Center.

ABM may be injured, or killed, by becoming entombed or crushed in their burrows during preparation of the site for construction or maintenance. In addition, temporary impacts could occur during the use of temporary construction workspace and material storage areas, and during the installation and maintenance of underground utilities and elevated dune walkovers. The normal activities (*e.g.*, foraging, mating, burrowing and dispersal) of individual ABM may be altered by loss of habitat and the presence of construction and maintenance noise, equipment and workers, and stockpiled materials.

The number of ABM actually killed or injured cannot be accurately predicted because their density cannot accurately be determined; therefore, we estimate harm, harassment, and mortality in terms of acres potentially occupied by ABM. Of the 41.1 acre project site, we would only expect ABM to be present on approximately 17.6 acres. However, much of the 17.6 acres has already been disturbed through project implementation (i.e., Pier, Pavilion, and associated parking built under the existing ITP). Few ABM are expected within the footprint of the Lodge and Conference Center as this area supports little to no habitat. We have assumed all ABM within the 17.6 acres will be directly affected through the previous and proposed implementation of this project. Harm, harassment, or mortality can be minimized as described above through capture and relocation and sand management. The dune restoration or enhancement will be completed in such a way (e.g., vegetation planting, sand fencing, or

developing dunes in unoccupied areas) as to avoid direct affects to ABM. If avoidance isn't possible, a permitted biologist will trap and relocate the mice from the area 1 week prior to project.

The critical habitat at the Pier is not proposed for development. Through what we believe to be a geospatial error, the remainder of the HCP footprint appears to contain 0.95 acres of designated critical habitat for ABM. The apparent critical habitat at the eastern edge of the Lodge and Conference Facility Footprint is not expected to be developed as the proposed project (i.e., the developed areas are not expected to extend to the edge of the footprint) and is expected to remain intact and contiguous with the rest of the critical habitat within the HCP AA. The apparent critical habitat impacted within the Pavilion/Interpretative Center footprint does not currently possess PCEs and is generally between the Pavilion and the wet beach. This small area of critical habitat currently does not support east-west or north-south corridors. Project implementation will not change the status of this portion of critical habitat. Therefore, the Service does not anticipate that this proposed project would result in the destruction or adverse modification of designated ABM CH.

As described above, 36.8 acres of critical habitat have been restored or enhanced for a total net benefit of 19.2 acres. An additional 50 acres may be restored or enhanced. If so, the gain of critical habitat with PCEs or enhanced PCEs would be 86.8 acres (a net gain of 69.2 acres).

Indirect effects

The indirect effects of the proposed action could occur throughout Gulf State Park and include: (1) introduction of predators such as domestic/feral cats; (2) introduction of artificial lighting that could provide potential predators an advantage and disrupt normal nocturnal ABM behavior; (3) creation of favorable conditions for potential competitors (*e.g.*, house mice) through inadequate refuse management; (4) spread of invasive plant species; and (5) increased human occupancy and use of the site.

As described in detail in Appendix A, these indirect effects are known to reduce the ABM population in suitable habitats. The 2014 HCP and this amendment/revision of the biological opinion contain numerous conservation measures to avoid or minimize these negative impacts to an insignificant and discountable level. Because the HCP has been revised for the proposed project, many of these measures (e.g., new lighting technologies, corridor enhancement, walkover construction) were enhanced to the benefit of ABM.

Human use of the project site will increase. Human use can result in trampling and erosion of the dune system. Gulf State Park will install walkovers with educational signage to direct visitors to different areas while preventing uncontrolled access to the dune system.

Human use also increases the risk of increasing predators, house mice, and other invasive species. Gulf State Park will control predators and mice. The Gulf State Park will also develop a landscaping plan which will be submitted to the Service for approval. Only native plants will be used in dune restoration/enhancement activities and invasive species (e.g., cogongrass and torpedo grass) will not be included in the plan. The landscaping plan and predator/competitor control will ensure dune habitats are still able to support burrows and adequate food resources for ABM while not supporting predators or house mice.

Gulf State Park will prepare an artificial lighting plan that is submitted to the Service for approval. This plan will address direct and indirect lighting of ABM critical habitat to ensure that darkness is maintained such that ABM can conduct their normal nocturnal behaviors.

Habitat fragmentation is not considered an issue at the proposed project site, as Gulf State Park is already isolated due to development from Gulf Shores and Orange Beach. The dune management through establishment of north-south and east-west corridors may increase connectivity across Gulf State Park and allow for more sustainability during small tropical storms and hurricanes. The additional proposed dune enhancement/restoration could further improve habitat connectivity across Gulf State Park.

Interrelated and Interdependent Effects
Effects of the action under consultation are analyzed together with the effects of other activities that are interrelated to, or interdependent with, that action. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. All actions for the proposed project are evaluated under Beneficial, Direct, and Indirect Effects.

Species' response to a proposed action
Numbers of individuals/populations in the action area affected
The Gulf State Park ABM population unit is considered highly susceptible to extirpation due to hurricanes (Traylor-Holzer 2005). However, suitable habitat has recovered significantly since Hurricanes Ivan and Katrina. We anticipate the loss of 17.6 acres of suitable habitat for ABM through previous development and use (under the existing ITP) and future development and use. However, 36.8 acres of critical habitat have been restored/enhanced and an additional 50 acres have been proposed for restoration/enhancement. Mice will be trapped and relocated prior to any construction or maintenance. We expect these mice will survive and reproduce based on the success of reintroduction efforts at Gulf State Park. Conservation measures for dune management, proposed restoration/enhancement activities, and avoidance or minimization of indirect effects should limit any adverse response to short-term and temporary affects only. Attendant loss of individual ABM in the project footprint missed during trapping is not expected to have a measureable effect on the larger ABM populations in the Action Area.

Sensitivity to change
ABM populations are known to have large seasonal and annual variations, which may be influenced by available forage, competition/predation pressures, light pollution, disease, or hurricane frequencies and magnitudes. However, it is unlikely that the infrastructure development as implemented and proposed would have a measurable adverse effect on the local ABM population outside of the initial construction. Rather, the conservation measures are expected to restore or enhance surrounding interior scrub dunes, ABM movement corridors, and frontal dunes and storm refugia allowing ABM to successfully use Gulf State Park for normal behaviors during the remaining ITP timeframe (i.e., December 27, 2034).

Resilience
The ABM population was severely and adversely affected during the 2004 and 2005 hurricane seasons, primarily as a result of severe rangewide losses of frontal dune habitat due to storm surge and flooding. Nevertheless by 2008, ABM populations and frontal dune habitat rangewide were shown to have generally recovered to near pre-hurricane levels, except at Gulf State Park. Gulf State Park is isolated

from other ABM populations and natural recolonization hasn't occurred recently. However, after reintroduction, ABM have successfully recolonized Gulf State Park. Given the species' ability to recover from large temporary losses of frontal dune habitat rangewide and within Gulf State Park after reintroduction, it is unlikely that the local population would be measurably impacted by the proposed project. ABM habitats, including frontal dunes, storm refugia and movement corridors, will be managed which could provide increased resiliency across the entire Gulf State Park Critical Habitat unit. Additional habitat restoration/enhancement could occur as a result of the proposed project; thereby providing additional potential for population resiliency.

Recovery Rate

As indicated above, ABM can withstand rangewide disturbances, such as hurricanes and flooding, provided sufficient storm refugia and recoverable habitats are available, affected habitats recover quickly, populations are adequately distributed across their range, and movement corridors are maintained. The rate of recovery by this species after disturbances is dependent on several factors, such as size of potential source/refugia populations, amount and availability of suitable habitat, dune structure and vegetation recovery rate, and predation pressures. It is likely that the local ABM population will recover quickly from potential adverse effects that result from the proposed project construction because of the implementation of conservation measures.

CUMULATIVE EFFECTS

Cumulative effects include the impacts of future State, local, or private actions that are reasonably certain to occur in the Action Area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation under section 7 of the Act. The Action Area is owned by ADCNR and is unlikely to experience further development of its coastal dune system other than what is outlined in this Biological Opinion. There are nine single/duplex/multi-family lots adjacent to the HCP AA which may be developed and indirectly affect Gulf State Park. However, development of these lots will require a Section 10 permit and will take into account the existing Gulf State Park ITP prior to permit issuance.

Within the Gulf State Park Critical Habitat Unit, Alabama Department of Transportation has proposed a grade and drain project within their right-of-way adjacent to Gulf State Park, on both sides of Highway 182. This action would likely impact CH for the ABM, but its location and size is unknown at this time. Because it is adjacent to the proposed project and may occur later in time, it could be considered a cumulative effect. However, without additional information, we are unable to conduct an impact assessment of a future on-site ALDOT project at this time. Efforts will be coordinated to contain the impacts within the ROW. This future ALDOT action may have a federal nexus (Federal Highways) and be evaluated under section 7 of the ESA. There is no other State, tribal, local or private action that is reasonably certain to occur within the Action Area for this proposed project.

CONCLUSION

While hurricanes caused local ABM extirpations, and during various levels of human use and occupancy, and instances of non-wildlife friendly lighting and predators, Gulf State Park allowed for reintroductions of the species to the area and ABM have persisted. Our previous BO and amendment determined the infrastructure development at GSP would not result in jeopardy to the ABM or adversely modify or destroy critical habitat for the species. This Biological Opinion documents further reductions in the project footprint and the potential for a substantial increase of ABM habitat restoration/enhancement than previously analyzed. In addition, improved conservation measures are also anticipated to avoid or minimize impacts in and adjacent to the project footprint. Based upon

previous operation, enhanced conservation measures, and the success of translocations and reintroductions to Gulf State Park, we expect ABM to continue to survive, reproduce, forage, and disperse throughout Gulf State Park during and after project completion. None of this new information suggests that our previous conclusion should be changed. Therefore, after reviewing the current status of ABM, the environmental baseline for the Action Area, the effects of the amended proposed project, and the cumulative effects, it is the Service's biological opinion that the project, as already implemented and proposed, is not likely to jeopardize the continued existence of the ABM, and will not destroy or adversely modify ABM CH. With implementation of this proposed project, the Gulf State Park Unit of designated critical habitat for ABM will remain functional for the species. This finding is based on the Service's assessment of the Project, as summarized below:

1. Within the 41.1 acre HCP footprint, 17.6 acres of suitable ABM habitat has been or will be impacted by the footprint of the project. However, dune habitat restoration/enhancement required on 22.7 acres and expanded to 36.8 acres resulted in habitat containing PCEs and used by ABM. ABM within the project footprint would be relocated or eliminated due to the loss and/or temporary modification of 17.6 acres of habitat. This area is equivalent to less than 1% percent of the potential ABM habitat range-wide (2,450 acres). These impacted areas are primarily within previously developed locations (i.e., the Lodge and Conference Facility, the Pier and the Pavilion).

2. Approximately 36.8 acres of habitat have been restored or enhanced with PCEs for ABM within the HCP AA, a net benefit of 19.2 acres. ABM movement and connectivity between dune habitats will be maintained, as necessary, under a dune restoration program. Additional habitat enhancement and restoration is proposed and could increase PCEs on a total of 86.8 acres, representing a potential net benefit 69.2 of PCEs and critical habitat.

3. We believe that the appearance of CH within the HCP footprint is a mapping error that is confounded by differences in GIS technologies over time and differences between projections and that no designated critical habitat is actually within the HCP footprint. However, to be conservative we conducted an analysis to evaluate the loss of CH from the HCP footprint due to the proposed project. No more than 0.75 acres of designated CH would be permanently impacted by the proposed project (at the Pavilion and Interpretive Center) for construction and maintenance. While we consider this a geospatial error, we have evaluated it as a permanent loss of designated critical habitat to err on the conservative side for the species and its habitat. No development will occur in the restored 0.3 acres at the Pier or and none is expected in the 0.2 acres on the eastern edge of the Lodge and Conference Facility footprint. However, because (1) PCEs were not and are not present in the area for development, (2) overall the loss of designated critical habitat is less than 1% of the Gulf State Park Unit, and (3) a minimum of 14.1 additional acres of critical habitat (in addition to the 22.7 acres of required mitigation) have been enhanced or restored, we do not believe the project has or will adversely modify or destroy critical habitat. Additional proposed restoration/enhancement could provide an additional 50 acres with PCEs for ABM. We anticipate that the proposed walkovers, which are designed to avoid or reduce pedestrian traffic in ABM habitats, would have only temporary effects on CH because: burrows would be flagged and avoided (if necessary mice would be relocated), and walkovers are built "top down" and cause only short-term vibrations during piling installation.

4. Based on evidence at the Fort Morgan Peninsula, ABM populations persisted and, by late 2008 and 2009, appear to have rebounded at many locations despite the destruction of large portions of their habitat. It appears that the existing coastal habitats provided sufficient storm refugia to support residual ABM populations long enough for them to disperse once adjacent habitats recovered. However, even in the absence of the Lodge and Convention Center, ABM did not reoccupy Gulf State Park due to a lack of connectivity between the Park and occupied habitats. Though after reintroductions, ABM dispersed through much if not all of the suitable habitat on site. The proposed project will not decrease the current amount, distribution and/or quality of ABM habitats on site nor fragment any additional habitat. Instead, the proposed project may result in additional habitat enhancement/restoration which could increase refugia on site and possibly reduce the risk of extirpation at Gulf State Park from small and large storms. If extirpation does occur, the State would work cooperatively with the Service to help aide in its recovery goals for ABM.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or 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 behavior 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 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 updated HCP and its associated documents clearly identify anticipated impacts to affected species likely to result from the proposed taking and the measures that are necessary and appropriate to minimize those impacts. All conservation measures described in the proposed HCP, together with the terms and conditions described in any associated Implementing Agreement and any section 10(a)(1)(B) permit or permits issued with respect to the proposed HCP, are hereby incorporated by reference as a reasonable and prudent measures and terms and conditions within the Incidental Take Statement pursuant to 50 CFR §402.14(i). Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the Act to apply. If the permittee fails to adhere to these terms and conditions, the protective coverage of the 10(a)(1)(B)permit and section 7(o)(2) may lapse. The amount or extent of incidental take anticipated under the proposed HCP, associated reporting requirements, and provisions for disposition of dead or injured animals are as described in the HCP and its accompanying section 10(a)(1)(B) permit(s).

AMOUNT OR EXTENT OF TAKE ANTICIPATED

Incidental take of individual ABM is impractical to detect for the following reasons: (1) individuals are small, cryptic and nocturnal; (2) dead individuals disappear rapidly because of carrion eaters; and (3) large frequent fluctuations occur in the ABM population. However, the following level of incidental take for this species can be anticipated by the loss of ABM habitat resulting from the proposed action. If take occurs, it would likely occur on the 17.6 acres of habitat within the 41.1 acre HCP footprint

and would likely be in the form of capture, wounding, killing, harming, or harassment. Thus, the anticipated maximum level of take of ABM that could occur is 17.6 acres of habitat on a 41.1 acre project footprint. Take is anticipated for all individual ABM that may occur within the 17.6 acres of habitat on the 41.1 acre footprint, which would be disturbed. With implementation of this proposed project, the entire designated critical habitat will remain functional for the species.

EFFECT OF THE TAKE

In the accompanying BO, the Service determined that this level of expected take is not likely to result in jeopardy to the species or destruction or adverse modification of CH.

REASONABLE AND PRUDENT MEASURES

The Service believes that the proposed conservation measures identified in the 2014 HCP are adequate to minimize the adverse impacts to the ABM and mitigate for the incidental take of the ABM under section 10(a)(1)(B) of the Act with the addition of the following terms and conditions. The conservation measures are described in the HCP and summarized in the "DESCRIPTION OF PROPOSED ACTIONS" section above and are, hereby, incorporated by reference.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Service must include conditions in each ITP to constrain the permittees to comply with the following terms and conditions. These are in addition to the conservation measures described in the HCP and summarized in "DESCRIPTION OF PROPOSED ACTIONS" section above. These terms and conditions are non-discretionary.

1. The Permittee must allow the Service access to the site for ABM population and/or habitat monitoring.
2. The Permittee must monitor Incidental Take as reflected by the amount of habitat permanently and/or temporarily impacted by each component of the proposed project. The Permittee must submit seasonal and annual monitoring and trapping reports to keep the Service up to date on implementation of the conservation measures outlined in the HCP and their effectiveness.
3. Upon location of dead, injured, or sick individuals of a threatened or endangered species, initial notification must be made to the Service Law Enforcement Office, Alabama at (334) 285-9600. Additional notification must be made to the Fish and Wildlife Service Alabama Ecological Services Field Office, also located in Daphne, Alabama at (251) 441-5181. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

COORDINATION OF INCIDENTAL TAKE STEMENT WITH OTHER LAWS, REGULTATIONS, AND POLICIES

Pursuant to the Migratory Bird Treaty Act of 1918, as amended (16 U.S. C. §703-712), measures to avoid take of Migratory birds have been incorporated into the proposed HCP. Bald eagles are known to use the action area. However, the applicant has agreed to implement the recommendations for avoiding disturbance at nest sites and foraging areas within the Service's 2007 National Bald Eagle Management Guidelines; therefore, no incidental (or non-purposeful) take permit under the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S. C. §668-668d) is needed.

CONSERVATION RECOMMENDATIONS

Section 7 (a)(1) of the Act directs Federal agencies to use 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 listed species or CH, to help carry out 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. Work with others to acquire, conserve, manage and improve off-site habitat for the benefit of ABM. Such areas could also be used to develop improved techniques for restoring storm-damaged ABM habitats and enhancing unoccupied ABM habitats to expand beach mouse populations. This could include supporting research to determine if manipulating habitat within interior scrub dunes can improve ABM use, if tertiary dunes can be created or expanded to increase ABM storm refugia, or if methods can be developed to improve efforts to restore frontal/tertiary dunes that have been impacted by large storms.

2. Encourage collaboration between landowners adjacent to Gulf State Park to address and control invasive species such as Cogongrass to improve habitat connectivity.

3. Continue to serve as an Alabama Beach Mouse conservation partner and allow for mice to be reintroduced from Gulf State Park to other appropriate habitats and allow for reintroductions into Gulf State Park if mice are extirpated from hurricane events.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request. As written in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Service involvement or control over the actions has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take authorized by this BO is exceeded; (2) new information reveals effects of the Service's action that may affect listed species or designated CH in a manner or to an extent not considered in this BO; (3) the Service's action is subsequently modified in a manner that causes an effect to the listed species or designated CH not considered in this opinion; or (4) a new species is listed or CH designated that may be affected by the actions. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease until reinitiation of consultation is completed.

For this BO, the incidental take would be exceeded when the take exceeds 17.6 acres of ABM habitat or take of any ABM located outside of 41.1 acre HCP footprint which is what has been exempted from the prohibitions of Section 9 of the Act by this opinion. For further coordination, please contact the Service's AFO at (251) 441-5181.

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Appendix A

Alabama Beach Mouse

Additional Life History and Ecological Information

ALABAMA BEACH MOUSE

Species Description

The old-field mouse, *Peromyscus polionotus,* varies in form and structure, and is genetically diverse throughout its range in the southeastern United States (Bowen 1968, Selander *et al.* 1971). Currently, there are 16 recognized subspecies of old-field mice (Hall 1981), eight of which occupy coastal habitats and are referred to as "beach mice" (Howell 1921). Five subspecies are restricted to the coastal dunes and adjacent strand habitats along the Gulf Coast of Alabama and northwestern Florida (Bowen 1968). The other three subspecies (two extant and one extinct subspecies) are known from the Atlantic Coast of Florida. These semi-fossorial (live part of their lives underground) mammals are native to coastal ecosystems and burrow in the frontal and scrub dunes where the vegetation provides cover and forage, and the soils are stable and well drained.

The ABM is restricted to the sandy dune system of Alabama's Gulf coast and is considered a "habitat specialist" (Humphrey and Barbour 1981) and "early succession specialist" (http://wotan.cse.sc.edu/perobase/systematics/p_polion.htm, March 5, 2008). Howell (1909 and 1921) first described ABM as being common on white sand dunes along the Gulf coast from Little Lagoon to Perdido Bay and "seem to be most numerous in the line of dunes nearest the surf, where the cover is very sparse, consisting of stunted live oak bushes, yaupon, pokeberry, patches of "sea oats" and a few low herbaceous plants." Anderson (1960) collected 23 specimens (referred to as *P. p. albifrons*) from the Gulf Shores-Romar Beach area. Bowen (1968) reexamined the taxonomic status of this group and assigned the population from Mobile Bay to Alabama Point and Ono Island to *P. p. ammobates.* He referred to the population east of Perdido Pass beginning at Florida Point as the Perdido Key beach mouse, *P. p. trissyllepsis.*

Some studies have been conducted on beach mouse genetics. An electrophoretic study (technique used to separate particles or molecules by comparing their rates of movement through an electric field) on 30 populations of *Peromyscus polionotus*, including ABM, 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 (Selander *et al.* 1971). Wooten *et al.* (1999a) isolated five microsatellite ABM loci (non-coding nuclear gene locations) and found 6-10 times the gene diversity observed previously using any other method (Selander *et al.* 1971). Wooten and Holler (1999) examined genetic diversity of ABM through the analysis of three microsatellite loci from ABM on the Perdue Unit of the BSNWR prior to and following Hurricane Opal (1995) which showed allele diversity increasing at these three loci following the storm. This suggests that hurricanes may actually increase genetic diversity by forcing mixture of local ABM populations, offsetting the effects of genetic drift and bottlenecking (Wooten *et al.* 1999a, Wooten and Holler 1999). Hoekstra and Vignieri, pers. comm., 2006 and 2008) studied an allele coding for light pelage color that was present in Florida Gulf coast beach mouse populations, but not present in ABM, inland *P. polionotus* or Atlantic coast beach mice. Their work suggests that light coloration in Atlantic beach mice and ABM may be a form of convergent evolution coded by different alleles, indicating ABM are a distinct subspecies. Tenaglia *et al.* (2007) analyzed the genetic relationships of jointly captured ABM from an eight-year grid based mark-recapture study on the BSNWR and found that adult male/female joint captures were the least related genetically. They hypothesized that this may indicate kin recognition in the subspecies, a mechanism that reduces the effects of inbreeding in species with restricted distribution.

Preliminary results from these studies support the separation of beach mice from inland forms, and support the currently accepted taxonomy (Bowen 1968) that each beach mouse group represents a

unique and isolated subspecies (Hoekstra and Vignieri, per. comm., 2006 and 2008; ITIS 2008; Van Zant 2006). Moderate levels of genetic variation, and low dispersal rates and distances are supported in Swilling and Wooten (1998), Wooten and Holler (1999), and Van Zant (2006). Van Zant (2006) also asserts that ABM populations have clusters of similar genotypes, or genetic spatial structure, that reduces the rate of genetic decay in this species.

Range

Assessment of ABM Range and Habitat Use

A range map for the ABM was developed in 2003 which included areas that: (1) were occupied by ABM; (2) provided basic ABM requisites (*i.e.*, food, cover and burrowing substrate); and (3) protected the essential behavior patterns of the species. It also included some areas that were not suitable for ABM use at that time, but could support the species in the future or with proper management (Service 2003 and 2006c). In 2008, the ABM range map was reassessed and converted into four general habitat types using a Geographic Information System (GIS) based approach. This range map contained just over 2,500 acres of habitat, including wet beach (54 acres), frontal dunes (1,087 acres), tertiary dunes (175 acres) and interior scrub (1,190 acres) (Drew Rollman, pers. comm., April 1, 2008 GIS spreadsheet 2, and April 16, 2008 GIS spreadsheet). After subtracting 54 acres of wet beach (usually avoided by ABM) and two recent ITPs (with footprints totaling 7.1 acres) issued by the Service to Caldwell Commercial Center and Batch IV Single-family Residences, the Service currently estimates that about 2,450 acres of habitat are potentially available to the ABM.

Beach mouse populations are subject to large, sometimes unpredictable spatial and temporal fluctuations due to a variety of factors including tropical storms, breeding success and survival rates, seasonal forage, predation/competition pressures, habitat succession, disease, and other factors that are poorly understood (Hill 1989, Rave and Holler 1992, Holler, *et al.* 1997, Swilling *et al.* 1998, Sneckenberger 2001). Most previous trapping efforts were conducted to determine the presence or absence of beach mice, or to use an accepted methodology (*e.g.*, CAPTURE Program) (Otis *et. al* 1978) in estimating the number or relative abundance of beach mice occupying a particular location and point in time (Meyers 1983; Holliman 1983; Humphrey and Barbour 1981; Holler *et al.* 1989; Holler and Rave 1991; Rave and Holler 1992; Swilling *et al.* 1998; Wooten *et al.* 1999b; Sneckenberger 2001; Service 2006c, 2008a and 2009c). Some efforts to develop estimates of total beach mouse populations have been attempted by researchers and the Service (Oli *et al.* 2001; Traylor-Holzer 2005; Traylor-Holzer *et al.* 2005; Reed and Traylor-Holzer 2006; Service 2008a). However, these estimates of total population size have not been considered reliable, primarily because of: (1) frequent large fluctuations in ABM subpopulations; (2) inconsistent use of sampling methodologies; (3) limited access/data gaps on private property; and (4) variable detection probabilities caused by environmental factors (*e.g.*, weather, moon phase, season and forage availability) and ABM behavior (Wilcox 2001, Conroy and Runge 2008, Service 2009c).

Consequently, this lack of reliability or confidence in past estimates of ABM population size, combined with the impracticality of sampling a large area (2,450 acres) with sufficient frequency and intensity to capture seasonal/annual population fluctuations in a timely manner, are the prime reasons the Service does not rely on overall population data as a basis for ensuring the continued survival and recovery of the ABM. However, the Service does consider ABM surveys to be useful in determining presence/absence and in revealing possible population trends. Therefore, the Service believes that, from a species protection and management perspective, a reasonable alternative to measuring ABM

population size (or numbers affected by an action) would be to relate the amount, type and value of potentially available ABM habitat that would be impacted by an action to ABM survival and recovery.

After Hurricanes Ivan and Katrina in 2004 and 2005, ABM numbers and distribution were reduced as a result of the loss of 90-95 percent of the frontal dunes, as well as from additional flooding and salt-burned vegetation in tertiary dune and interior scrub habitats within its range (Service 2004a, 2005, 2006c and 2009c). Beach mouse survey data on the Perdue Unit of BSNWR and seven HCP locations (Laguna Key, Martinique, Plantation Palms, Kiva Dunes, The Dunes, Beach Club and Bay to Breakers) between 2004 and 2010 (Table 1) generally show dramatic declines in ABM capture rates immediately after the hurricanes with rising ABM capture rates generally by 2007-2008 and no mice were detected on GSP (Service 2006c, 2009c and 2010, Service files). Today, most coastal habitats damaged by these hurricanes are recovering on public lands and/or private property where restoration activities were carried out, although dune recovery in some developed areas is lagging where active dune restoration is not required (AECOM 2009a and b; Service 2009c and 2010). Similarly, the ABM metapopulation appears to be recovering as evinced by increased ABM captures during recent trapping efforts (Service 2006c, 2009c and 2010). However, ABM were not able to successfully recolonize GSP on their own due to isolation of GSP from other occupied habitats. Therefore, ABM were reintroduced to GSP in 2010 (Service 2013). Based on the best available information, it is likely that the ABM currently occupies nearly all areas it had before Hurricanes Ivan and Katrina, with the possible exception of single-family residences where dune restoration efforts and ABM distribution data are often lacking. The single-family residential area (677 acres) covers about 28 percent of the ABM's range (2,450 acres) (Trayler-Holzer *et al.* 2005). In recognition of the lack of habitat restoration efforts on private property, the Service assisted in ABM habitat recovery on private lands through beach dune revegetation partnerships. These consisted of cost-share dune restoration projects on private lands in cooperation with local schools and the Baldwin County Soil and Water Conservation District that focused on dune revegetation and artificial lighting workshops for private landowners (Service 2009b).

During a Structured Decision Making process, the Service team reviewed the best available information in assessing the risk associated with permitting the construction of an earlier version of this Project (Service 2008b). Part of that assessment included a reevaluation of the habitats used by the ABM and their relative importance in supporting the life requisites of this species. That information, which was pivotal in reaching a final team decision, is summarized in Service files.

After reviewing all available information on ABM habitat use and distribution contained in published and unpublished literature, trapping data, listing and CH rules, current range map/aerial photography, expert opinions and personal observations, the SDM team reached the conclusion that not all areas identified as suitable ABM habitat are of equal value to the species, and that ABM use of various habitat types may change over time (*e.g.*, season, predation and competition pressures, population densities, and weather conditions).

Table 1. ABM survey data from 2004 to 2013 from seven HCP sites and Perdue Unit of the Bon Secour National Wildlife Refuge, Baldwin County, Alabama (derived from Service 2006c, 2009c and 2010; Service files).

Site	2004 Sp/F/S	2005 Sp/F/S	2006 Sp/F/S	2007 Sp/F/S	2008 Sp/F/S	2009 Sp/F/S	2010 Sp/F/S	2011 Sp/F/S	2012 Sp/F/S	2013 Sp/F/S
Laguna Key										
# traps	200/150	150	200	ND	164/192	200	200	200	200	200
#. Individual ABM	27/5/14	0/0/0	0/0/0	ND 0 (W)	20/11/6 (W)	36/19/9 (W)	4/ND/ND	7/2/0(W)	7/2/0 (W)	7/0/4 (W)
Martinique										
# traps	230	230	210/200	200/187/166	180/180/120	180/180/180	180	200	200	200
#. Individual ABM	59/ 6/ 29	13/ 2/ 8	17/11/ 8	39/11/45	48/ND/37	80/17/40	ND/8/ND	13/9/16/	11/6/20	17/23/41
Beach Club										
# traps	450	334	334	334/194/334	240	240	240	200	200	200
#. Individual ABM	148/6 /35	11/4/3	8/0/7	10/5/7	16/11/25	ND/21/32	26/ND/10	14/5/4	9/1/3	7/6/12
Plantation Palms										
# traps	200	200/100	120	160	120	140/100/120	ND	100	100	100
#. Individual ABM	27/1/4	1/0/0	3/6/ND	6/ND/11	ND/ND/11	35/1/3	ND	3/4/3	4/0/0	6/3/2
Kiva Dunes										
# traps	100	300	100	100	100	100	100	100	100	100
#. Individual ABM	ND/ND/32	ND/ND/0	ND/2/ND	6/ND/11	17/3/ND	21/8/ND	21/18/ND	28/17/12 (W)	28/ND/16(W)	15/3/8(W)
Bay to Breakers										
# traps	242	242	100/200	180/200	160	160	150	100	100	100/50/50
#. Individual ABM	25/0 /ND	0/0/ND	1/0/0	13/16/9	ND/12/ND	0/19/13	ND/ND/3	3/6/ND	3/0/ND	2/3/2

The Dunes										
# traps	240	240	200	140/160	180	180	180	180	180	180
#. Individual ABM	53/1 /ND	0/ND /ND	9/ND/ 4	6/13/8	29/ND/17	30/5/19	ND/ND /13	33/ND/10/	9/2/7	16/1/4
BSNWR										
# traps	180	180	~140(dune)	180(dune) 128 (scrub)	178(dune) 126 (scrub)	200(dune) 124 (scrub)	600	600	600	600
#. Individual ABM	64 (70)/4 /ND (MSW and Gazebo sites)	57/ ND /ND (MSW and Gazebo sites)	3/ 14/ ND (MSW and Gazebo)	2/ND/ND 3/ND/ND (random sites)	68/20/ND 9/ND/ND (random sites)	101/22 /ND 146/22 /ND (random sites)	584 Sp/F Total Captures	353 Sp/F Total Captures	178Sp/F Total Captures	82 Sp/F Total Captures
Legend: ND = no data Sp = spring F = fall S= summer W = winter										

In general, the ABM's preferred habitat under normal (non-hurricane) conditions appears to be the frontal and tertiary dunes, and the more open portions of the interior scrub adjacent to the tertiary dunes and along Hwy 180 ROW which provide its basic life requisites (food, cover, burrowing substrate) (Service 2006b). During and immediately after hurricanes, ABM appear to concentrate on tertiary dunes and other higher elevation refugia that are not inundated by storm surge or torrential rainfall (Swilling 2000, Sneckenberger 2001 and 2006). Based on the best available data, this habitat is important for the long-term conservation of ABM because, after the loss of frontal dunes from large storms, it contains most of the source populations for ABM to recolonize recovering dune habitats.

The ability of storm refugia to dampen genetic bottlenecks and speed recolonization after stochastic storm events is dependent on the sizes of these refugia and their locations in relation to other essential ABM habitats (*i.e.*, contiguous matrix of frontal/tertiary dunes and open interior scrub). Interior scrub occupies most of the habitat within the ABM's range, but ABM seem to be either absent (particularly if the vegetation is thick with dense leaf litter, closed canopy cover, and little open sand) or in lower densities (if close to frontal dunes, or if vegetation is more open with exposed loose sand areas), even after hurricanes. Decreased habitat suitability (*e.g.*, dense vegetation, shallow water table, and/or compacted or poorly drained soils) along with increased predation (*e.g.*, owls, foxes, snakes) and competition (*e.g.*, cotton mice/rats) pressures are likely reasons why the interior scrub generally seems to support fewer ABM than the frontal and tertiary dunes. However, interior scrub may have some value to ABM by providing: (1) dispersal connections between suitable habitat patches across its range; (2) forage areas during poor food production on the frontal/tertiary dunes; (3) additional habitat for ABM to occupy as population densities approach carrying capacity on frontal/tertiary dunes; and (4) potential future habitat if its climax vegetative communities are "set back" by fire, storms or other perturbations (Service 2009b and c).

Listing History and Revised Critical Habitat

The ABM was listed as endangered under the ESA in 1985. At that time, 1,038 acres of CH were designated for this subspecies that extended along 10.6 miles of Baldwin County coastline between Fort Morgan State Historic Site (FMSHS) and Gulf State Park (GSP) (Service 1985). "Critical habitat" is defined as: (1) specific areas within the geographical area occupied by a species, at the time of listing, that contain physical or biological features essential to the conservation of the species, and that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by a species at the time of listing that have been determined to be essential for the conservation of the species.

In 2006, the Service proposed the revision of designated CH for this subspecies (Service 2006a and b). A final rule revising designated CH was published on January 30, 2007 (72 FR 19: 4329-4369) which expanded designated CH within the ABM's range. The Service determined that 2,281 acres of ABM habitat remaining within the species range were occupied by ABM during or subsequent to its listing under the ESA and are essential to the conservation of this subspecies. Of this essential ABM habitat, the Service identified 1,211 acres that met the standard for CH (Service 2007).

A Primary Constituent Element (PCE) is a physical and biological feature which is considered essential to the conservation of the subspecies. The Service identified the following PCEs in the revised CH for the ABM:

1. Continuous mosaic of primary, secondary and scrub (*i.e.*, interconnected frontal and tertiary dunes, and interior scrub) vegetation and dune structure, with a balanced level of competition and few or no competitive or predaceous nonnative species present, that collectively provide foraging opportunities, cover and burrow sites;
2. Frontal 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 (*i.e.*, tertiary dune/suitable interior scrub) dunes, generally dominated by scrub oaks (*Quercus* spp.), 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. Unobstructed habitat connections that facilitate genetic exchange, dispersal, natural exploratory movements, and recolonization of locally extirpated areas,
5. 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.

The revised CH for the ABM consists of the following five units:

1. Unit 1 – 446 acres in the Fort Morgan State Historic Site and private lands to the east. It is located at the western edge of the ABM range, and consists principally of habitat that was known to be occupied at the time of listing (Service 1985, Holliman 1983) south of Hwy 180 (Fort Morgan Parkway). This unit contains all five PCEs. Threats in this unit include human generated refuse, feral cats, degraded habitat from activities associated with recreational use, and storm events (*e.g.*, loss of dune topography and vegetation, habitat fragmentation).
2. Unit 2 – 268 acres including east-to-west bands of ABM habitat and connections between habitats south of the Alabama Department of Environmental Management's Coastal Construction Control Line (CCCL) and along the roadway right-of-way for Fort Morgan Parkway. This unit, which can be inundated during storm events (Service 2004a, ENSR 2004), represents the last remaining natural habitat connecting ABM populations in-Units 1 and 3. This unit contains three PCEs (numbers 2-4). Threats include feral cats, artificial lighting, development, and storm events (*e.g.*, loss of dune topography and vegetation, habitat fragmentation).
3. Unit 3 – 275 acres in the central portion of the Fort Morgan Peninsula. It includes portions of the Morgantown, Surfside Shores, Cabana Beach subdivisions, and the proposed Project, as well as Bureau of Land Management properties and some areas along the Fort Morgan Parkway right-of-way (ROW). All five PCEs are present in varying amounts throughout this unit. Threats include habitat degradation and fragmentation, extensive recreational pressure, feral cats, post storm-cleanups, artificial lighting, predation, human-generated refuse, and storm events (*e.g.*, loss of dune topography and vegetation, habitat fragmentation).

4. Unit 4 – 30 acres including a Bureau of Land Management parcel and 27 private in-holdings within the Perdue Unit. This unit contains all five PCEs. Threats may include artificial lighting from residences, human-generated refuse that may attract predators, feral cats, habitat fragmentation from the construction of properties, and storm events (*e.g.*, loss of dune topography and vegetation, habitat fragmentation).
5. Unit 5 –192 acres in Gulf State Park, immediately east of the City of Gulf Shores and west of the City of Orange Beach. It represents the last remaining large block of ABM habitat on the eastern portion of the ABM's historic range. This unit contains two PCEs (numbers 2 and 3). Threats to ABM habitat include habitat destruction from recreational use, human-generated refuse that could attract predators, feral cats, artificial lighting, and storm events (*e.g.*, loss of dune topography and vegetation, habitat fragmentation).

Life History

ABM Habitat Distribution and Requirements

Subsequent ABM research (Swilling *et al.* 1998, Swilling 2000, Lynn 2000, Sneckenberger 2001) and distribution data (Service 2006b, 2009b and c) have refined improved our knowledge of what constitutes suitable beach mouse habitat requirements and those factors that influence their habitat use.

In general, suitable ABM habitat provides at least one of the following requisites as described below:

1) Burrowing sites – Burrows are required by beach mice to provide protection from predators, intense heat, and other harsh environmental conditions, as well as refuge for activities such as birthing, resting and caching of food items. The presence of potential burrow sites may be a limiting factor in the availability of ABM habitat. ABM prefer to burrow on the slopes of dunes and in areas with greater vegetative cover, less soil compaction, and higher elevation sites relative to sea level (Lynn 2000, Swilling 2000, Sneckenberger 2001, Service 2006b).
2) Cover – Cover is described as an area that would provide protection from predators during ABM nocturnal activities, but would not necessarily be used for foraging or burrowing (Swilling 2000, Smith 2003, Service 2006b).
3) Foraging areas – Foraging areas provide food sources, which are generally seasonal and dependant on rainfall and storm patterns during any given year (Swilling 2000, Service 2006b). In addition, ABM are opportunistic omnivores (*i.e.*, use whatever food items are available at the time) and typically consume insects, seeds and acorns. Insects (particularly beetles) appear to make up a substantial portion of their diet during the summer season (Moyers 1996).

Although some researchers have indicated that beach mice are restricted to or prefer frontal dunes (Ivey 1949, Blair 1951, Pournelle and Barrington 1953, Bowen 1968), early observations (Howell 1909 and 1921) suggested ABM also occur in open coastal scrub (*i.e.*, tertiary dunes and open interior scrub). Recent research has shown that coastal scrub serves an invaluable role in the persistence of beach mouse populations (Meyers 1983, Swilling *et al.* 1998, Sneckenberger 2001). ABM have been observed moving 300-500 ft inland from the primary dunes to use food

sources in the scrub (*i.e.*, tertiary dunes and open interior scrub) (Swilling *et al.* 1998, Sneckenberger, pers. com., 2006). Studies have shown that beach mice occupy open scrub dunes and no differences in body mass, home range size, dispersal, reproduction, survival, food quality and burrow site availability can be detected between beach mice at the southern edge of the scrub (*i.e.*, tertiary dunes) and those occupying the frontal dunes (Swilling *et al.* 1998, Swilling 2000, Sneckenberger 2001).

In south Baldwin County, coastal ridge and swale habitats remain in the Fort Morgan area, the eastern half of the Peninsula from Morgantown to Laguna Key, and at the GSP. A number of terms have been used in beach mouse literature to identify various zones within this Gulf coast dune system, including primary dune, secondary dune, frontal dune, interdunal swale, escarpment/adjacent scrub, interior scrub dune and scrub dune.

In an effort to simplify ABM habitat types, we developed an ABM habitat map which delineates four cover types: wet beach, frontal dunes, tertiary dunes and scrub (*i.e.*, interior scrub) dunes. Wet beaches are not used by ABM and are not considered ABM habitat in this document.

Frontal (*i.e.*, primary and secondary) dunes are well described in the literature (Ivey 1949, Blair 1951, Pournelle and Barrington 1953, Bowen 1968, Holliman 1983, Swilling *et al.* 1996 and 1998, Lynn 2000, Sneckenberger 2001) and are characterized by sea oats and other grasses, beach morning glory (*Ipomoea imperati*), railroad vine (*I. pes-caprae*), woody goldenrod, and false rosemary). In some literature, tertiary dunes are considered part of the older east-west dune ridges within "scrub" habitat along south Baldwin County, while others identify it separately as "escarpment" and/or "adjacent scrub" (SARPC 2001, Neal and Crowder 2006, Service 2006c and d).

Tertiary dunes, when present, occur at the interface between frontal and interior scrub dunes and are characteristically the highest dunal ridges (about 11 to >25 ft above MSL) in this system. Vegetation is relatively sparse along its steep southern exposure, but is patchier along its ridgeline and becomes denser along its northern slope which is generally dominated by scrub oaks, yaupon holly, sand pine, and other woody vegetation. Between Morgantown and Laguna Key, they form a more or less continuous line with elevations up to 20 ft or more (SARPC 2001).

Interior scrub dunes are further inland from the tertiary dunes and may include east-west ridges of dense sand live oak/sand pine canopy alternating with interdunal swales containing seasonally or perennially inundated wetlands. Often, these dunes have overstory and/or dense vegetation, contain thick groundcover or leaf litter, and occasionally alternating ridges and swale wetlands.

At the time the ABM was listed under the ESA, habitat use by ABM was thought to be limited generally to frontal dune systems. Since that time, our knowledge of the various coastal habitats used by ABM has expanded greatly. Published literature, reports, trapping data, and field observations indicate that ABM use different habitat types within the coastal dune system (Appendix D). Research indicates that habitat may be a limiting factor for ABM following periods of population increases or catastrophic weather events such as tropical storms (Swilling *et al.* 1996, Swilling *et al.* 1998, Lynn 2000, Sneckenberger 2001).

As indicated earlier, these data suggest a gradient of habitat use by ABM which is generally weighted more toward frontal/tertiary dunes, although they have been found in relatively open interior scrub habitat (*e.g.*, east end of Perdue Unit of BSNWR and along Highway 180 ROW). Furthermore, the species tends to avoid dense interior scrub, frequently flooded wetlands, and wet beach habitats. When frontal dunes are destroyed during hurricanes due to storm surges and flooding, ABMs appear to persist in areas of higher elevated habitats, particularly tertiary dunes. Subsequently, ABM recolonize adjacent frontal dunes after this habitat begins to recover, which may take several years. Interior scrub habitat may not be as suitable for ABM for a number of reasons, including a lack of suitable substrate, frequent presence of dense vegetation/ground cover/leaf litter, increased competition with other rodents more suited to interior habitats, increased predation pressures, prevalence of wetlands and maritime forest, and a tendency for much of the interior scrub to flood during heavy rain events, as occurred in April 2005 (Service 2005, 2009b and c).

While seasonally abundant, the availability of food resources in the primary and secondary (frontal) dunes fluctuates (Sneckenberger 2001). In contrast, tertiary and interior scrub habitats provide a more stable level of food resources, which become crucial when food is scarce or nonexistent in the frontal dunes. In addition to providing burrow sites, food resources, and cover, tertiary dune/interior scrub habitats can serve as higher elevation refugia during storm events and as population sources for recovering storm-impacted frontal dunes (Swilling *et al.* 1998, Sneckenberger 2001). This suggests that connections between frontal/tertiary dune and interior scrub habitats are also essential to individual beach mice. The transition from scrub habitat to maritime forest (characterized by large pines and oaks, thick leaf litter, and dense understory) or perennially inundated wetlands frequently identifies the northern or landward extent of the majority of suitable beach mouse habitat. Extremely overgrown or densely vegetated areas are also unsuitable for the ABM due to the potential for high predation rates, poor burrowing substrate, and competition with other rodent species (Swilling 2000, Sneckenberger 2001).

Hurricanes can strongly affect beach mice populations and their habitat by eliminating frontal dunes and sometimes tertiary/interior scrub dunes during tidal surge, wave over-wash and high winds (Holliman 1983, Rave and Holler 1992, Swilling *et al.* 1998, Service 2004a and b, 2005). Surviving beach mouse populations often must depend on higher elevation tertiary/interior scrub habitat which provides most of the remaining food resources and potential burrow sites until frontal dune topography and vegetation can recover (Holler and Rave 1991, Swilling *et al.* 1998, Lynn 2000, Sneckenberger 2001). In addition to reducing the risk of species extirpation by providing refuge habitat during and after storm events, tertiary dunes/interior scrub also allow for population expansion into other more suitable habitats (Holliman 1983, Swilling *et al.* 1998, Lynn 2000) and may contribute to the preservation of ABM genetic variation (Wooten 2007).

Dune recovery times vary depending upon factors such as hurricane characteristics (*i.e.*, frequency, severity, amount of associated rain, directional movement of the storm eye, storm speed), succession stage of habitat prior to hurricane, dune elevation, and community efforts to rehabilitate dune systems. Depending on these factors, recovery of habitat may take from three to 20 years (Salmon *et al.* 1982). Johnson (1997) reviewed aerial photography and maps of the Shell-Crooked Island barrier system east of Panama City Florida, and estimated that it could take

as long as 2-17 years for frontal dunes and as much as 19-52 years for tertiary/interior scrub dunes to re-establish following hurricanes. While storms temporarily reduce population densities (often severely), this disturbance regime also maintains open habitat and retards plant succession, yielding habitats that are more suitable for beach mice than those lacking periodic disturbance over the long term (Service 2006d).

Using Blair's (1951) ABM density estimates, Meyers (1983) hypothesized that a minimum 124 acres of "optimal" ABM habitat would be needed to maintain an ABM population of 100 to 150 individuals, plus natural corridors (*i.e.*, habitat connections) for migration between populations. He believed beach mouse habitat preserves should be at least 247-494 acres and protection of several separate habitat areas was needed for long-term survival. Additional research to determine the minimum area necessary for sustaining this species has not been carried out since Meyers' work in 1983. However, it is clear from the examination of unpublished reports and anecdotal information that ABM cannot survive within isolated habitat areas without sufficient storm refugia. For instance, the ABM population on GSP (which has only about 9 acres of tertiary dunes available to ABM) was thriving on about 192 acres between 1998 and 2004 until Hurricanes Ivan/Katrina over-washed the area and eliminated this population (Service 2007, Service files).

Age/sex structure

Age structure is the proportion of individuals in different age groups and can be used to illustrate how a population might change in the future. Hill (1989) demonstrated that 87 percent of the ABM throughout her study (September 1987 - September 1988) lived four months or less beyond first capture. Hill (1989) found only five ABM (0.8 percent) lived at least 12 months or longer. Beach mice along the Gulf Coast of Florida and Alabama generally have a lifespan of about nine months, but may live as long as 20 months (Swilling 2000, Blair 1951, Rave and Holler 1992). Holler *et al.* (1997) found that about half of the beach mice captured for the first time survived into the following season. Mice held in captivity by Blair (1951), and in later studies at Auburn University, have lived three years or more. Population turnover, as estimated by survival rates, is high and typical of microtine rodents. In general, the majority of individuals in an ABM population are replaced with new individuals within a 10 to 12-month period (Hill 1989, Rave and Holler 1992). ABM subadults are most abundant during winter and least abundant during summer (Blair 1951, Hill 1989, Holler and Rave 1991).

Reproductive Strategies

Smith (1966), Foltz (1981) and Lynn (2000) have found evidence that *P. polionotus* are generally monogamous; however, paired males may produce extra litters with unpaired females. Male and female beach mice are capable of breeding at an age of 25 and 35 days respectively. Gestation averages 24 days and litter sizes average three to four with extremes of one and eight individuals. Littering intervals may be as short as 26 days with the peak breeding season in autumn and winter. Mature female beach mice can produce a litter every month and may live long enough to breed over a period of about eight months, potentially producing an average of 24 to 32 young each year.

ABM populations are usually greater in winter and spring, reflecting seasonal differences in breeding activity and reproductive success; in contrast to the summer when the population levels

and reproductive success are generally lower (Rave and Holler 1992). For example, the proportion of captured females exhibiting reproductive activity (lactating or pregnant) is lowest during summer and greatest in winter. Likewise, the number of subadult ABM captured is greater in winter and lower in summer months. Survival of newborn offspring and recruitment of subadults appear to increase in autumn and winter when food resources are more abundant (Rave and Holler 1992).

Recruitment and Dispersal

As densities increase, sub-adult ABM are forced to disperse into adjacent habitats. However, Swilling and Wooten (2002) found that habitat type (tertiary vs. frontal dunes) does not appear to be a factor in habitat selection by dispersing subadults. Dispersal is a natural and genetically programmed adaptation that avoids inbreeding or resource competition with family members, locates mates (Frankel and Soulé 1998), and perhaps other reasons. Although Swilling (2000) documented ABM movement up to 0.87 mile, mean dispersal distances are 529 ft $\pm$ 858 ft (0.1 $\pm$ 0.26 mile), significantly less than for *P. polionotus* (Smith 1968, Swilling and Wooten 2002). Swilling's (2000) study also indicated that adults may share home ranges with subadults. Because population density, reproduction and survival for ABM are simultaneously at seasonal highs during the fall/winter months, many subadults appear to be recruited into the adult population rather than disperse to adjacent habitats (Swilling and Wooten 2002). They concluded that ABM form family groups in patches of high quality habitat where home range overlap was generally tolerated.

Subadult males and females did not differ significantly in the likelihood of dispersal, dispersal distance, or the size of mean home range (an estimated 224 feet in diameter) (Swilling and Wooten 2002). Data also indicated that mice remaining within their natal (birth) site areas have smaller home ranges than those that disperse. Swilling and Wooten (2002) found that 55 percent of the recaptured subadults remained within their natal sites, however, these individuals survived for a shorter duration than those that dispersed. Increased predation is offered as a possible explanation (*e.g.*, predators may have focused on areas of high ABM density).

Food Habits

Beach mice are nocturnal (active at night) and forage for food throughout the dune system. They are opportunistic omnivores that exploit a variety of available resources, feeding on seeds and fruits of coastal dune plants, such as bluestem *(Schizachyrium maritimum)*, sea oats *(Uniola paniculata),* gopher apple (*Licania michauxii*), and evening primrose *(Oenothera humifusa).* However, insects are also an important component of their diet. In most cases, seeds and fruits consumed by beach mice are either produced by low-growing, prostrate plants, or become available as fallen seeds (Moyers 1996).

Data on possible seasonal use of food by beach mice have come from two relatively recent studies (Moyers 1996, Sneckenberger 2001). These studies indicated that various habitats provide a variety of food types throughout the year and that some ABM exploit these food differences. ABM inhabiting the primary/secondary (*i.e.*, frontal) dunes undergo feast (fall and winter) and famine periods (spring and summer) with respect to available food resources. In contrast, tertiary dune and nearby interior scrub habitats appear to maintain a more stable, though patchy, level of potential food resources throughout the year (Sneckenberger 2001). Weather

conditions and other factors may also influence food availability, both temporally and spatially. Bird *et al.* (2004) determined that the use of foraging areas by beach mice was negatively affected by the presence of illumination, type of lighting, and distance from light source. Predation risks, which also may be increased by artificial lighting (Bird 2003), play a role in beach mice foraging patterns (Sneckenberger 2001).

Shorter foraging distances may result in energy conservation (Pyke 1983). Foraging behavior is determined by both food quality and quantity. During winter and spring 1999-2000 at the Perdue Unit, ABM inhabiting frontal dunes traveled an average of 80-83 feet from their burrow, whereas ABM inhabiting the tertiary dunes traveled an average of 141-143 feet from their burrow (Sneckenberger 2001). In the fall of 1999, ABM inhabiting the tertiary dunes traveled shorter distances than those in the frontal dunes on average; a reversed trend was noted during the following winter and spring.

Nutritional analysis of ABM foods indicated that plant species in both frontal and tertiary dune habitats provide a similar range of nutritional quality. Sneckenberger (2001) showed that protein content ranged from 7.8 to 32.6 percent in the frontal dunes and from 2.8 to 40 percent in the tertiary dunes. *Spartina*, bluestem, panic grass, and sea oats were the most common plants used by ABM inhabiting the frontal dunes. ABM in tertiary dune habitat used sand live oak, bluestem, greenbrier, gopher apple, and jointweed (Sneckenberger 2001). Sea oats and bluestem are believed to be of high nutritional quality (Moyers 1996) and are likely important dietary components during the primary reproductive season (Rave and Holler 1992).

Population Dynamics

Population dynamics include the factors that contribute to the growth or decline of a population, including birth and death (especially juvenile and adult survivorship), as well as immigration and emigration rates (Pulliam and Dunning 1997). Demographic factors, such as sex ratios of adults and age-class structure of the population, are important considerations because they contribute to birth and mortality rates.

Population Size and Variability

The ABM life cycle consists essentially of four life-stage events: (1) newborns (birth to weaning); (2) weaned juveniles (weaned to 22 days); (3) subadults (22–45 days); and (4) adults. ABM populations have a life-stage structure a number of individuals in each stage at any particular time. Adult survivorship and reproductive recruitment will account for population change if ABM do not emigrate from or immigrate to the population. If this "closed population" condition exists, then population growth occurs when births (or recruitment of young ABM into the population) exceed deaths. Field studies of two ABM populations have provided long-term data on population dynamics (Hill 1989, Holler and Rave 1991, Rave and Holler 1992, Holler and Moyers 1994).

Generally, populations of beach mice reach peak numbers between late autumn and early spring (Rave and Holler 1992, Holler *et al.* 1997). Studies have indicated that there are monthly, seasonal and annual variations in the size of individual populations (Hill 1989, Rave and Holler 1992, Holler *et al.* 1997, Swilling *et al.* 1998, Sneckenberger 2001). These fluctuations can be a result of reproduction rates, food availability, habitat quality and quantity, catastrophic events

(*e.g.*, hurricanes, drought or disease), and/or predation (Blair 1951, Bowen 1968, Smith 1971, Hill 1989, Rave and Holler 1992, Swilling *et al.* 1998, Swilling 2000).

ABM populations can also be affected by large storms and hurricanes. The GSP subpopulation is separated from the main Fort Morgan Peninsula population to the west by urban development in Gulf Shores. This small isolated population was extirpated in 2004-2005 after Hurricanes Ivan and Katrina (Farris 2004 and 2005, Service 2004a and 2005, Volkert 2005). This local ABM population had also been extirpated in the early 1980s as a result of habitat isolation/fragmentation, tropical storms, feral cat predation, and/or competition with house mice (Holliman 1983, Service 1985, Holler and Rave 1991), but was successfully reintroduced back into the GSP in 1998 (Service 2007). An effort to reestablish ABM on GSP was initiated by Service and GSP personnel in the spring of 2010 with the translocation of 22 ABM from Fort Morgan and Perdue Units of the BSNWR. In October and November of 2010, ABM were recaptured, and unmarked mice were found; indicating new recruitment into the reintroduced population (Service 2013). Mice continued to be captured during survey events in 2012 and 2013 and reoccupy all available habitats on both sides of Highway 182 (Service 2013).

PVA Analyses

Population viability analyses (PVAs) (Shaffer 1981, Woodruff 1989) and population and habitat viability analyses (PHVAs) (Lacy 1993) are quantitative models designed for the purpose of assessing extinction risks or population status for a given species (Morris and Doak 2002). Most authors agree that they are valuable tools for comparing various management scenarios and identifying data gaps and risk factors (Ellner *et al.* 2002, Brook *et al.* 2002, Morris and Doak 2002). However, estimates of extinction probabilities derived from PVAs/PVHAs should be interpreted with caution and full acceptance of model caveats (Brook *et al.* 2002, Morris *et al.* 1999, Morris and Doak 2002).

The Service has examined various PVAs in an effort to gain a better understanding of ABM population dynamics, to determine the relative impact of various management scenarios, and to address questions regarding size and long-term viability of ABM populations. However, initial model attempts (Sankaran 1993) did not have the benefit of key demographic information that is now available. A PVA developed by Oli *et al.* (2001), considered the life history of ABM but did not adequately consider the highly stochastic nature of the environment or the effects of various intensity hurricane impacts.

Beginning in 2004, three PVAs were conducted by the Conservation Breeding Specialist Group (CBSG) under Service contract. CBSG divided the ABM range into six Vortex modeling areas or units. Their modeling efforts suggested that: (1) smaller populations, particularly those that are isolated and lacking higher elevation habitat (such as Gulf State Park), tend to be extirpated rapidly; (2) habitat connectivity is important for long-term ABM conservation; (3) invasive species (*e.g.*, cogon grass and domestic cats) can have significant effects on the long-term existence of the ABM; (4) hurricanes have the greatest effect on ABM population dynamics; and (5) habitat restoration following hurricanes may lead to a small but measurable increase in ABM viability over time under some conditions (Traylor-Holzer *et al.* 2005, Traylor-Holzer 2005, Reed and Traylor-Holzer 2006).

ABM probabilities of extinction derived from the last of CBSG's modelling efforts were 26.8 percent (baseline), 41.2 percent (if connectivity between model units is lost) and 46.8 percent (if the metapopulation is confined to public lands) over a 100-year period. However, these extinction probabilities are sensitive to various model assumptions, particularly dispersal rate, carrying capacity, hurricane impacts, and demographic parameters. Consequently, they should be viewed with caution and careful consideration of their uncertainty and consequences to species management. Rather than placing importance on the exact, quantitative value of the ABM's long term survival, the models should be viewed as providing a more qualitative assessment of the species wellbeing and the relative behaviour of individual populations (Traylor-Holzer *et al.* 2005, Traylor-Holzer 2005, Reed and Traylor-Holzer 2006).

The Service contracted Conroy and Runge (2007) to review and critique earlier PVAs on ABM (*e.g.*, Oli *et al.* 2001 and Traylor-Holzer *et al.* 2005). They concluded that past estimates of extinction probability were not reliable because input and output uncertainties were not properly addressed. They also conducted a PVA using a "state-space" approach and a "reverse-time" capture-recapture model to estimate demographic parameters and to project population trajectories for ABM. They estimated that the probability of extinction for ABM over the next 200 years is between 0.31 and 0.33. However, standard errors near the end of that time frame were 0.46 – 0.47 which indicate high uncertainty, probably due to the uncertainty associated with the input parameters used to drive the model (Conroy and Runge 2007). Consequently, the Service determined that the PVAs would be more appropriate for qualitative assessments of development alternatives, mitigation strategies, and management practices within ABM populations and habitats, as well as identifying data gaps and species' risks.

Status and distribution

Reasons for listing

Alabama, Perdido Key, and Choctawhatchee beach mice were listed in 1985 as endangered species primarily because of habitat fragmentation, alteration, and/or loss due to coastal development (Service 1985). The threat of development-related habitat loss has continued to increase. Other factors that contributed to listing included low population numbers, habitat loss from other sources (*e.g.*, hurricanes), predation or competition by animals related to human development (cats and house mice), and the lack of regulations on coastal development.

Coastal development

One of the reasons for the precipitous decline of many endangered species is habitat loss and fragmentation (Wilcox and Murphy 1985). Holler (1992) and Humphrey (1992) stated that habitat loss and fragmentation associated with residential and commercial real estate development are the primary threats contributing to the endangered status of beach mice. Habitat fragmentation often leads to the isolation of small populations (*e.g.*, GSP) which causes higher extinction rates as a result of reduced gene flow and diversity, particularly with pressures from predation (especially cats), disease and competition. Holliman (1983) estimated that 62 percent of all (historical) beach mouse habitats in Alabama had been lost to development between 1921 and 1983. Significant beachfront development along the north-central Gulf coast began in the 1950s. Douglass *et al.* (1999, as cited by the South Alabama Regional Planning Commission [2001]) determined that development in southern Baldwin County along the Gulf

more than doubled between 1970 and 1996 (*i.e.*, from 28 to 61 percent of beach frontage). By 1996, little land suitable for development in Orange Beach and Gulf Shores remained (SARPC 2001).

One of the most rapid and obvious effects of fragmentation is elimination of the species that occurred only in the portions of the landscape destroyed by development (Noss and Csuti 1977). Many species, like the ABM, are especially susceptible to extirpation and potentially extinction from habitat loss because of their limited distributions. The prime example is the extinction of a similar species, the pallid beach mouse (Humphrey 1992). Residential and commercial developments that fragment ABM habitat may act as barriers to ABM movement (Meyers 1983, Service 2006c). 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). Meyers (1983) believed that "intense" development could act as a barrier to migration, isolating mice within habitat segments because high-density developments require more space for associated structures, such as recreational and parking facilities. As a result, larger contiguous blocks of beach mouse habitat are lost compared to single-family residential development. Whether beach mice can be considered isolated by development depends on several factors that are not totally understood, including the location, density and size of the development; amount and type of beach mouse habitat affected by development; and distance or connectivity between undeveloped lands containing beach mouse habitat.

Some mobile species can integrate a number of habitat patches into their regular use patterns (Noss and Csuti 1997). An example is the white-footed mouse (*P. leucopus*) which is able to maintain populations in fragmented landscapes only when dispersal between woodlots, aided by hedgerows, is great enough to balance out local extinctions (Fahrig and Merriam 1985). Previous studies on ABM indicate that the species can and do move between undeveloped habitat and remnant parcels of suitable habitat within developed areas. While we are uncertain what habitat parameters define a corridor for ABM (*e.g.*, minimum width, amount of cover), we have evidence that ABM use undeveloped habitat surrounding single-family residences and blocks of habitat preserved within multi-family developments with HCPs. ABM have been found in dune habitats within single-family residential developments along the West Beach area of Gulf Shores, in the Veterans/Cabana Beach subdivisions in the Multi-Family area, and throughout the Single-Family area on the remainder of the peninsula. Additionally, we have evidence the use of native vegetation for landscaping may encourage ABM to continue to use remnant habitat within HCPs. Although these areas generally exhibit a high degree of habitat fragmentation, ABM persist within these developed areas, possibly as a result of adjacent source populations in less developed or unaltered habitats connected by movement corridors of natural habitat. Beach mice occupying small parcels within high-density developments are more vulnerable to increased isolation and problems associated with suppressed immigration, which affect population numbers and genetic diversity (Meyers 1983, Noss and Csuti 1997, Service 2006c). Conversely, HCPs with non-native vegetation landscaping, especially those with sod installed act as a barrier to the remnant portions of habitat within these HCPs. 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).

Isolation of habitats by imposing barriers to species movement is an effect of fragmentation that accomplishes the same loss as reduction in habitat size (Noss and Csuti 1977). A barrier to ABM movement depends upon a number of factors, such as location, size and land use, and can include parking lots, sodded areas, high-density residential developments, highly lit areas, and holding ponds. Trapping and track tube surveys indicate that ABM can cross AL 182, a 4-lane roadway extending through GSP. However, due to the highway fragmentation, the area north of Highway 182 may not be occupied in similar densities or facilitate individual movement as connected areas such as Bon Secour National Wildlife Refuge (NWR) or Fort Morgan State Historic Site (FMSHS). It is likely that isolation of habitats by high-density development led to the extirpation of ABM in the Gulf Shores/Orange Beach area (Holler and Rave 1991). The viability of subpopulations may depend on enough movement of individuals among and connections to habitat patches to balance extirpation from other habitat patches (*e.g.*, if the GSP subpopulation had been able to move to another patch of habitat to the east or west, or if other subpopulations in local habitat patches had been able to migrate to GSP [as a source population], then the GSP subpopulation would not have been extirpated). If essential habitat requisites are eliminated or habitat connectivity is severed, ABM populations may be at increased risk. Therefore, ABM requires habitat connectivity that allows the species to move between habitat patches containing vital resources (*i.e.*, food, cover, burrowing habitat, and higher elevation refugia).

The potential importance of suitable habitat that connects separate populations has been explored since the mid-1970s (Diamond 1975, Hobbs 1992). Their importance is predicated on the perception that: (1) the chances of extinction will be lower when habitat fragments can be connected by natural corridors that provide adequate habitat for the movement of native animals; and (2) corridors may significantly improve the conservation functions of disjunct habitat reserves by connecting them with strips of protected habitat (Hobbs 1992). Habitat connectivity is especially important where mice occupy fragmented areas lacking one or more habitat types. For instance, when food or burrow sites are scarce in the frontal dunes (*e.g.*, seasonally or after hurricanes), beach mouse access to connected tracts (*e.g.*, scrub or other frontal dune habitats) with these resources is important in maintaining local beach mouse populations and distributions. Trapping data suggest that beach mice occupying the higher elevation tertiary dunes and open interior 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 or a functional pathway to frontal dune habitat does not exist, beach mice may not be able to obtain the resources necessary to expand the local population and reach the densities necessary to persist through the harsh summer season or the next storm. Functional pathways may allow for natural behavior patterns, such as dispersal and exploratory movements, and the maintenance of gene flow and genetic variability of the population within fragmented or isolated areas (Service 2009b).

The effects of barriers or loss of habitat connectivity on ABM are dependent on their location, duration and magnitude. These effects are both relative and cumulative. Meyers (1983) contended that high density developments which eliminate large sections of contiguous habitat can be expected to be more of a barrier to ABM movement than a fully developed single-family subdivision, which in turn would impede ABM movement more than single-family homes on

large lots along the Peninsula. The cumulative effects of barriers are what finally extinguish populations in most cases (Noss and Csuti 1997).

How such development activities will affect the ABM over the long term is not known and will likely depend on interactions between future developments and stochastic events (*e.g.*, hurricanes). The importance of the fragmentation process in the habitat requirements of the ABM is not totally understood. However, fragmentation can affect the biological integrity of the ABM through isolation and possible local extirpation. It is believed that fragmentation contributed to the repeated extirpation events at GSP and the loss of ABM in Orange Beach/Gulf Shores (Meyers 1983), and Ono Island, as well as Perdido Key beach mouse at Florida Point and the pallid beach mouse (Humphrey 1992, Lynn 2000).

Development of the Alabama Gulf Coast with single-family homes, large condominiums and commercial developments has undoubtedly reduced the amount of historic natural habitat available to the ABM and this trend will likely continue. Development pressures also include indirect effects, such as attraction of potential competitors (house mice) through inadequate refuse management, artificial lighting that disrupts normal nocturnal ABM behavior, attraction of non-native predators such as the domestic/feral cat, and fragmentation of ABM habitat. Hurricanes and tropical storms have altered, and will continue to cause impacts to, ABM habitat in the area. In this area, Category 3 Hurricanes such as Frederic, Ivan and Katrina caused at least two breaks through ABM habitat at GSP from Lake Shelby to the Gulf of Mexico. The breaks may fragment any storm-surviving ABM population at Gulf State Park until the habitat returns. However, more severe hurricanes may cause the entire loss of the population at GSP. Due to its isolation from other populations, reintroductions are usually necessary to restore a population of ABM at GSP. Hurricanes may also create or maintain dune habitat that is suitable for ABM unless altered by man. However, some minimum amount of ABM habitat not altered by storm events is necessary to allow beach mice to find refugia during these events and to persist over the long-term (Pergams *et al.* 2000). At GSP, approximately 9 acres of high hurricane refugia (tertiary dunes) remains (Drew Rollman, pers.comm.). Recent hurricanes have maintained these dunes as high quality habitat. However, there still may not be enough high hurricane refugia to maintain a population at Gulf State Park after a severe hurricane such as Frederic, Ivan or Katrina.

Table 2 estimates the ABM habitat affected by developments with ITPs on the Fort Morgan Peninsula. Because no accurate baseline information is available prior to human habitation on the Peninsula, it is difficult to estimate the amount of historic ABM habitat that has been lost. Our estimation is that up to 7,000 - 8,000 acres of coastal dune habitat were historically occupied by ABM (Service 2006c and 2007).

Table 2. Major Developments on the Fort Morgan Peninsula and ABM Habitat Lost and Preserved by those Actions (Service 2008c and e, 2009a and 2010). (ABM habitat information for this table was taken from each development's biological opinion, ITP or permit application. ABM habitat in this table is based on the Service's knowledge of ABM habitat at the time of ITP issuance; therefore, some of the older projects did not consider tertiary dune/interior scrub dunes as ABM habitat.)

Development Name and Year of ITP Issuance	Total Acres On-Site	Acres of ABM Habitat Lost	Acres of ABM Habitat Preserved
Laguna Key (1994)	46	25	8
Martinique on the Gulf (1996)	52	7.5	10.5
Beach Club (1996)	86	42	16
Gulf Shores Plantation* (1982)	69	38	16
Plantation Palms (1996)	4	2	2
Kiva Dunes (1994)	252	91	32
Bay to Breakers (1996)	11	1.5	2
The Dunes (1996)	35	27	8
Batch I, 17 Single Family Homes (2004)	16.2	2.9	13.3
Batch II, 54 Single-Family Homes (2005)	23.8	4	19.8
Batch III, 48 Single-Family Homes (2007)	20.7	5.1	15.8
Caldwell Comm. Cntr. (2008)	5.3	2.8	2.02
Batch IV, 42 Single-Family Homes (2008)	23.2	4.3	19.5
Batch V, 32 Single-Family Homes (2009)	16.9	3.6	13.7
General Conservation Plan (**to date**)	7.26	1.1	6.16
Total	**668.36**	**257.7**	**184.78**

* Gulf Shores Plantation was constructed prior to ABM listing, but provides multiple dune walkovers protecting CH.

Detailed descriptions of most of these ITPs are contained in the ABM 5-Year Review (Service 2008b, 2009a, 2009b). The Service has developed a General Conservation Plan (GCP) for single-family residential development within the ABM's range which would provide additional conservation benefits for this species. Impacts associated with development of about 400 single-family or duplex lots and expansion of about 500 residences would be permitted under the GCP which would affect up to an estimated 75 acres of ABM and coastal dune habitat. Potential impacts to tertiary dunes would be limited to less than two acres (Service 2012).

Public Lands

Bon Secour NWR, Perdue Unit Area. Bon Secour NWR was established by Congress in Baldwin and Mobile Counties in 1980 to conserve an undisturbed natural beach/dune ecosystem with associated wildlife, scientific, and public recreational uses. Bon Secour NWR encompasses about 6,816 acres, among five management units, three of which include ABM habitat. The refuge includes beaches, frontal and tertiary dunes, interior scrub, fresh and saltwater marshes, maritime forests, and open freshwater.

The Perdue Unit of the Bon Secour NWR includes the largest publicly owned area of ABM habitat (1,036 acres) and is considered to have one of the most stable ABM populations. Within the south-central portion of the Perdue Unit there are privately owned residential in-holdings known as Pine Beach and Veterans I which consist of frontal/tertiary dune and interior scrub habitats. One single-family dwelling ITP was issued in 1995 and two single-family ITPs were issued as part of Batch I in 2004. These lots lay within the frontal and tertiary dune/interior scrub habitats. Several other residences were constructed prior to the listing of ABM. Impacts on ABM habitat from residential construction in Pine Beach and Veterans I currently total about one acre.

Gulf State Park. This 6,150-acre state park is located between Gulf Shores and Orange Beach, and represents the last remaining sizable block of habitat on the eastern portion of the historic range of the subspecies. The park contains 192 acres of designated ABM critical habitat that extends along 2.2 miles of shoreline. The majority of this critical habitat unit is south of Hwy 182. The ABM were extirpated from the park as a result of Hurricanes Ivan and Katrina and were reintroduced in 2010 into suitable habitats south of Hwy 182. The reintroduction has been successful and ABM have reoccupied all available habitats and adjacent suitable habitat on both sides of Highway 182.

Fort Morgan State Historic Site. This site is located at the western tip of Fort Morgan Peninsula in Baldwin County, Alabama. It is owned by the State Parks Division of the Alabama Department of Conservation and Natural Resources, and managed by the Alabama State Historical Society. The Service has a cooperative agreement with the State to manage natural areas on these lands which provide wildlife habitat, including ABM habitat. It contains 510 acres, of which 172 acres are designated ABM critical habitat. This site is State owned and managed by the State Parks Division of the Alabama Department of Conservation and Natural Resources. It has pressures from heavy recreational use. ABM habitat here had sustained severe impacts from Hurricanes Ivan/Katrina. Coastal dune restoration efforts have been successful in restoring ABM habitat.

Lighting from Development

Although the negative effects of artificial lighting are well documented for sea turtles (Witherington and Martin 2003), its potential effects within beach mouse habitat have not been extensively studied. Natural illumination of the dune systems due to moon phases is known to have a direct effect on beach mouse activity (Blair 1951, Wolfe and Summerlin 1989). Bird *et al.* (2004) found that beach mouse foraging behavior was altered as a result of artificial light by reducing use of foraging patches and/or reducing seed harvest. They also suggested that artificial lights may cause habitat fragmentation due to altered movement patterns of mice. This

alteration in behavioral patterns causes beach mice to avoid otherwise suitable habitat and decreases the amount of time they are active (Bird *et al.* 2004; Falcy, 2011). Efforts are in place, proposed or on-going to address beachfront lighting within the range of the subspecies. In 2006, the City of Gulf Shores passed a lighting ordinance (No. 1461) that helps reduce artificial lighting impacts on beach mouse habitat. The Service is also working with the City of Orange Beach to draft a beachfront lighting ordinance. The Service conducted an artificial lighting workshop in 2008 and is available to provide technical assistance for artificial lighting alternatives (Service 2009b).

Hurricanes

Hurricanes and tropical storms are a natural environmental phenomenon affecting the Atlantic and Gulf Coasts. These events generally produce damaging winds, storm tides and surges, and/or torrential rains that erode beaches and dunes on barrier islands, peninsulas and mainland beaches, as well as flood inland coastal areas. Primary dune habitat sustains the heaviest damage during hurricanes, temporarily leaving little or no habitat for beach mice.

Hurricanes can impact beach mice either directly (*e.g.*, drowning or burrow collapse) or indirectly (*e.g.*, increased predation, reduced forage, fragmentation or loss of habitat). The passage of these storms may result in beach mice succumbing in their burrows, surviving the storm in place, or seeking refuge in adjacent areas. The effects of storm events on beach mice can be short- or long-term, depending on storm intensity (*e.g.*, winds, storm surge, rainfall), time of year, and point of landfall (*i.e.*, generally land areas affected by the east side of the "eye wall" are subjected to substantially more damage than on the west because of greater wind forces and storm surges).

Beach mouse populations on frontal dune systems without access to elevated tertiary dune habitat are susceptible to catastrophic losses during tropical storms and hurricanes. Holliman (1983) was the first to consider that higher elevation scrub habitat may provide a "refuge" for ABM fleeing the frontal dunes during storm events, such as Hurricane Frederic in 1979. Following Hurricane Opal in 1995, Swilling *et al.* (1998) reported higher ABM densities in the tertiary/interior scrub than the fore dunes for nearly one year after the storm event. As vegetation began to recover in the frontal dunes, they were re-occupied by ABM and population densities surpassed those in the tertiary/interior scrub dunes by the fall and winter following the storm. The ability of ABM to move between the frontal dunes and higher elevation tertiary dunes/interior scrub is believed to be important for ABM to persist over the short- and long-term (Swilling *et al.* 1998, Sneckenberger 2001, Service 2004a).

Service field investigations following Hurricane Georges in 1998 demonstrated that ABM use tertiary dune habitat as refugia. Interior habitats appeared to be used more at FMSHS than at the Perdue Unit of BSNWR due to the fact that more frontal dune habitat remained at the Perdue Unit after the hurricane. All available cover was used within the frontal dunes (including debris lines) on the Perdue Unit. Seven months after Hurricane Georges, the interior habitat of FMSHS continued to provide a refuge for the displaced frontal dune population that survived the storm (Service files).

Following the passage of a hurricane, the dune system typically begins a slow natural repair

process that may take three to more than 20 years depending on the magnitude of dune loss (Salmon *et al.* 1982) and frequency of large storms. During this period, sea oats and pioneer dune vegetation become established, and begin collecting sand and building dunes. As the dunes become stable, other successional dune vegetation begins to colonize the area (Gibson and Looney 1994). Assessment of various types of experimental dune restoration techniques were conducted on Eglin Air Force Base, Okaloosa/Santa Rosa Island after Hurricane Opal (Miller *et al.* 1999). The study showed that a minimum of four years are needed between catastrophic events like hurricanes for dunes to become re-established. Additional work by Auburn University indicated that at BSNWR, six years are needed for dunes to be re-established (*i.e.*, stable and growing, but not necessarily attaining pre-impact size or height) (Boyd *et al.* 2003). In areas where dunes are left to rebuild naturally, habitat recovery may be delayed until pioneer plants begin to re-establish.

Hurricane Ivan made landfall in Alabama on September 16, 2004, and destroyed or severely impacted 90-95 percent of the frontal dune habitat along Baldwin County's coastline (Service 2004a). In 2005, about 50 percent of the ABM habitats recovering from Hurricane Ivan were again impacted by Hurricane Katrina (Service 2005, AECOM 2009a and b). The Service conducted a preliminary evaluation of habitats where ABM might persist after these two hurricanes. This post-Ivan/Katrina evaluation effort was based on presence/absence data from traps and/or tracking tubes in limited portions of the Perdue Unit, FMSHS and GSP units, all current multi-family HCPs, and some single-family residential HCPs previously known to be occupied. Using inundation predictions from the most conservative inundation model, together with post-storm data, pre-storm ABM habitat use information, and current GIS-based ABM range maps, we estimated that ABM distribution after the 2004-2005 hurricanes and April 2005 flooding event may have been restricted to suitable habitats on 840 acres or less on the Fort Morgan Peninsula (Drew Rollman, pers. comm., March 10, 2008 spreadsheet 3). The damages caused by these hurricanes essentially restricted ABM to tertiary dune and some open interior scrub (*e.g.*, AL182 right-of-way) habitats in most areas, a situation that changed little until 2007-2008 when the frontal dunes began to show significant recovery and increasing ABM populations (Danielson and Falcy 2008, AECOM 2009a and b, Service 2009c and 2010).

In the past, ABM persisted in spite of local extirpations from storms and other harsh, stochastic events in coastal ecosystems. Historically, after such events, beach mouse populations from adjacent occupied or refuge habitats would eventually reinvade recovering dune habitats or newly created early succession habitat. These new local populations would expand for several years until habitat capacity was reached or habitat suitability declined through vegetation succession, storm damage, or other events. This would lead to localized often dramatic fluctuations in populations and allele frequencies (Wooten 1994). This naturally dynamic nature of ABM populations is well suited to persistence in changing habitat, such as coastal dunes. The species' ability to withstand bottlenecks suggests that it can recover very well from population size reductions (Wooten 1994), provided sufficient habitat is available for population expansion. With continued fragmentation from residential and commercial development, beach mice are unable to recolonize these areas as they did in the past (Holliman 1983). The current distribution of ABM along the Alabama coastline is much more restricted and fragmented as compared to historic conditions. Therefore, it is more likely that a hurricane making landfall in or near Alabama could impact the entire range of the subspecies.

Large tropical storms and hurricanes will continue to impact ABM habitat throughout its range and additional storm modeling was conducted following Chen and Wang (2007) to evaluate inundation potentials for three habitat types (frontal, tertiary and interior scrub dunes) within the ABM's range. Modeling exercises predicted that 91 percent (986 acres) of frontal dunes within ABM habitat would be inundated during a 100-year storm (*i.e.*, strong category 3 hurricane at the mouth of Mobile Bay). These modeling exercises also indicated that only about 470 acres of habitat (225 acres of frontal/tertiary dunes and 245 acres of interior scrub) within the ABM's range (2,450 acres) would not be inundated by such a storm (Drew Rollman, pers. comm., October 13, 2010 spreadsheet; Service 2009c). Therefore, It is reasonable to conclude that the restoration of relatively contiguous tracts of suitable ABM habitat, with high refugia, over a wider area with multiple independent local populations would improve the probability of ABM persistence (Oli *et al.* 2001; Danielson 2005; Service 2006b, 2006c and 2009b).

Predation

Beach mice have a number of natural predators, including coachwhip and corn snakes, pygmy and diamondback rattlesnakes, short-eared and great-horned owls, great blue herons, Northern harriers, foxes, skunks and weasels (Novak 1997, Blair 1951, Bowen 1968, Holler 1992, Moyers *et al.* 1999, Van Zant and Wooten 2003). Mortality from natural predation on ABM populations with sufficient recruitment and habitat availability is usually not a concern. However, additional predation pressure from non-native predators may result in the extirpation of small, local populations of beach mice.

Of particular concern is beach mice predation from free-roaming or feral cats (*Felis sylvestris catus*). Feral cats are estimated to kill hundreds of millions of birds, small mammals, reptiles and amphibians each year (American Bird Conservancy 1999). Cat tracks have been observed in areas of low trapping success for beach mice (Moyers *et al.* 1999) and their presence can have a serious negative impact on beach mice survival. Residents or vacationers may allow their pet cats to roam freely or may feed feral cats. Such actions likely contribute to low populations and possible extirpation of some beach mouse populations. It is believed that cats contributed to the loss of the Perdido Key beach mouse population at the Florida Point Unit of GSP after Hurricane Opal stressed the population (Traylor-Holzer *et al.* 2005, Service files). PVA modeling has shown that one cat killing one ABM per day in each of the six model units resulted in virtually certain extinction of ABM in less than 20 years. If 10 or more cats occur within each unit, the models predicted that the species would be extinct in 5 years or less (Traylor-Holzer *et al.* 2005). Therefore, development planning should incorporate measures to control feral or free-roaming cats on project lands within and adjacent to beach mouse habitats.

Other non-native predators such as the red fox (*Vulpes vulpes*) and coyote (*Canis latrans*) are also of concern. Red fox are not native to the coastal habitats of northwest Florida or coastal Alabama, but were introduced to the area by fox hunters in the last century. Since the near extermination of the red wolf (*C. rufus*) in the 1960's, the coyote's western range has expanded into the southeastern U.S. (Service 1990). Both canids compete with the native gray fox (*Urocyon cineroargenteus*).

Competition

Beach mice are the only small mammals that live exclusively within the coastal dune landscape

containing frontal and tertiary dunes, and associated interdunal and scrub habitats. Other small mammals, such as cotton rats and cotton mice, occur in the forested or densely vegetated portions of coastal habitats and may compete with ABM for resources. The house mouse and other introduced rodent species, such as Norway (*Rattus norvegicus*) and black (*R. rattus*) rats, occur in areas associated with humans and may out-compete ABM in developed areas.

Generally, research has shown that house mice exhibit overlapping food habitats (Gentry 1966) with beach mice and commonly occupy some of the same habitats. An occasional house mouse has been collected in occupied ABM habitats near Fort Morgan and a unit of GSP near Gulf Shores (Service files), but significant numbers of house mice have been recently caught in unoccupied Perdido Key beach mouse habitat at Florida Point on GSP (Jeff Gore and Dan Greene, pers. comm., Florida Fish and Wildlife Conservation Commission 1/25/10). Some believe that house mice may compete with beach mice for food resources. Others have concluded that house mice are poor competitors where they co-occur with beach mice in areas of intact coastal dune habitat, but may be capable of coexisting with beach mice (Caldwell 1964, Caldwell and Gentry 1965, Gentry 1966, Meyers 1983). Briese and Smith (1973) concluded that house mice primarily invade disturbed areas or areas where human structures provide suitable places to live, but that the species seldom coexist in undisturbed natural habitats. Humphrey and Barbour (1981) documented mutually exclusive distribution patterns of Gulf Coast beach mice and house mice. They suggested that these patterns were a result of competitive exclusion of beach mice by house mice following habitat degradation and introduction of exotic predators. King (1957) studied aggressive behavior of house mice and white-footed mouse (*Peromyscus leucopus*) and suggested that these species might aggressively compete in nature. However, Caldwell (1964) found no evidence of direct aggressive competition between house mice and beach mice under field or laboratory conditions, and even observed these species sharing common nests under laboratory conditions.

Frank and Humphrey (1996) concluded from their work on the Anastasia Island beach mouse that house mice could coexist in dune habitats with beach mice and not be a serious threat to their persistence under conditions favorable for beach mice. However, the presence of house mice may be an indicator of poor habitat conditions for beach mice. In 2000, beach mice successfully occupied nearly all available habitats on the GSP. However, in dune habitat separated by hotel units on GSP, only house mice were captured and no beach mice were reported (Swilling *et al.*, pers. comm., 1998-1999; Service 2002). Other factors, such as the presence of cats in this general area, may also have influenced ABM distribution on GSP at that time.

Range-wide Trends

Although coastal development has slowed in recent years, we anticipate that development pressures will increase when the depressed real estate market recovers. If continued development results in further ABM habitat fragmentation and degradation, then it would likely have adverse effects on the distribution and/or density of the ABM population, depending on the location and density of those residential and commercial developments. In turn, this could exacerbate the impacts from large storm events that intermittently occur to ABM habitats, as well as the effects on ABM numbers due to continuing predation and competition from non-native species.

New Threats

Non-Native Species

Any activities that modify coastal dune habitats (*e.g.*, road building, mowing, land grading and development) can create avenues for non-native species, such as cogongrass (*Imperata cylindrical*), torpedo grass (*Panicum repens*), beach vitex (*Vitex rotundifolia*) and fire ants (*Solenopsis invicta*) to invade ABM habitats and impact local ABM populations. Cogon grass, torpedo grass, pampas grass and beach vitex are established in Gulf Shores, Orange Beach, and the Fort Morgan Peninsula. The non-native plants can replace native plants which are important in maintaining the structure and continuity of ABM habitat, and provide food resources for the ABM. Fire ants have been known to attack beach mice in live traps and may have impacts on nesting females and their pups (D. LeBlanc pers. comm. 2008; Danielson and Falcy 2008).

Other non-native species, such as the house mouse, domestic cat, red fox and perhaps coyote, also may place additional predation or competition pressures on ABM populations (see also **Status and Distribution,** Predation and Competition).

Climate Change

Sea level, temperature, precipitation and storm frequency/strength are expected to change significantly with global climate change. The IPCC (2007) reported the following global implications of climate change on small islands with "high" or "very high confidence": (1) Sea level rise will exacerbate inundation, storm surge and erosion; (2) Beach erosion and other deteriorating coastal conditions will affect local resources; (3) Freshwater resources will be reduced; and (4) Higher temperatures will allow increased invasion of non-native species.

The magnitude, rate and effects of relative sea level increase will vary regionally because of differences in land subsidence, tectonic uplift, isostatic rebound, and the compaction of muddy soils (Gutierrez *et al.* 2007 and Anthony *et al.* 2009). Global sea level increase in the 20th century measured about 170 mm (Bindoff *et al.* 2007) and is expected to increase exponentially in the 21st century as air temperatures continue to increase (Rahmstorf 2007). Satellite observations since 1993 show that sea level has been increasing at a rate of about 2.28 - 3 mm/yr (228-300 mm/century), significantly higher than the average over the previous half-century (IPCC 2007, Cazenave and Nerem 2004).

Most barrier-lagoon systems respond naturally to sea level increase by migrating landward along undeveloped shorelines with gentle slopes (Hayes 2005). The retreating shore face profile can remain essentially unchanged as the shoreline retreats landward and upward in response to moderate sea level increases (Bruun 1962). However, with accelerated sea level increase, landward retreat of barriers may not be rapid enough to prevent inundation (Zhang *et al.* 2004). Hardened shorelines on developed coastlines impede this natural migration and increase the vulnerability of coastal structures to inundation and storm damage (Titus 1998).

Along most of the U.S. Atlantic and Gulf coasts, sea level has been rising 0.08 – 0.12 in/year (203 – 305 mm/century) (EPA 2009). Mean monthly sea level readings between 1966 and 2006 indicate sea level has increased at Dauphin Island, Alabama (immediately west of the mouth of

Mobile Bay), an average of 2.98 mm/year or nearly 1 foot/century (NOAA 2009). By 2100, ocean levels around Alabama could be 15 inches (38 cm) higher than today, if the average subsidence rate of 2 inches per century continues under a moderate sea-level rise scenario. Models used by Wigley (1999), which assumed a temperature rise between 1.9 and 2.9 degrees C combined with ice melt, arrived at sea-level rise projections between 46 and 58 cm (about 1.5 – 2 ft) by the end of this century (Davenport 2007).

The Alabama Gulf coast has about 55 miles of open-water shoreline along Baldwin and Mobile Counties. About half of this shoreline is receding, generally by 2-5 feet in recent decades. The rate of shoreline retreat is a function of the slope of the inundated land and the rate of sea-level rise. In coastal areas with gentle slopes, a very small increase in sea level would cause substantial island migration (Bush *et al.* 2001).

Sea level is expected to rise about 60 cm (~2 feet) along most of the U.S. Gulf and Atlantic Coast in the next century. The 1.5-meter elevation contour roughly represents the area that would be inundated during spring high tides with a 7-cm rise in sea level. Such a rise appears most likely to occur in the next 12 years (Titus and Narayanan 1995).

Recent evidence of an increase in intense tropical cyclone activity in the North Atlantic over the last 40 years (Meehl *et al.* 2007 and Trenberth *et al.* 2007) supports predictions of increasing hurricane frequency (Holland and Webster 2007 and Mann *et al.* 2007) and intensity (Webster *et al.* 2005 and Emanuel 2005) that will continue to increase with warmer global temperatures. Oouchi *et al.* (2006) have suggested that the number of storms in the North Atlantic could increase by as much as 34% by the end of the 21st century. Others have challenged these predictions, suggesting instead that the apparent trend in increasing storm frequency is an artifact of improved monitoring (Landsea 2007) and predicting that hurricane intensity would be dampened by the effects of increased vertical wind shear (Vecchi and Soden 2007).

The consequences of sea level increase become acute during storm events as a result of increased erosion and high storm surges that can rapidly redistribute sediment (Fenster and Dolan 1993). During periods of high storm surge, low barrier islands can be over-washed, moving sediment from the front of the barrier and depositing it onto inland flats and lagoons (Wilby *et al.* 1939 and Leatherman 1981). Increased storm intensity will likely cause more frequent breaches of barrier islands (Morton and Sallenger 2003).

The implications for changes to the Alabama Gulf coast, particularly within the ABM's range, are far from clear and could likely be influenced by a number of factors, such as shoreline elevation and structure, sand availability, and underlying land formation. Substantial migration of the Peninsula is possible, based on anticipated rates of sea level rise and basic island dynamics, but could be substantially complicated by existing and future coastal development, the rate of sea-level rise, erosion on the interior side of the Peninsula, hurricane frequency and intensity, and other factors. Even with this level of uncertainty, it is reasonable to assume that beach mouse habitat, particularly the frontal dunes, would be adversely impacted over the short and long-term by shoreline inundation and erosion, as well as the effects of salt spray on interior dune vegetation, associated with predicted increases sea level and/or storm activity along the Gulf coast.

Summary

Alabama beach mouse has a small and fragmented range. Individuals reproduce quickly and often; though relative abundance can vary greatly. The species is capable of using a wide-variety of dune habitats, even in the presence of coastal development. The ability to quickly reproduce and use a variety of habitats allows for resiliency in the species. However, all PVA Vortex modeling efforts to date reflect the great influence tropical cyclones have on beach mouse population dynamics, the importance of higher elevation habitat (primarily tertiary dunes $\geq$12 feet above mean sea level) as storm refugia, and the value of habitat connectivity between isolated populations for beach mouse conservation.

ABM persisted at Gulf State Park during operation of the former hotel and conference center. Several extirpation events from hurricanes occurred at Gulf State Park after hurricanes (and potentiall predation events) because GSP is isolated from other ABM populations and has limited high storm refugia. GSP allowed reintroductions after each extirpation event and implemented predator control. Through these events ABM have dispersed throughout all suitable habitat on GSP. Thus, after severe tropical storms and hurricane events, where low dunes are inundated, reintroductions of ABM to Gulf State Park will likely be necessary to establish an ABM population within this unit.

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