

**Biological Opinion for Issuance of an Incidental Take Permit
Section 10(a)(1)(B)**

Coquina Caye Condominiums

**Perdido Key
Escambia County, Florida**

**Prepared by:
U.S. Fish and Wildlife Service
Panama City Field Office, Florida
October 12, 2012**



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Acronyms

Act	Endangered Species Act
BO	Biological Opinion
CCCL	Coastal Construction Control Line
CFR	Code of Federal Regulation
FR	Federal Register
FWC	Florida Fish and Wildlife Conservation Commission
HCP	Habitat Conservation Plan
ITP	Incidental Take Permit
GINS	Gulf Island National Seashore
GPS	Gulf State Park
K	Carrying Capacity
MHWL	Mean High Water Level
NAS	Naval Air Station
NAVY	Pensacola Navy Air Station
PCEs	Primary Constituent Elements
Permit	Incidental Take Permit
PKBM	Perdido Key Beach Mouse
PHVA	Population and Habitat Viability Analysis
PVA	Population Viability Analysis
Service	U.S. Fish and Wildlife Service



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October 12, 2012

Memorandum

To: Assistant Regional Director, Habitat Conservation, FWS, Atlanta, GA

From: Deputy Field Supervisor, FWS, Panama City Field Office, Panama City, FL

Subject: Biological Opinion for Incidental Take Permits for the Perdido Key Beach Mouse (*Peromyscus polionotus trissyllepsis*) for the Coquina Caye Condominiums in Escambia County, Florida

This document represents the Fish and Wildlife Service's (Service) biological opinion based on our review of the information provided pertaining to the proposed development of a Gulf of Mexico beachfront condominium complex in Escambia County, Florida, and submitted for a section 10(a)(1)(B) Incidental Take Permit (ITP) by the Millennium Group I, L.L.C. (Applicant). The effects of their actions on Perdido Key beach mice (*Peromyscus polionotus trissyllepsis*) (PKBM) and PKBM critical habitat have been evaluated per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). The Service's approval of an ITP is a Federal action subject to consultation under section 7(a)(2) of the Act.

The Service has determined that the project would not likely adversely affect nesting sea turtles and piping plover and would not likely adversely modify critical habitat designated for the piping plover based on the inclusion of conservation measures in the Habitat Conservation Plan (HCP) (**Table 1**).

This biological opinion does not rely on the regulatory definition of destruction or adverse modification of critical habitat at 50 Code of Federal Regulations [C.F.R.] 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

This biological opinion is based on information from the HCPs provided by the Applicant and their consultant, Wetland Sciences, Inc., and from meetings, discussions, correspondence, and project site inspections. This biological opinion is also based on the experience of Service biologists and an extensive literature search on beach mice, other *Peromyscus* species, and other small mammals. A complete administrative record is on file in the Service's Panama City Field Office, Florida.

Table 1. Species and critical habitat evaluated for effects from the proposed action but not discussed further in this biological opinion.

SPECIES OR CRITICAL HABITAT	PRESENT IN ACTION AREA	“NOT LIKELY TO ADVERSELY AFFECT”
Loggerhead sea turtle (<i>Caretta caretta</i>)	Yes	Yes
Green sea turtle (<i>Chelonia mydas</i>)	Yes	Yes
Leatherback sea turtle (<i>Dermochelys coriacea</i>)	Yes	Yes
Kemp’s ridley sea turtle (<i>Lepidochelys kempii</i>)	Yes	Yes
Piping plover (<i>Charadrius melodus</i>)	Yes	Yes

CONSULTATION HISTORY

Consultation regarding the proposed condominium complex began with a request for a site visit with the Applicant, followed by a site visit with the consultant and Florida Fish and Wildlife Conservation Commission (FWC) representative.

<u>June 24, 2004</u>	The Service conducted a site visit. This project initially proceeded through the section 7 process before changing to the HCP process.
<u>January 27, 2006</u>	A draft HCP for this project was received.
<u>December 4, 2006</u>	A complete application package for an ITP and HCP for residential construction was received.
<u>December 12, 2006</u>	The application was forwarded to the southeast regional office.
<u>May 17, 2007</u>	The Service published a notice in the Federal Register announcing the availability of the application, HCP, and environmental assessment of the proposed permitting action for public review. Comments were received that led to the recalculation of proposed impacts.
<u>July 19, 2008</u>	A revised site plan was sent to the Service by Wetland Sciences.
<u>July 27, 2009</u>	The Service sent a letter to Wetland Sciences explaining the delay in completing the HCP process.
<u>May 2010</u>	Additional revisions to the HCP were made.
<u>February 2012</u>	Additional revisions to the HCP were made.

September 10, 2012 The Service received the final revised HCP. These changes were incorporated into this biological opinion and other pertinent documents needed for the ITP.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Applicant seeks an incidental take permit (permit or ITP) from the Service under section 10(a)(1)(B) of the Act, as amended. The permit would authorize take of the PKBM in Escambia County, Florida. The proposed take would be incidental to the construction and human occupancy of a beachfront condominium development on a 1.21 acre parcel (**Figure 1**) as allowed by local government zoning and associated restrictions. Impacts to Perdido Key beach mouse habitat are summarized in Table 2.



Figure 1. Location of the Coquina Caye proposed project site with respect to the Gulf Coast of Florida and Alabama.

Table 2. Proposed impacts to PKBM habitat associated with the proposed Coquina Caye development.

Habitat Statistics	Impacts (acres)
Total area	1.21
Open beach	0.29
PKBM habitat	0.92
Permanent impacts	0.43
Temporary impacts to be restored	0.15
Avoided PKBM habitat	0.34
PKBM habitat in conservation easement	0.49

The property is currently in an undeveloped and natural state. The parcel is bound to the north by SR 292, to the east by a single-family residence, to the west by a multi-family residence, and to the south by the Gulf of Mexico. The general vicinity of the property is dominated by redevelopment of beach cottages with high-rise condos. Presently, there are numerous such projects under construction. Construction of the Coquina Caye condominium would include an eight-story, fifteen-unit condominium complex, parking lot, pool and pool deck, and dune walkover, covering approximately 0.43 acre (**Figure 2 and 3**). Some of the disturbance from new construction would be temporary and restored upon project completion.



Figure 2. Parcel of proposed Coquina Caye project on Perdido Key with respect to adjacent land use.

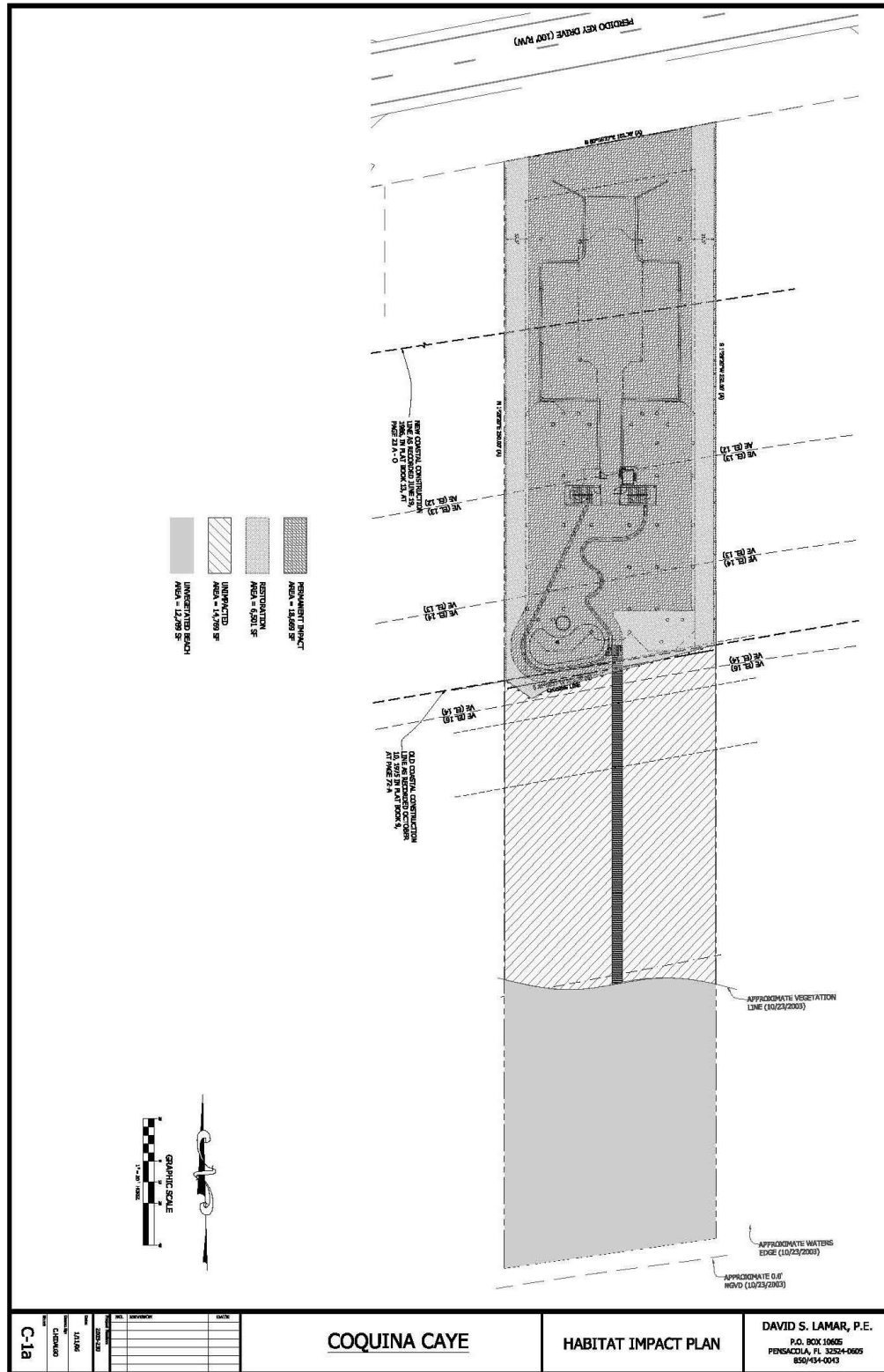


Figure 3. Site plans of the Coquina Caye project transposed on current condition of the project site.

Action Area

The Service has described the Action Area to include all areas which would be affected directly or indirectly by this Federal action and not merely the immediate area involved in the proposed work as indicated in the general site location for this project. The Action Area for this biological opinion is described as West Perdido Key. West Perdido Key consists of 147 acres in southern Baldwin County, Alabama and Escambia County, Florida. This area extends about 3.5 miles along the Gulf of Mexico coastline and includes suitable beach mouse habitat between Gulf State Park, Alabama and Perdido Key State Park, Florida. This area is delineated by Old River, maritime forest, or wetlands to the north and the extent of the primary dune system to the south. The PKBM habitat on the project site accounts for 0.92 acre or approximately 0.6% percent of West Perdido Key.

Beach mouse habitat in the Action Area consists of primary and secondary dune habitat. Habitat fragmentation due to development exists to varying degrees. Specific records of beach mouse presence/absence are not available for the entire area as access has not been granted to the Service to conduct beach mouse trapping on most privately-owned areas. However, Service personnel did observed signs of beach mouse burrows and tracks near the Coquina Caye site in 2005. The Action Area includes areas within the geographic range occupied by the subspecies at the time of listing, provides essential connectivity between public lands, and provides habitat for natural movements, behaviors, and long-term persistence of PKBM.

Conservation Measures

The Applicants have incorporated measures to minimize and mitigate the impacts of the proposed projects to the maximum extent practicable. The following information identifies the proposed measures.

Project design to avoid and minimize impacts

1. Land buffers along the east and west sides of the proposed buildings will be maintained to provide corridors to connect PKBM habitat onsite with off-site habitat to the north on all properties. These corridors, originally designed as landscape buffers with sod and ornamental plants, will be a minimum of 10 feet wide and will be planted with native vegetation.
2. The proposed project has been designed to include only the minimum number of parking spaces required by County code (1.5 spaces per unit plus one extra handicap space). The proposed footprint of the parking area represents the minimum area needed to accommodate the required number and size of the parking spaces. The parking lot designs were devised to cantilever the parking spaces on the perimeter of the parking lots to maximize the width of the habitat corridors.
3. The deck and pool were designed to decrease the development footprints and are in accordance with Pool Deck Design (Florida Building Code Section 1004) in the Escambia County Land Development Code.

4. Hand-rails will be installed on the deck to deter pedestrians from entering the dune habitat from the deck area.
5. Silt/construction fence will be installed along the east and west property boundaries, and along a 20 ft buffer of the building footprint to prevent access to beach mouse habitat during construction. The fence would allow movement of beach mice and prevent pedestrian trespass and construction activities outside the buffer.
6. Sand fence will be installed seaward of the foredune to both enhance sand retention and prevent pedestrian access to the dune habitat on the property. The sand fence will be installed in a sea turtle compatible configuration.
7. No permanent fences or privacy walls will be constructed that would restrict beach mouse movements.
8. A single dune walkover will be constructed to provide access over the dune habitat to the beach at each property. The walkover will provide the only access to the beach, minimizing future habitat impacts on the property. The walkover will be constructed using top-down techniques and will have a minimum elevation of 3 feet above grade and any existing vegetation.
9. Educational signs will be installed on deck and walkover providing natural history information about the PKBM, sea turtles, shorebirds (including piping plovers), and habitat conservation. These signs are intended to increase awareness resulting in beneficial behavior modification of residents and guests of the facilities.
10. Trash collection and storage for the units will be contained in the interior spaces. Exterior trash receptacles have been eliminated with the exception of one in the pool area. These receptacles will be animal-proof and will reduce predator and competition pressure from nuisance and exotic species otherwise attracted to unprotected trash.
11. The project was designed to relocate exterior entrances to mechanical and life-safety equipment rooms to the interior. This was done to eliminate exterior entrance areas and occasional pedestrian traffic within habitat areas.

Project construction measures to minimize impacts during construction of the development

1. A summary of the HCPs and any issued permit requirements will be provided to the general contractor and included in all sub-contracts for the project. The construction contract documents will include a stipulation that conservation objectives be communicated to and agreed upon by all sub-contractors.
2. Limits of construction will be clearly marked on all construction plans and would be clearly indicated onsite with silt fence or other barrier fence for all projects.

3. No barriers will be placed on the properties that would limit wildlife movement to and from adjacent properties.
4. Wildlife lighting will be utilized for the parking lots, common areas and exteriors of the structures. All windows and glass doors would have the appropriate glass or window tint that only allows 45 percent light transmittance from inside to outside.
5. All areas temporarily impacted during construction will be restored to ambient or design grade and planted with native dune vegetation. Review and approval of the landscape plans for the developments by the Service will be required.

Operation and management of the development

Measures have been incorporated in the project operation and management. Where relevant, operation policies will be included in condominium documents provided to each unit owner. The condominium documents will contain these referenced provisions included in the HCP:

1. Cats will be prohibited on the premises. All other pets will be restricted to the inside of the condominium units.
2. Waste receptacles have been eliminated from all outdoor common areas in the projects with the exception of one in the pool area. These receptacles will be animal-proof.
3. Pesticide and herbicide application will be prohibited outside the units.
4. All beach chairs and umbrellas or similar items will be removed from the beach at the property each night during the sea turtle nesting season from May 1 through October 31.
5. Access to the site would be granted to the Service, FWC, U.S. Department of Agriculture - Wildlife Services, and their representatives to conduct PKBM population monitoring, and predator control.
6. General guidance provided in the covenants and restrictions for the condominium will provide reference and information about the Endangered Species Act and the presence of the endangered PKBM, prohibit littering on the beach or common areas, prohibit cats from the property, limit all other pets to inside the units, and prohibit access to the conservation easement and other natural areas on the sites.

Mitigation to address unavoidable impacts

Construction of the Coquina Caye condominium would include an eight-story, fifteen-unit condominium complex, and associated amenities. Though a number of minimization efforts were incorporated into the design, construction, and operation of this facility, 0.43 acre of the

site would be permanently altered—all of which is PKBM habitat. Approximately 0.49 acre of PKBM habitat and 0.29 acre of open beach would remain on site. This resource loss is offset by a number of actions proposed by the land owner intended to benefit the PKBM, its habitat and recovery. Approximately, 0.15 acre of the temporarily impacted PKBM habitat would be restored to PKBM habitat by grading and planting with native dune vegetation. The applicant has also proposed to contribute \$43,000 ($100,000 \times 0.43$ acre) to a PKBM Conservation Fund to compensate for the 0.43 acre of impacts to PKBM habitat. This Conservation Fund allows for restoration and enhancement activities on Perdido Key for the sole purpose of conservation of the PKBM. This fund would be perpetually augmented by a \$201 annual assessment of each unit owner in the complex. The funds in the Conservation Fund would be spent in accordance with the Conservation Strategy (FWC et al. 2005) prepared for the PKBM. Annual conservation effort priorities would be determined by an interagency committee, including the Service.

Contributions to the PKBM Conservation Fund are provided following the Intergovernmental Agreement among the Service, FWC, and Escambia County based on the Conservation Strategy for the PKBM (2005), Business Plan for the PKBM Conservation Fund (2005), and the adoption by Escambia County of the 1975 Coastal Construction Control Line (CCCL) prohibitions ordinance (2005-56).

Additional Conservation Measures to be Required in the HCP

1. All construction on the beach shall be conducted outside the turtle nesting season (May 1 through October 31) or following a CCCL permit issued by the State of Florida. *Rationale: This is a standard requirement by the State of Florida in their CCCL permit program. This is the area of greatest sea turtle nesting and could affect the number of sea turtles coming ashore to nest and hatchlings emerging from the nest and crawling to the sea.*
2. The applicant will place in escrow, funds sufficient to finance 12 PKBM monitoring events at the property. These 5-night trapping events would be conducted four times a year (quarterly) for the first three years after project completion. The data collected from this effort would be provided in an annual report to the Service. Any undesirable species captured during the trapping events would be humanely destroyed, thus reducing competitive stress on the PKBM. Further, authorization and access to natural areas would be granted to the Service, Escambia County, and FWC, or their representatives, to conduct additional monitoring of their own.
3. To insure perpetual maintenance of the primary dune community on the property, the land owners offer to record a conservation easement on the undeveloped portion of the site. With the exception of a 10-foot access easement associated with the dune walkover, this measure ensures that all land seaward of the proposed structures would remain in its natural state in perpetuity.
4. Each applicant would establish a condition in the covenants and restrictions of the development that requires restoration of sand and vegetation in the dune community after a named storm event, if such areas are not otherwise restored by a governmental

entity or other third party as part of an overall or isolated dune restoration program (such as, for example purposes only, the dune restoration program undertaken by state, federal and local government entities after Hurricane Ivan). This requirement shall not interfere with or otherwise prohibit future participation in any such dune restoration program. This mitigation measure provides legal assurance that restoration of future habitat losses would occur.

5. The following changes or additions to the dune restoration plan will be made:
 - a) all vegetation planting must be completed by May 1;
 - b) all vegetation planted will be plants for coastal dune and beaches in Escambia County, FL;
 - c) irrigation of planted dune vegetation will be by backpack only;
 - d) all dune restoration material will meet State of Florida requirements for beach quality material;
 - e) all fence will be installed according to State of Florida sea turtle compatible requirements – Sand Fence Installation Configuration for Sea Turtle Nesting Beaches in Northwest Florida; and
 - f) the use of mulch and landscape fabric is prohibited in the dune habitats and the landscaped areas.

Rationale: The plant species to be used for dune restoration and landscaping are native to beach and dune habitats. They have evolved to withstand the harsh coastal environment of salt spray, continual winds, little fertilizer, and dry sands. Except for the initial establishment of the vegetation, irrigation should not be required for plant survival. Other alternatives to irrigation include using a gel additive in the sand at the time of planting. Mulch and landscape or “weed” fabric could preclude movement of beach mice or their ability to burrow.

6. The applicants would contribute to the PKBM Conservation Fund, for the purpose of the restoration and enhancement activities on Perdido Key for recovery of the PKBM. This fund would be perpetually augmented by a \$201 annual assessment of each unit owner within Coquina Caye condominiums. The funds in the Conservation Fund would be spent in accordance with the Conservation Strategy (FWC et al. 2005) prepared for the PKBM. Annual conservation effort priorities would be determined by an interagency committee, including the Service.
7. All covenants and restrictions will be further stipulated that no changes will be made that would cause noncompliance with the requirements outlined in this biological opinion and contained in the issued ITP. *Rationale: Since covenants and restrictions can be changed (vs. third party protection through a conservation easement) these additional requirements are needed to assure that the requirements are met.*
8. Upon location of dead, injured, or sick individuals of an endangered or threatened species, initial notification must be made to the Fish and Wildlife Service Law Enforcement Office, Clermont, Florida (352-429-1037). Care should be taken in handling sick or injured individuals and in preservation of specimens in the best

possible state for later analysis of the cause of death or injury. *Rationale: This is a standard permit requirement issued by the Service in all incidental take permits and provides for possible rehabilitation of an injured species and confirmation of the problem or injury.*

Biological Goal of Issuing the Incidental Take Permit

The biological goal for issuing the ITP is to adequately minimize and mitigate the impacts of the proposed projects on PKBM to the maximum extent practicable. We have determined this can be accomplished by following the guidance in the PKBM Conservation Strategy (2005), the Recovery Plan for the subspecies (1987), and the critical habitat designation (71 Federal Register (FR) 60238). Specifically, we refer to the following guidance which has been applied to minimize and mitigate the impacts of the Coquina Caye project.

From the PKBM Conservation Strategy (2005)

- 1) Conduct surveys to determine the current status and distribution of PKBM.** This strategy provides baseline information needed to determine priorities and actions required to address the other conservation strategies.
- 2) Restore and maintain the dune systems within GINS, PKSP, and GSP, and the areas between.** This strategy seeks to re-establish, enhance, and maintain contiguous PKBM in the primary, interdunal, secondary, and scrub dune systems habitats that have been degraded through human actions or natural disasters.
 - a) Emphasize re-establishment of the dune system.
 - b) Establish dune building devices (e.g. fencing) to encourage dune growth.
 - c) Restore the topography of the primary dune system.
 - d) Plant the rebuilt dune system with appropriate vegetation.
 - e) Plan for and provide, appropriate beach access that is consistent with protection of the dune system.
- 3) Minimize the impacts of development and use of PKBM habitat.** This strategy seeks to maintain the best possible conditions for beach mice in an area being impacted by development.
 - a) Maintain beach mouse habitat in a natural state (i.e., minimize the development footprint habitat).

- b) Maintain remaining beach mouse habitat in blocks (i.e., patches) as large and contiguous as possible, and in areas to maximize connections or potential connections with beach mouse habitat on adjoining properties.
- c) Place remaining beach mouse habitat in permanent conservation easements where feasible.
- d) Use dune topography and plants native to beach mouse habitat as the primary landscaping features.
- e) Have covenants, deed restrictions, or similar permanent instruments established for properties developed in beach mouse habitat that would be designed to reduce mortality or other negative impacts to occupied beach mouse areas. Such instruments would:
 - i) Prohibit free-ranging pets outdoors.
 - ii) Require the use of animal-proof garbage containers to prevent attracting house mice and beach mouse predators.
 - iii) Require outdoor lighting that meets the criteria of the International Dark-Sky Association to reduce the impacts of development lighting.
 - iv) Prohibit use of pesticides or pest control in outside areas.
 - v) Limit the use of herbicides or fertilizers in beach mouse habitat.
 - vi) Require boardwalks or similar dune walkover structures for beach access across the dune habitat.
 - vii) Require predator control when necessary.

4) Mitigate for negative impacts from development and disturbance of PKBM habitat.

This strategy seeks an overall enhancement in the beach mouse's probability of survival as required for some permitting actions for the take of beach mice.

- a) Create and place into permanent conservation easements, beach mouse habitat in areas to maximize connections or potential connections with beach mouse habitat on adjoining properties. In order to provide continuity and stability for the east-west connection along the beach front primary dune system, the County has adopted an ordinance requiring construction set-backs based on the state-determined 1975 set back line, and prohibiting side yard set-back variances south of SR 292. The requirements of this ordinance would be in addition to permanent protection provided by permit applicants.

- b) Establish education programs to inform users (residents, guests, etc.) of the status and biology of beach mice, the importance of dune habitats for beach mice, and the importance of the dune systems to human safety.
- c) Fund a predator control program that specifically targets beach mouse predators.
- d) Seek opportunities for, and fund, beach mouse habitat restoration. This could include efforts to restore dune habitats, efforts to restrict inappropriate dune crossings, efforts to stop inappropriate parking that facilitates inappropriate dune crossings, etc.

5) Maintain the long term viability of the wild populations and the genetic integrity of the PKBM. This strategy seeks to assure that isolation of areas occupied by beach mice does not occur. Absence of gene flow can impair reproduction or other vital population functions. Unexpectedly high or increased rates of disease or mortality also could threaten population viability. Further, the status of the PKBM as a distinct, genetically unique entity should be maintained.

From the Recovery Plan (1987)

Task 1213 – Maintain predator control programs focused on feral cats and red foxes, where needed.

Task 1216 – Install additional boardwalks as needed to protect habitat from pedestrian traffic.

Task 1217 – Evaluate location of parking areas and access trails to beaches, and relocate them if advantageous to preservation of beach mouse habitat.

Task 1218 – Install scavenger-proof receptacles in heavily used areas, and ensure frequent trash pickup service.

Task 131 – Obtain easements to allow beach habitat to be preserved wherever possible.

Task 1311 – Encourage private landowners to maintain habitat.

Task 1312 – Negotiate to protect intervening habitat on privately-owned lands between inhabited beach mouse areas.

Task 131 – Encourage property owners to include restrictive agreements in sales and rental contracts requiring house cats to be confined.

Task 31 – Provide public with information about life history and distribution of beach mice.

Task 32 – Inform public about need for careful sanitation around dwellings to reduce beach mouse predators.

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/critical habitat description

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

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

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

Rivers and various inlets bisect the Gulf and Atlantic beaches and isolate habitats in which the beach mice live. Where populations are not separated by water, human development may have fragmented the ranges of the subspecies. The outer coastline and barrier islands are typically separated from the mainland by lagoons, swamps, tidal marshes, and flatwood areas with hardpan soil conditions. However, these dispersal barriers are not absolute; sections of sand peninsulas may from time to time be cut off by storms and shift over time due to wind and current action. A consequence of coastal development and the dynamic nature of the coastal environment, beach mouse populations are generally comprised of various disjunct populations.

The PKBM was listed with the CBM and ABM as endangered species under the Act in 1985 (50 FR 23872). The PKBM is also listed as an endangered species by the State of Florida. Critical habitat was designated for the PKBM, CBM, and the ABM at the time of listing (50 Code of Federal Regulations [CFR] § 17.95, 50 FR 23872), and revised October 12, 2006 (71 FR 60238). The proposed project is within the area designated as critical habitat for the PKBM.

Since the listing of the PKBM, research has refined our knowledge of beach mouse habitat requirements and factors that influence their use of habitat. The findings most pertinent to the revision of critical habitat and determination (prudence) to revise the current critical habitat designation involve the role of scrub dune habitat. Coastal dune habitat is generally categorized as: primary dunes (characterized by sea oats [*Uniola paniculata*] and other grasses), secondary dunes (similar to primary dunes but also frequently include such plants as woody goldenrod [*Chrysoma pauciflosculosa*], false rosemary [*Conradina canescens*]), and interior or scrub dunes (often dominated by scrub oaks [*Quercus geminata* spp.] and yaupon holly [*Ilex vomitoria*]). The transition from scrub habitat to maritime forest, which is characterized by large trees (pines and oaks), thick leaf litter and dense understory, frequently serves to delineate the northern or landward extent of suitable beach mouse habitat.

The primary and secondary dunes (frontal dunes) were previously considered optimal beach mouse habitat since it is where the mice were thought to reach their highest densities (Blair 1951; Meyers 1983; Holler 1992). Because the scrub dunes appeared to support lower densities of beach mice, this habitat was believed to be of lower quality (Blair 1951; Bowen 1968). As a result, the scrub dunes were not considered to be of great importance to beach mice (Swilling 2000), and little attention was paid to this habitat (Sneckenberger 2001). Recent evidence, however, has indicated that scrub dunes are an important component of beach mouse habitat (Swilling 2000; Sneckenberger 2001). Furthermore, the scrub dunes appear to serve as refugia for beach mice during and after a tropical storm event (Holliman 1983; Swilling et al. 1998), from which recolonization of the frontal dunes takes place (Swilling et al. 1998; Sneckenberger 2001). In addition to providing burrow sites, food resources, and cover, scrub dune habitat also serves as a high-elevation refuge during storm events and as a population source as the frontal and secondary dunes recover (Swilling et al. 1998; Sneckenberger 2001). A conceptual schematic depicting idealized Perdido Key beach mouse habitat and the relative placement of SR 292 in the landscape is shown below (**Figure 4**).

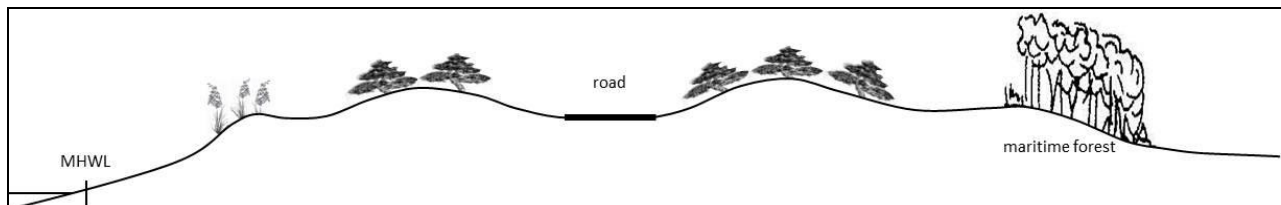


Figure 4. Conceptual cross section schematic of Perdido Key beach mouse habitat relative to the existing roadway.

Hurricanes can severely affect beach mice and their habitat, as tidal surge and wave action overwash habitat, leaving a flat sand surface denuded of vegetation; sand is deposited inland, completely or partially covering vegetation; blowouts between the Gulf of Mexico, bays, and lagoons leave patchy landscapes of bare sand; primary dunes are sheared or eroded; and habitat

is completely breached, creating channels from the Gulf of Mexico to bays and lagoons. Until frontal dune topography and vegetation redevelop, scrub habitat maintains beach mice populations and provides the majority of food resources and potential burrow sites (Lynn 2000; Sneckenberger 2001). While storms temporarily reduce population densities (often severely), this disturbance regime maintains open habitat and retards plant succession, yielding a habitat more suitable for beach mice than one lacking disturbance. The low-nutrient soil of the coastal dune ecosystem often receives a pulse of nutrients from the deposition of vegetative debris along the coastline (Lomascolo and Aide 2001). Therefore, as the primary and secondary dunes recover, beach mice recolonize this habitat readily as food plants develop to take advantage of the newly available nutrients. Recovery times vary depending upon factors such as hurricane characteristics (*e.g.* severity, amount of associated rain, directional movement of the storm eye, storm speed), successional stage of habitat prior to hurricane, elevation, and restorative actions post hurricane. Depending on these factors, recovery of habitat may take from one year to over 50 years (Johnson 1997).

In addition to habitat needs, beach mouse populations at GINS, PKSP, and Gulf State Park (GSP) remain isolated and are vulnerable to natural and anthropogenic factors that may directly reduce beach mouse populations. Maximizing the number of independent self-sustaining populations is critical to species survival. Protection of only a single, isolated, minimally viable population would risk the extirpation or extinction of a species as a result of harsh environmental conditions, catastrophic events, or genetic deterioration over several generations (Kautz and Cox 2001). To reduce the risk of extinction through these processes, it is important to establish multiple protected populations across the landscape (Soule and Simberloff 1986; Wiens 1996).

Based on our current knowledge of the life history, biology, and ecology of the species and the requirements of the habitat to sustain the essential life history functions of the species, we have determined that the PKBM critical habitat primary constituent elements (PCEs) include:

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

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

Critical habitat has been designated on lands that have been determined to be essential to the conservation of the PKBM. An area is considered essential if it possesses one or more of the primary constituent elements and the following characteristics: (1) supports a core population of beach mice; (2) was occupied by PKBM at the time of listing; (3) is currently occupied by the beach mouse and is an area essential to the conservation of the species because it represents an existing population needed for conservation.

Five units were designated for the PKBM spaced throughout its historic range, depending on the relative fragmentation, size, and health of habitat, as well as availability of areas with beach mouse primary constituent elements. The five units are: (1) Gulf State Park Unit, (2) West Perdido Key Unit, (3) Perdido Key State Park Unit, (4) Gulf Beach Unit, and (5) Gulf Islands National Seashore Unit (**Table 3 and Figure 5**). The proposed projects are located on lands designated as critical habitat within the West Perdido Key Unit (Unit-2), Perdido Key State Park Unit (Unit-3), and Gulf Beach Unit (Unit-4), and the project site contains critical habitat primary constituent elements (PCE).

Table 3. Designated critical habitat for the Perdido Key Beach Mouse.

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

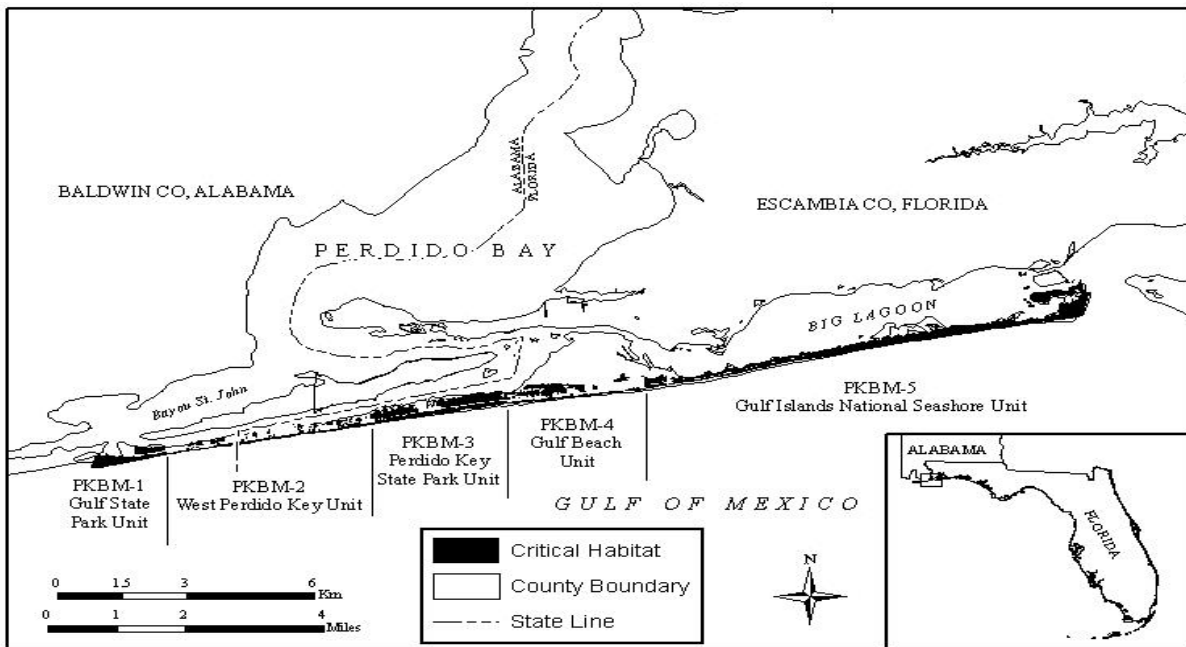


Figure 5. Designated Critical Habitat Units for the Perdido Key Beach Mouse.

The Gulf State Park Unit (Unit 1) consists of 115 acres in southern Baldwin County, Alabama, on the westernmost region of Perdido Key. This unit encompasses essential features of beach mouse habitat within the boundary of Gulf State Park between the west tip of Perdido Key at Perdido Pass east to approximately 1.0 mile west of where the Alabama–Florida State line bisects Perdido Key and the area from the mean high water line (MHWL) north to the seaward extent of the maritime forest. This unit was occupied by the species at the time of listing. PKBM were known to inhabit this unit during surveys in 1979 and 1982, and by 1986 this was the only known existing population of the subspecies (Humphrey and Barbour 1981; Holler et al. 1989). This population was a core population and was the donor site for the reestablishment of PKBM into Gulf Islands National Seashore in 1986. This project ultimately saved Perdido Key beach mice from extinction as the population at GSP was considered extirpated in 1998 due to tropical storms and predators (Moyers et al. 1999). A re-introduction in March 2010 appears to have been successful (See “*Status*” for more explanation) and this unit is once again confirmed as occupied.

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

original critical habitat designation (50 FR 23872). The original designation did not include scrub habitat which we now know is necessary for the long-term persistence of beach mouse populations.

The Unit was overwashed and inundated by storm surge several times during the 2004 and 2005 storm seasons. Dune vegetation was washed away or covered with sand. Habitat recovery efforts are ongoing and include natural and human facilitated dune restoration (sand replacement, sand fence installation, and vegetation planting) and dune protection (walkovers and pedestrian trails). The State of Alabama rebuilt and added facilities (parking and restrooms) on GSP.

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

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

The Unit was overwashed and inundated by storm surge several times during the 2004 and 2005 storm seasons. Structures were destroyed or severely damaged. Dune vegetation was washed away or covered with sand. Habitat recovery efforts were initiated and included natural and human facilitated dune restoration by property owners and local governments and include creation of a sand berm with vegetation planting. The berm has been designed to simulate a natural dune formation.

The Perdido Key State Park Unit (Unit 3) consists of 238 acres in southern Escambia County, Florida. This unit encompasses essential features of beach mouse habitat within the boundary of Perdido Key State Park (Park) from approximately 2.0 miles east of the Alabama–Florida State line to 4.0 mile east of the State line and the area from the MHWL north to the seaward extent of

the maritime forest. Beach mouse habitat in this unit consists of primary, secondary, and scrub dune habitat. Trapping efforts in this area were limited in the past. In 2000, a relocation program began to reestablish mice at Perdido Key State Park. This project is considered a success and the population occupying this unit now considered a core population. This unit provides PCEs 2, 3, 4, and 5 and is essential to the conservation of the species. Improving and/or restoring habitat connections would increase habitat quality and provide more functional connectivity for dispersal, exploratory movements, and population expansion. This unit is managed by the Florida Park Service. Threats specific to this unit that may require special management considerations include artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, and/or a decrease in habitat quality. This unit serves as a re-designation and expansion of a zone included in the initial critical habitat designation (50 FR 23872); however, the zone did not include scrub habitat, which we now know is necessary for the long-term persistence of beach mouse populations.

There were damages to the Unit resulting from the overwash and inundation by storm surge that occurred several times during the 2004 and 2005 storm seasons. Blow outs occurred on the west and east portions of the State Park. Two sections of the SR 292 were washed out. Park facilities were destroyed. Dune vegetation was significantly impacted, but has been restored both passively and actively. Park facilities have been reconstructed in accordance with protected species guidelines.

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

The Gulf Beach Unit was overwashed and inundated by storm surge several times during the 2004 and 2005 storm seasons. Structures were destroyed or severely damaged. Dune vegetation was washed away or covered with sand. Habitat recovery efforts are underway and include natural and human facilitated dune restoration by property owners and local governments and

include creation of a sand berm with vegetation planting. The berm has been designed to simulate a natural dune formation.

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

Unit 5, in its entirety, possesses all five PCEs and is essential to the conservation of the species. However, most of this unit consists of frontal dunes, making the population inhabiting this unit particularly threatened by storm events. Threats specific to this unit that may require special management considerations include artificial lighting, presence of feral cats as well as other predators at unnatural levels, and high recreational use that may result in soil compaction, damage to dunes, and/or a decrease in habitat quality. This unit is managed by the National Park Service–Gulf Islands National Seashore. This unit was included in the initial critical habitat designation (50 FR 23872) as well as the 2006 revision (71 FR 60238).

The majority of this unit was overwashed and inundated by storm surge several times during the 2004 and 2005 storm seasons. Park facilities were destroyed and most of the Park road was destroyed. Dune vegetation was washed away, covered with sand. Habitat recovery efforts were initiated and include natural and human facilitated dune restoration by the GINS. Park structures were reconstructed landward of their former locations and in accordance with protected species guidelines.

Historic Range

Historically, PKBM were documented to occur on Perdido Key in coastal dune habitat between Perdido Bay, Alabama and Pensacola Bay, Florida (50 CFR 23872; Bowen 1968) (**Figure 6**). Historical information indicates that both Pensacola Pass and Perdido Pass were natural inlets. The existing navigation channel project at Pensacola Pass (east end of Perdido Key) was authorized in 1962 and the Perdido Pass navigation channel project was authorized in 1971 (U.S. Army Corps of Engineers 1976; Browder and Dean 1999).

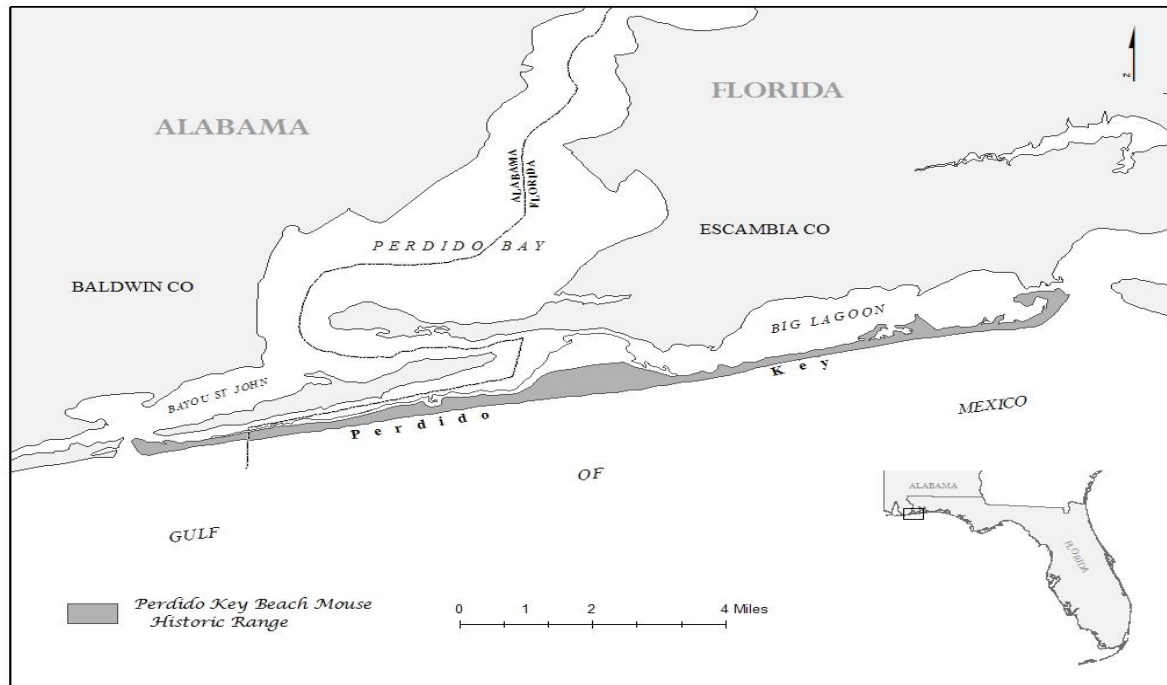


Figure 6. Historic range of the Perdido Key Beach Mouse.

Life history

Behavior

Peromyscus polionotus is the only member of the genus that digs an extensive burrow. Beach mice are semifossorial, using their complex burrows as a place to rest during the day and between nightly foraging bouts, escape from predators, have and care for young, and hold limited food caches. Burrows of *P. polionotus* generally consist of an entrance tunnel, nest chamber, and escape tunnel. Burrow entrances are usually placed on the sloping side of a dune at the base of a shrub or clump of grass. The nest chamber is formed at the end of the level portion of the entrance tunnel at a depth of 23.6 to 35.4 inches (60 cm to 90 cm), and the escape tunnel rises from the nest chamber to within 9.8 inches (2.5 cm) of the surface (Blair 1951). Nests of beach mice are constructed in the nest chamber of their burrows, a spherical cavity about 4 to 6 cm in diameter. The nest comprises about one fourth of the size of the cavity and is composed of sea oat roots, stems, leaves and the chaffy parts of the panicles (Ivey 1949). Beach mice have been found to select burrow sites based on a suite of biotic and abiotic features including dune slope, soil compaction, vegetative cover, and height above sea level (Lynn 2000; Sneckenberger 2001). A shortage of potential burrow sites is considered to be a possible limiting resource.

Like other beach mice, PKBM are nocturnal and forage for food throughout the dune system. Beach mice feed primarily upon seeds and fruits, but have been shown to prey on insects (Moyers 1996). In most cases, seeds and fruits consumed by PKBM are either produced by low-growing, prostrate plants, or become available as fallen seeds (Moyers 1996). Beach mice appear to forage on food items based on availability and have shown no preferences for

particular seeds or fruits (Moyers 1996). Research suggests that the availability of food resources fluctuates seasonally in Gulf Coast coastal dune habitat, specifically that the frontal dunes appear to have more species of high quality foods, but these sources are primarily grasses and annuals that produce large quantities of small seeds in a short period of time. Foods available in the scrub consist of larger seeds and fruits that are produced throughout a greater length of time and linger in the landscape (Sneckenberger 2001). Nutritional analysis of foods available in each habitat revealed that seeds of plant species in both habitats provide a similar range of nutritional quality.

Reproduction and Demography

Studies on *Peromyscus* species in peninsular Florida suggest that these species may achieve greater densities and undergo more significant population fluctuations than their temperate relatives, partially because of their extended reproductive season (Bigler and Jenkins 1975). Subtropical beach mice can reproduce throughout the year; however their peak reproductive activity is generally during late summer, fall, and early winter.

Sex ratios in beach mouse populations are generally 1:1 (Extine 1980; Rave and Holler 1992). Beach mice are believed to be generally monogamous (Smith 1966; Foltz 1981; Lynn 2000). While a majority of individuals appear to pair for life, paired males may sire extra litters with unpaired females. Beach mice are considered sexually mature at 55 days of age; however some are capable of breeding earlier (Weston 2007). Gestation averages 28 to 30 days (Weston 2007) and the average litter size is four pups (Kaufman and Kaufman 1987). Littering intervals may be as short as 26 days (Bowen 1968). Peak breeding season for beach mice is autumn and winter, declining in spring, and falling to low levels in summer (Blair 1951). However, pregnant and lactating beach mice have been observed in all seasons (Moyers et al. 1999).

Apparent survival rate estimates (products of true survival and site fidelity) of beach mice along the Gulf Coasts of Florida and Alabama have demonstrated that their average life span is about nine months (Swilling 2000). Other research indicated that 63% of Alabama beach mice lived (or remained in the trapping area) for four months or less, 37% lived five months or greater, and 2 percent lived 12 to 20 months (Rave and Holler 1992). Less than half (44 percent) of beach mice captured for the first time were recaptured the next season (Holler et al. 1997). Greater than ten percent of mice were recaptured three seasons after first capture, and four to eight percent were recaptured more than one year after initial capture. Beach mice held in captivity have lived three years or more (Blair 1951; Holler 1995).

Habitat and Movement

Beach mice inhabit coastal dune ecosystems on the Atlantic and Gulf Coasts of Florida and the Gulf Coast of Alabama. The dune habitat is generally categorized as: primary dunes (characterized by sea oats and other grasses), secondary dunes (similar to primary dunes but also frequently include such plants as woody goldenrod, false rosemary), and interior or scrub dunes (often dominated by scrub oaks and yaupon holly). Contrary to the early belief that beach mice were restricted to (Howell 1909, 1921; Ivey 1949), or preferred the frontal dunes (Blair 1951; Pournelle and Barrington 1953; Bowen 1968), more recent research has shown that scrub habitat serves an invaluable role in the persistence of beach mouse populations (Swilling et al. 1998;

Sneckenberger 2001). Beach mice occupy scrub dunes on a permanent basis and studies have found no detectable differences between scrub and frontal dunes in beach mouse body mass, home range size, dispersal, reproduction, survival, food quality, and burrow site availability (Swilling et al. 1998; Swilling 2000; Sneckenberger 2001). While seasonally abundant, the availability of food resources in the primary and secondary dunes fluctuates (Sneckenberger 2001). In contrast, the scrub habitat provides a more stable level of food resources, which becomes crucial when food is scarce or nonexistent in the primary and secondary dunes. This suggests that access to primary, secondary and scrub dune habitat is essential to beach mice at the individual level.

Two main types of movement have been identified for small mammals: within home-range activity and long-range dispersal. Such movements are influenced by a suite of factors, such as availability of mates, predation risk, and habitat quality. Movement and home range studies have been conducted for most beach mouse subspecies, but are limited to natural habitat (i.e., research has been conducted on public lands within contiguous beach mouse habitat, not within a development or in a fragmented landscape). Studies of the home range size of beach mice (using trapping and telemetry data) have yielded estimates of 1 to 5 acres (Novak 1997; Lynn 2000). Individual beach mice have been observed traveling extensive distances (several hundreds to thousands of feet up to a mile) during one night (Swilling et al. 1998; Lynn 2000; Moyers and Shea 2002). Beach mice have also been documented crossing two-lane roads within public lands (Gore and Schaefer 1993; Service 2004).

Significant seasonal differences in the movement of ABM have been found, which may be a result of seasonal fluctuations in food availability, food quality, and nutritional needs (Sneckenberger 2001). Santa Rosa beach mice demonstrated an increase in movement as habitat isolation increased suggesting that longer travel distances were needed to obtain necessary resources (Smith 2003). Santa Rosa beach mice also preferred vegetative cover and connectivity, which is likely a behavioral response to increased predation risk in open areas. Thus, while beach mice are able to travel great distances, the travel pathways should have vegetated cover and only a few large gaps or large open areas. Previous connectivity research suggests critical thresholds exist for species persistence in fragmented landscapes (With and Crist 1995). As connectivity becomes more reduced, species ability to move through and between habitats is reduced in a nonlinear fashion.

Population dynamics

Population size

Estimating animal abundance or population size is an important and challenging scientific issue in wildlife biology (Otis et al. 1978; Pollock et al. 1990). A number of different census methods are available to estimate wildlife populations, each with particular benefits and biases. Beach mouse surveys involve relatively standardized scientific methods, common to the study of small mammals. The basic census method for beach mice involves mark-recapture by live trapping. Mice are captured at night in live traps placed along lines or grids. Each captured animal is checked to determine if it has been captured for the first time (unmarked) or if it is a recapture (marked). A five-night minimum trapping period has been standard practice since 1987 for Gulf

Coast beach mice. Data from such surveys have been analyzed using various methods with differing degrees of accuracy and bias, as number of individuals captured, minimum number known alive, number captured per 100 trap nights, or a mathematically modeled statistical population estimate (program CAPTURE). Additionally, tracking tubes have recently been used to estimate the distribution of beach mice within an area.

Since its listing in 1985, PKBM population estimates have never numbered more than 400 to 500 individuals until 2003. Population estimates for trapping efforts yielding captures were generated using Program CAPTURE (Otis et al. 1978). The 2003 population estimate (pre-Hurricane Ivan) was between 500 to 800 PKBM divided among two populations: GINS Area and PKSP (Service 2004). Tracking and trapping surveys have been conducted on PKSP and small sections of GINS since the passage of Hurricane Ivan in 2004 to determine presence or absence of beach mice. In October 2005, a trapping effort of less than one-third of the habitat available on public lands yielded captures of less than 30 individuals. Tracking data from June 2006 indicated that about 25 and 32 % of the available habitat was occupied at PKSP and GINS, respectively (FWC 2007). Tracking data from March 2007 indicated that less than 10 % and about 28 % of the available habitat was occupied at PKSP and GINS, respectively (FWC 2007). Most recent tracking data from the summer of 2010 suggest population abundance and distribution is increasing within GINS and PKSP (FWC 2010a). Additionally, a re-established population at GSP (see “Status”) appears to be growing (FWC 2010b).

Population variability

Population density of beach mice typically reaches peak numbers in the late autumn into spring (Rave and Holler 1992; Holler et al. 1997). Peak breeding period occurs in fall and winter, apparently coinciding with the increased availability of seeds and fruits from the previous growing season. Seasonal and annual variation in size of individual populations may be great (Rave and Holler 1992; Holler et al. 1997). Food supplementation studies showed that *P. polionotus* mouse populations increased when foods were abundant; thus, populations of *P. polionotus* and beach mice appear to be food-limited (Smith 1971; Galindo-Leal and Krebs 1998).

Beach mouse populations fluctuate on a seasonal and annual basis. Attempts to explain population dynamics have revealed an incomplete understanding of the species and its population cycles. It is clear that beach mice, like all rodents, are known for high reproductive rates and experience extreme highs and lows in population numbers. Tropical storms and drought may be associated with depressed beach mouse populations, perhaps resulting from elimination of habitat and food supply reduction. These fluctuations can be a result of reproduction rates, food availability, habitat quality and quantity, catastrophic events, disease, and predation (Blair 1951; Bowen 1968; Smith 1971; Hill 1989; Rave and Holler 1992; Swilling et al. 1998; Swilling 2000).

Population stability

Population viability analysis (PVA) is essentially a demographic modeling exercise to predict the likelihood a population will continue to exist over time (Groom and Pascual 1997). The true

value in using this analytical approach is not to determine the probability of a species' extinction, but to clarify factors that have the most influence on a species' persistence. From 1996 to 1999, the Service's Panama City Florida Field Office funded Auburn University to develop PVAs for two PKBM and two ABM subpopulations (Holler et al. 1999; Oli et al. 2001). The subpopulations modeled consisted of two subpopulations of PKBM, one at GINS-Perdido Key Area and one at Gulf State Park - Florida Point, and two subpopulations of ABM, one at Bon Secour NWR and one at Ft. Morgan State Park. They used a stochastic (random) differential equation (Wiener-drift) model, applied to long term demographic data. The model is "stochastic" because it incorporates the variable effects of the environment upon population change. However, it did not model the effects of hurricanes on the habitat or population of beach mice.

The Oli et al. (2001) analyses indicated that all four subpopulations were at risk of extinction, with habitat fragmentation as the most influential factor. The GINS-Perdido Key Area has the highest risk for extinction; the PKBM had a 100% chance of reaching one individual (becoming functionally extinct) within 21 (mode) or 45 (median) years. At Gulf State Park - Florida Point, the PKBM had a low risk of becoming functionally extinct (1.3%) within 13 to 20 years. However, following Hurricane Opal in 1995 and subsequent predation pressure, the PKBM population at Florida Point was believed to be extirpated in 1998. This localized extirpation clearly demonstrates that while PVAs are useful in determining significant factors in species survival, they have limited use in predicting the time to extinction for a given species.

More recently, the Conservation Breeding Specialist Group (Traylor-Holzer 2004, 2005, 2006) was contracted by the Service to conduct a population and habitat viability analysis (PHVA) on ABM using the Vortex population simulation model (Lacy 1993). The goal was to develop an ABM population model and use the model to assess the status of the ABM habitat and populations and projections for continued existence. This model, unlike the earlier one, includes the potential effects of hurricanes. The PHVA results project the ABM to have a $26.8\% \pm 1.0\%$ likelihood of extinction over the next 100 years. Much of this risk is due to hurricane impacts on ABM populations and habitat which can result in population declines. The model suggests that hurricanes are a driving force for ABM populations, both directly and also indirectly as their impacts interact with other factors, including development of higher elevation (scrub) habitat and predation by cats. Due to the similarities in the subspecies and proximal location, it can be inferred that these factors also have a strong influence on the persistence of PKBM populations. (Again, when reviewing PHVA results, it is crucial that the actual values for the risk of extinction are not the focus of the interpretation. The true value of a PHVA is the ability to compare management strategies and development scenarios, run sensitivity analyses, and determine the main influence(s) on population persistence. However, it is notable that a 5 to 10 percent chance of extinction in 100 years is considered high to very high (Shaffer 1981; IUCN 2001).

Similar to the land use arrangement on Perdido Key, the Fort Morgan Peninsula (occupied by ABM) consists of three areas of public lands separated by two areas of private lands (**Figure 7**) which allow for limited (varied) dispersal between the public lands. The current level of dispersal between public lands through private lands is unknown, and due to development and habitat degradation, dispersal between public lands may not occur in the future. Without

dispersal between public lands through private lands, the PHVA results project the ABM to have a $41.2\% \pm 1.1\%$ likelihood of extinction. If all privately-owned habitat between the public lands is lost, the likelihood of extinction increases to $46.8\% \pm 1.1\%$. Again, it can be inferred that a similar increase in risk of extinction would occur with the PKBM if dispersal could not occur through private lands.

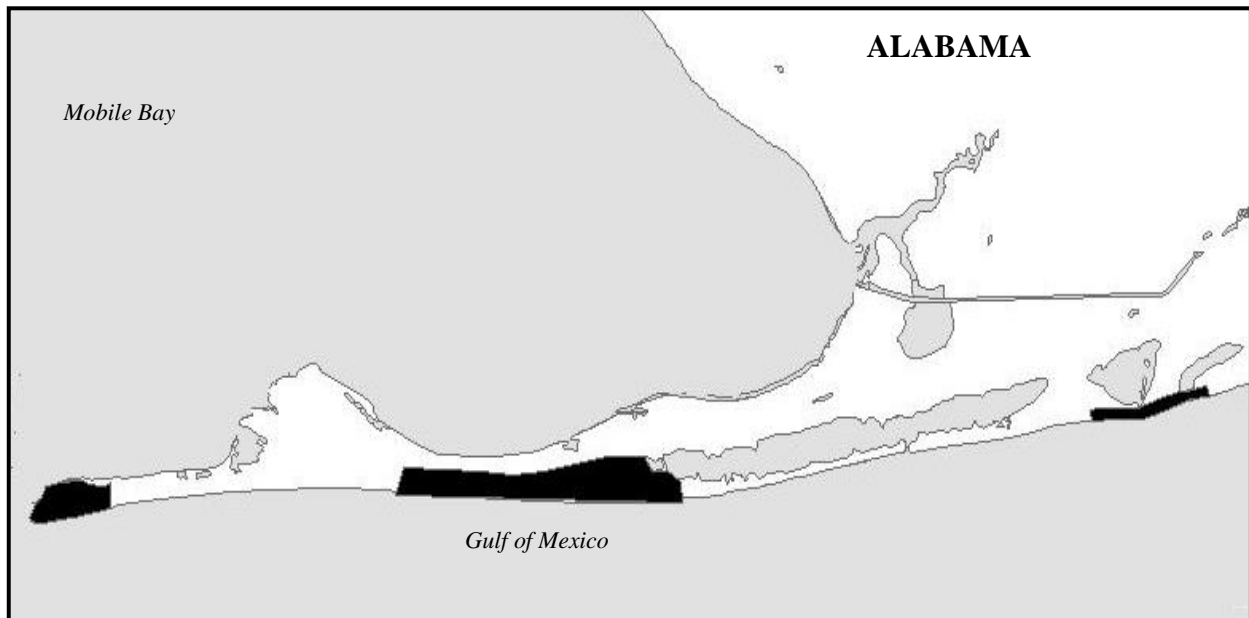


Figure 7. Public lands on the Fort Morgan Peninsula, Baldwin County, Alabama.

Despite the similarities in the subspecies, it is important to note that carrying capacity (K), which was found to be a strong influence on the model, would be different in PKBM. For ABM, K was estimated using maximum ABM density estimates (4.5 to 11.6 ABM per acre) and acres of habitat (2697 acres). Based on current trapping and habitat quality, density estimates for PKBM would likely be lower and remaining PKBM habitat consists of less than 1300 acres, the Vortex model for PKBM would likely project a greater likelihood of extinction.

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

Species which are protected across their ranges have lower probabilities of extinction (Soulé and Wilcox 1980). Beach mouse populations naturally persist through local extirpations due to storm events or the harsh, stochastic nature of coastal ecosystems. Historically, these areas would be recolonized as population densities increase and dispersal occurs from adjacent populated areas. From a genetic perspective, beach mice recover well from population size reductions (Wooten 1994), given sufficient habitat is available for population expansion after the bottleneck occurs.

As human development has fragmented the coastal dune landscape, beach mice can no longer recolonize along these areas as they did in the past (Holliman 1983). As a continuous presence of beach mice or suitable habitat along the coastline is no longer possible and any hurricane can impact the entire range of each subspecies, the probability of beach mice persisting would be enhanced by the presence of contiguous tracts of suitable habitat occupied by multiple independent populations (Danielson 2005). The history of the PKBM illustrates the need for multiple populations (a now extirpated population was the source of the two remaining populations of the subspecies) (Holler et al. 1989; Service 2006a). While maintaining multiple populations of beach mouse subspecies provides protection from total loss (extinction), especially when migration and relocations are possible (Oli et al. 2001), conservation of each subspecies necessitates protection of genetic variability throughout their ranges (Ehrlich 1988). Preservation of natural populations is therefore crucial, as the loss of a population of beach mice can result in a permanent loss of alleles (Wooten 1999). This loss of genetic variability cannot be regained through translocations or other efforts.

Status and distribution

Reasons for Federal listing as an endangered species

The PKBM was listed as an endangered species primarily because of the fragmentation, adverse alteration, and loss of habitat due to coastal development. This subspecies is assigned a high recovery priority because the degree of threat to its persistence is high, it is a subspecies with high level of taxonomic distinctness, and its potential for recovery is great if threats can be eliminated or minimized. Recovery of the PKBM is in conflict with economic activities, a factor which further elevates its priority ranking.

The threat of development-related habitat loss continues to increase. Additional contributing factors include low population numbers, habitat loss from other causes (including hurricanes), predation (fox, coyotes, and cats), and competition by animals associated with human development (house mice), and regulatory weaknesses regarding coastal development.

Coastal development

Habitat loss and fragmentation associated with residential and commercial real estate development are important factors contributing to the endangered status of beach mice (Holler 1992; Humphrey 1992; James 1992; Stout 1992). Beachfront development along the Gulf Coast of Florida began in the 1950s and continues to this day. Coastal development has fragmented all the subspecies into disjunct populations. Isolation of habitats by imposing barriers to species movement is an effect of fragmentation that equates to reduction in total habitat (Noss and Csuti 1997). These factors, along with the influx of development-related predators such as the domestic cat and competition with house mice, probably caused the extinction of the Pallid beach mouse (Humphrey 1992).

Isolation of small populations of beach mice reduces or precludes gene flow between populations and can result in the loss of genetic diversity. Demographic factors such as predation (especially by domestic cats), diseases, and competition with house mice, are intensified in small, isolated

populations, which may be rapidly extirpated by these pressures. Especially when coupled with events such as storms, reduced food availability, and/or reduced reproductive success, isolated or fragmented populations may experience severe declines or extirpation (Caughley and Gunn 1996). Contiguous tracts or functionally connected patches of suitable habitat are essential to the long-term conservation of beach mice.

Along with the rest of northwest Florida, the impact of recreation and tourism on the economy and real estate development continues to expand on Perdido Key. By the late 1990s distinct patterns of development had emerged on Perdido Key. Several areas consisted primarily of single family houses - the waterfront lots on Old River Road, the interior portion of the Key, the northeast section of the Key, and Pirates Cove in the center portion of PKSP. The area near the “curve” on Perdido Key Drive had developed at higher densities and heights with a mix of commercial, multi-family residential and some single-family detached houses. The dominant residential development in this area was low-rise (up to four stories). The far west portion of the Key has single-family and low-rise multi-family structures as well as some of the largest (and tallest) multi-family developments. Most of the development on the Key occurred prior to 1990. Between 1990 and 1994, the majority of development was single-family dwellings. Since 1995, there has been an increase in the number of multi-family developments on the Key, typically being developed at the maximum density allowed. Into the early 2000’s development or re-development continued. Single-family residences and small multi-family complexes sold for construction of high-rise/high density complexes (PKNP 1997 as referenced in Escambia County 2003) and this trend continues into 2007. While this trend is still prevalent, construction has slowed because of the existing economic situation.

Following documentation of PKBM on private lands in 2004, an interagency working group formed to address the new and redevelopment that was ongoing at Perdido Key. The Service, FWC, and Escambia County worked together to create other options to offset impacts to PKBM and their habitats from the development. A Conservation Strategy for the PKBM outlined the measures needed to conserve the subspecies (FWC et al. 2005). A Business Plan (RCF 2005) determined the funding needed to implement the Conservation Strategy (Conservation Fund). Finally, an Intergovernmental Agreement between the three levels of government was signed in December of 2005. The agreement establishes the Conservation Fund for implementing PKBM conservation activities and outlines the coordination and processes by which the Conservation Fund will be managed.

The Conservation Strategy outlines the goals and objectives specific to the PKBM. The conservation objectives for the strategy are to create, enhance, and maintain Perdido Key beach mice and habitats in PKSP, GINS, and GSP; and restore, enhance, and maintain beach mice and contiguous PKBM habitat in the primary, interdunal, secondary, and scrub dune systems within and between GINS, PKSP, and GSP.

Specific strategies that address the objectives are:

- 1) Conduct surveys to determine the current status and distribution of PKBM.** This strategy provides baseline information needed to determine priorities and actions required to address the other conservation strategies.

2) Restore and maintain the dune systems within GINS, PKSP, and GSP, and the areas between. This strategy seeks to re-establish, enhance, and maintain contiguous PKBM habitat in the primary, interdunal, secondary, and scrub dune systems that have been degraded through human actions or natural disasters.

- a) Emphasize re-establishment of the dune system.
- b) Establish dune building devices (e.g. fencing) to encourage dune growth.
- c) Restore the topography of the primary dune system.
- d) Plant the rebuilt dune system with appropriate vegetation.
- e) Plan for and provide, appropriate beach access that is consistent with protection of the dune system.

3) Minimize the impacts of development and use of PKBM habitat.

This strategy seeks to maintain the best possible conditions for beach mice in an area being impacted by development.

- a) Maintain beach mouse habitat in a natural state (i.e., minimize the development footprint habitat).
- b) Maintain remaining beach mouse habitat in blocks (i.e., patches) as large and contiguous as possible, and in areas to maximize connections or potential connections with beach mouse habitat on adjoining properties.
- c) Place remaining beach mouse habitat in permanent conservation easements where feasible.
- d) Use dune topography and plants native to beach mouse habitat as the primary landscaping features.
- e) Have covenants, deed restrictions, or similar permanent instruments established for properties developed in beach mouse habitat that would be designed to reduce mortality or other negative impacts to occupied beach mouse areas. Such instruments would:
 - i) Prohibit free-ranging pets outdoors.
 - ii) Require the use of animal-proof garbage containers to prevent attracting house mice and beach mouse predators.
 - iii) Require outdoor lighting that meets the criteria of the International Dark-Sky Association to reduce the impacts of development lighting.

- iv) Prohibit use of pesticides or pest control in outside areas.
- v) Limit the use of herbicides or fertilizers in beach mouse habitat.
- vi) Require boardwalks or similar dune walkover structures for beach access across the dune habitat.
- vii) Require predator control when necessary.

4) Compensate for negative impacts from development and disturbance of PKBM habitat.

This strategy seeks an overall enhancement in the beach mouse's probability of survival as required for some permitting actions for the take of beach mice.

- a) Create and place into permanent conservation easements, beach mouse habitat in areas to maximize connections or potential connections with beach mouse habitat on adjoining properties. In order to provide continuity and stability for the east-west connection along the beach front primary dune system, the County has adopted an ordinance requiring construction set-backs based on the state-determined 1975 set back line, and prohibiting side yard set-back variances south of SR 292. The requirements of this ordinance would be in addition to permanent protection provided by permit Applicants.
- b) Establish education programs to inform users (residents, guests, etc.) of the status and biology of beach mice, the importance of dune habitats for beach mice, and the importance of the dune systems to human safety.
- c) Fund a predator control program that specifically targets beach mouse predators.
- d) Seek opportunities for, and fund, beach mouse habitat restoration. This could include efforts to restore dune habitats, efforts to restrict inappropriate dune crossings, efforts to stop inappropriate parking that facilitates inappropriate dune crossings, etc.

5) Maintain the long term viability of the wild populations and the genetic integrity of PKBM. This strategy seeks to assure that isolation of areas occupied by beach mice does not occur. Absence of gene flow can impair reproduction or other vital population functions. Unexpectedly high or increased rates of disease or mortality also could threaten population viability. Further, the status of the PKBM as a distinct, genetically unique entity should be maintained.

Distribution

Since the late 1970s, PKBM have existed as isolated populations along its historic range (16.9 miles). The effects of Hurricane Frederic (1979) coupled with increased habitat fragmentation due to human development led to the extirpation of all but one population of PKBM. The less than 30 individuals at Gulf State Park –Florida Point were once the only known existing population of PKBM (Holler et al. 1989). Beach mice from this site were used to re-establish PKBM at GINS between 1986 and 1988; (Holler et al. 1989). Then in 1999 the population at

Florida Point was considered extirpated (Moyers et al. 1999). In 2000, ten PKBM (5 pairs) were relocated from GINS to Perdido Key State Park. In February of 2001, this relocation was supplemented with an additional 32 PKBM (16 pairs). The PKBM were released on both the north and south sides of SR 292 in suitable habitat. Two years of quarterly survey trapping indicated that the relocations of PKBM to PKSP were successful and this was considered an established population (Service 2004). PKBM were also trapped on private land between GINS and PKSP in 2004, increasing documentation of current occurrences of the mouse (Lynn 2004). Based on the similarity of habitat between these areas and the rest of Perdido Key, as well as the continuity of the habitat, the mouse is believed to inhabit other private properties where suitable habitat exists north and south of SR 292. The PKBM is considered to occur on 40 percent of Perdido Key (1,143 of 2,949 acres) (**Table 4**).

Table 4. Areas and acreages of Perdido Key and Perdido Key beach mouse habitat in Florida and Alabama.¹

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

¹Data calculated by U.S. Fish and Wildlife Service Panama City, Florida using 2004 State of DOQQ aerial photography, 2005 parcel data from Baldwin County, AL and 2005 parcel data from Escambia County, Florida. Acres of habitat are revised with each ITP issuance (latest ITP issued in April 2009). ²The Gulf State Park population is currently considered extirpated.

Status

The listing of PKBM was based on data collected in 1983 to 1984, and at that time beach mice were recovering from the effects of Hurricane Frederick in 1979. Following Hurricane Frederick, estimated population numbers based on trapping were 13 PKBM found at one location (GSP). Just prior to listing, only one PKBM was captured in trapping surveys, this again being at GSP. The effects of Hurricane Frederic (1979) coupled with increased habitat fragmentation due to human development led to the extirpation of all but one population of PKBM.

Since listing, all populations of PKBM have been extirpated at some time. Through translocation efforts, at least one population has remained viable to present day. Less than 30 individuals at GSP were once the only known existing population of PKBM (Holler et al. 1989). Beach mice from this site were used to re-establish PKBM at GINS between 1986 and 1988; (Holler et al. 1989), and PKBM from GINS were translocated to PKSP in 2000. By that time, the GSP population was considered extirpated (Moyers et al. 1999). The Perdido Key-wide population estimate of PKBM just prior to Hurricane Ivan in 2004 was between 500 and 800 individuals.

The status of PKBM populations was uncertain following Hurricane Ivan and the subsequent active 2005 hurricane season (Hurricanes Cindy, Dennis, Katrina, and tropical storm Arlene). Hurricane Ivan's landfall track was located between the cities of Mobile, Alabama and Pensacola, Florida with the eye passing about 16 miles west of the Alabama-Florida line. Rated as a Category 5 (Saffir-Simpson scale) hurricane while in the southern Gulf of Mexico, the storm dropped to a Category 3 as it made landfall. Strong winds in the northeast quadrant of the storm impacted the eastern Alabama coast and western Florida panhandle coast, including Perdido Key. High water marks in the area were reported as 10 to 15 feet above sea level. Significant damage occurred to structures, roadways, and coastal habitat throughout the area. The storm affected the entire historic range of the PKBM in the following ways:

- a. Tidal surge and wave action overwashed habitat leaving a flat sand surface denuded of vegetation.
- b. Sand deposition completely or partially covered vegetation.
- c. Blowouts occurred between the Gulf and bay/lagoon leaving a patchy landscape of bare sand, dune, and scrub habitat.
- d. The frontal portion of the primary dune habitat was sheared but landward areas were relatively unaffected.
- e. Vegetation was killed by salt spray, and
- f. Islands were breached entirely and channels from the Gulf to bay/lagoon were created.

Tracking and trapping surveys from 2004 to 2009 at PKSP and GINS documented the presence of beach mice (GINS 2004, 2005; FWC 2004, 2005, 2006, 2007). In October 2005, following the active hurricane seasons of 2004 and 2005, a trapping effort of less than one-third of the habitat available on public lands yielded captures of less than 30 individuals. Tracking data from June 2006 indicated that about 25 and 32 percent of the available habitat was occupied at PKSP and GINS, respectively (FWC 2007). Trapping at PKSP and GINS in March 2007 was cancelled after one night after the capture of only one mouse (a fatality) and very limited sightings of beach mouse sign (tracks, burrows) (FWC 2007). Trapping conducted in April of 2008 was more encouraging with the capture of 35 mice at GINS (Sneckenberger 2008 pers. comm.). However, no mice were captured on PKSP (Himes 2008 pers. comm.). Tracking data from summer of 2009 suggested population abundance and distribution was increasing within GINS and PKSP (FWC 2010a). Trapping at GINS and PKSP in spring 2010 generally confirmed this with PKBM widely distributed at both public lands. However, abundance at GINS was lower than anticipated.

In the spring of 2010 PKBM were released at GSP. The source population was captive mice from Brevard and Palm Beach Zoos. A total of 48 PKBM were released in the southwestern portion of GSP and were fitted with radio transmitters. Within a few days, most of the transmitters were found in a red fox den near the Carib condominiums to the north of the bridge. By the time two adults and five red fox pups were removed by USDA employees, 13 mice remained. Monitoring continued daily for the life of the transmitters (3 weeks) and monthly trapping continued over the summer and fall. A 3-day trapping effort at the end of September 2010 yielded 51 individual PKBM, including 8 of the originally released mice. Mice were found throughout habitat at GSP south of Highway 182 (FWC 2010b). A 3-day trapping effort the week of May 7, 2012, continued to find PKBM distributed throughout habitat south of Highway

182. Two reproductively-active male PKBM were found north of Highway 182 (Gore pers. comm. 2012). The release appears to be a success and PKBM are occupying all three public lands for the first time since being listed as endangered.

When suitable habitat is available, beach mice will readily re-establish unoccupied habitat. However, the amount of available and suitable habitat has been reduced and habitat fragmentation has increased due to development since the time of the federal protection listing in 1985.

Recovery Criteria

The currently approved Recovery Plan for the three beach mouse Gulf Coast subspecies was published in 1987 (U.S. Fish and Wildlife Service 1987). The primary recovery objectives identified in the Recovery Plan are: 1) stabilization of populations by preventing further habitat deterioration, and 2) re-establishment of populations in areas where they were extirpated. For each of the subspecies to be considered for down listing to threatened, there must be a minimum of at least three distinct self-sustaining populations in designated critical habitat with at least 50 percent of the critical habitat being protected and occupied by beach mice. Recovery actions or “tasks” from the Recovery Plan relevant to the proposed action are provided below.

Task 1213 – Maintain predator control programs focused on feral cats and red foxes, where needed.

Task 1216 – Install additional boardwalks as needed to protect habitat from pedestrian traffic.

Task 1217 – Evaluate location of parking areas and access trails to beaches, and relocate them if advantageous to preservation of beach mouse habitat.

Task 1218 – Install scavenger-proof receptacles in heavily used areas, and ensure frequent trash pickup service.

Task 131 – Obtain easements to allow beach habitat to be preserved wherever possible.

Task 1311 – Encourage private landowners to maintain habitat.

Task 1312 – Negotiate to protect intervening habitat on privately-owned lands between inhabited beach mouse areas.

Task 131 – Encourage property owners to include restrictive agreements in sales and rental contracts requiring house cats to be confined.

Task 31 – Provide public with information about life history and distribution of beach mice.

Task 32 – Inform public about need for careful sanitation around dwellings to reduce beach mouse predators.

The approved Recovery Plan for the Perdido Key beach mouse is not up-to-date in regard to species status and threats, and as PKBM critical habitat has been revised, the criterion involving a percentage of occupied and protected critical habitat may also warrant modification. Since the Recovery Plan was finalized, all populations of PKBM have been extirpated at one time or another. Through translocation efforts, at least one population has remained viable to present day. Currently, PKBM are present on three public land areas and on private lands. The second criterion (minimum of 50% of critical habitat is protected and occupied by mice) has not been met for either the original critical habitat or the recently revised critical habitat.

A five-year status review of the PKBM was completed by the Service in August 2007 (Service 2007). Recommendation included the following actions:

1. Establish a full time beach mouse recovery coordinator position.
2. Revise the Recovery Plan.
3. Implement a population and habitat assessment and monitoring program.
4. Prepare an emergency response plan.
5. Acquire lands.
6. Conduct research including -corridor size persistence, HCP success, and genetic studies.
7. Conduct translocations when needed.
8. Prepare materials and conduct outreach and education.
9. Conduct PKBM response to hurricane investigation.
10. Complete habitat quality improvement projects.

In 2011, Escambia County and FWC applied for and received a Section 6 Recovery Land Acquisition Grant of \$2,967,022 from the Service to acquire and manage a private parcel strategic to the conservation of the PKBM. The acquisition process is still underway.

Threats to Perdido Key beach mice

Coastal Development on Perdido Key

The Florida Legislature enacted the Local Government Comprehensive Planning and Land Development Regulation Act (Florida Statute Chapter (F.S. Ch.) 163, pt. II) which mandated the preparation of comprehensive plans and unified land development codes for all units of local government. The intent was to provide orderly growth management rules and regulations. As part of the Comprehensive Plan, density or dwelling caps were established for certain areas including Perdido Key.

According to the Escambia County, Florida Comprehensive Plan, the land use on Perdido Key is designated as mixed use (MU-4). This category provides for a complimentary mix of residential, commercial and tourism (resort) related uses. About 16% of the land may be developed in resort/tourism related uses and in small scale commercial uses. Site specific densities are pursuant to the requirements of the zoning districts where a site is located (R1PK, R2PK, R3PK, C1PK, CCPK, CGPK, and PRPK). Each zoning district has its own height and building footprint limitations, which vary from one zoning district to the next. Density transfers may not

be made to parcels south of Perdido Key Drive (SR 292). The proposed developments are in the CCPK commercial core districts.

Pertinent limitations include:

- 1) A maximum density of 13 dwelling units per acre;
- 2) pervious area must be at least 25 percent of the total parcel area; lot coverage shall not exceed 19 to 25 percent depending on height of building;
- 3) there shall be a side yard of at least 10 feet;
- 4) no building shall exceed a height of 18 stories (plus two for parking);
- 5) there shall be a maximum of 2 parking spaces for every single family residence, 1.5 parking spaces for each multi-family dwelling, and one space for every 500 sq ft of floor area of a retail/commercial building;
- 6) xeriscape landscaping; and
- 7) artificial exterior lighting must not affect adjacent properties or sea turtles.

In the 1997 Settlement Agreement with Department of Community Affairs (DCA), a dwelling cap was issued for Perdido Key. The terms were that the maximum allowed units on the Key were 7,150 dwelling units and 1,000 lodging units. As of September 14, 2009, Development Orders/Agreements for 6,850 dwelling units have been issued or “reserved” (**Table 5**). Only 149 lodging units have been issued or reserved (leaving 651 units) (**Table 5**). The majority of the projects are located on the eastern part of the Key between the bridge and River Road and the west end of Perdido Key Drive near the Alabama border. Relative to the rest of Escambia County from 2003 to 2008, Perdido Key accounted for approximately 10% (138 DO of 1,445 DOs County-wide) of the Development Orders/Agreements. The amount of development on Perdido Key in recent years has dropped off significantly with the downturn in the economy.

Table 5. Residential, commercial and lodging dwelling unit on Perdido Key as of June 2012.

<http://www.myescambia.com/Bureaus/DevelopmentServices/DevelopmentMonitoring.html>

DEVELOPMENT ON PERDIDO KEY	
DWELLING UNITS (DU)	
TOTAL EXISTING DWELLING UNITS ON THE GROUND	3812
TOTAL DWELLING UNITS WITH APPROVALS OR DEVELOPMENT RIGHTS BUT NOT BUILT	2315
DWELLING UNITS WITHOUT DEVELOPMENT ORDERS BUT HAVE DEVELOPMENT AGREEMENT	523
DWELLING UNIT DATA SUMMARY	
TOTAL DWELLING UNITS AVAILABLE	7150
MINUS EXISTING ON THE GROUND	3812

MINUS DWELLING UNITS W/ APPROVAL OR DEVELOPMENT RIGHTS	2315
MINUS UNITS WITH DEVELOPMENT AGREEMENTS	523
TOTAL DWELLING UNITS LEFT-AVAILABLE	500

LODGING UNITS (LU)	
TOTAL LODGING UNITS AVAILABLE	1000
MINUS LODGING UNITS- EXISTING AND APPROVED	149
MINUS LODGING UNITS WITH DEVELOPMENT AGREEMENTS	200
TOTAL LODGING UNITS REMAINING	651

Based on the current development cap on Perdido Key and the number of Development Orders issued by Escambia County, it could be expected that up to 30 projects within PKBM habitat may submit ITP applications to the Service. While development was increasing in 2005-06, development has considerably slowed so that expected project completions would now occur within 5 to 10 years. Some of these projects would be redevelopments and construction could take place without a Service permit if the project remains in the existing footprint. Others that are located on undeveloped land may also require a permit from the Service. Thus, depending on the development scenario (smaller vs. larger) and the current market the cumulative impact may include some loss of direct and indirect revenue to the local, county and State economy which would be generated by the construction, occupancy and maintenance of larger projects. Revenue could be generated from the smaller projects and may increase valuation trends in housing and rental units on the Key.

Hurricanes

Hurricanes are known to affect beach mouse population densities in various habitats. Mechanisms for effects include direct mortality of individuals, relocation/dispersal, and subsequent effects of habitat alterations (that impact such factors as forage abundance/production and substrate elevation). Habitat impacts can be widespread, encompassing the range of the subspecies.

Hurricanes can severely affect beach mice and their habitat, as tidal surge and wave action overwash habitat, leaving a flat sand surface denuded of vegetation; sand is deposited inland, completely or partially covering vegetation; blowouts between the Gulf of Mexico, bays, and lagoons leave patchy landscapes of bare sand; primary dunes are sheared or eroded; and habitat is completely breached, creating channels from the Gulf of Mexico to bays and lagoons. Until frontal dune topography and vegetation redevelop, scrub habitat maintains beach mice populations and provides the majority of food resources and potential burrow sites (Lynn 2000; Sneckenberger 2001).

Pries et al. 2009 found that frontal dune habitat occupancy by the Santa Rosa beach mouse went from 100% prior to Hurricane Ivan in 2004 to 60% after the storm. Occupancy of scrub habitat remained relatively constant at around 75%. Approximately 68% of the frontal dune area

occupied by beach mice was lost, compared to a loss of only 15% of the scrub dunes. Scrub area may provide more stable habitat for beach mice than frontal dunes. Scrub dunes can serve as refugia if mice can move from the frontal dunes to scrub dunes during hurricanes (Swilling et al. 1998), and are a source for recolonization of frontal dunes following hurricanes.

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

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

In addition to the overall change in post Hurricane Opal distribution of ABM, the average percent of newly marked beach mice individuals increased from 14% for the three trapping periods before the storm to an average of 26.7% for the same interval post hurricane (Swilling et al. 1998). The average for the three trapping periods immediately following was even higher, at 42.7% of the individuals captured. This increased presence of new individuals reflected increased reproduction (Swilling et al. 1998). A statistical analysis of the data indicated that the number of females exhibiting signs of reproduction was higher than normal (18.9 % higher). Similar results were also found at Topsail Hill Preserve State Park. Four to five months following Hurricane Opal, all female CBM captured were pregnant or lactating (Moyers et al. 1999). Trapping six months after the hurricane, 52% of captured CBM were new unmarked beach mice.

Although hurricanes can significantly alter PKBM habitat and population densities in certain habitats, some physical effects may benefit the subspecies. Hurricanes may function to break up population subgroups and force population mixing (Holler et al. 1999). The resultant breeding

between members of formerly isolated subgroups increases genetic heterogeneity and could decrease the probability of genetic drift and bottlenecks.

Habitat Loss and Degradation

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

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

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

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

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

Maximizing the number of independent self-sustaining populations is critical to species survival. Protection of single, isolated, minimally viable populations risks the extirpation or extinction of a species as a result of harsh environmental conditions, catastrophic events, or genetic deterioration over several generations (Kautz and Cox 2001). To reduce the risk of extinction through these processes, it is important to establish multiple protected populations across the landscape (Soule and Simberloff 1986; Wiens 1996).

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

The presence of vegetative cover reduces perceived predation risk of foraging beach mice, and allows for normal movements, activity, and foraging patterns. Foraging in sites with vegetative cover is greater and more efficient than in sites without cover (Bird 2002). Beach mice have also been found to select habitat for increased percent cover of vegetation, and decreased distance between vegetated patches (Smith 2003). Wilkinson et al. (2010) noted that the Santa Rosa beach mouse (SRBM) preferred to cross narrow open sand gaps (less than 8.38 m (27.49 ft) wide) to relatively large patches of vegetation ($\geq 11.75 \text{ m}^2$) (126.43 ft^2) during new moon phases when the predation risk is presumed to be low. A preliminary test of predictive models for the SRBM found that barrier island occupancy may be constrained more by predation risk, hurricane damage, and human impacts than by strict dependence on a particular preferred habitat (Wilkinson et al. 2009).

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

Genetic viability

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

In 1995, the Service contracted with Auburn University to conduct genetic analysis of post-re-establishment gene structure in PKBM (Wooten and Holler 1999). Results of the work for PKBM determined the following: (1) founder effect (from Gulf State Park to GINS) did impact the GINS population and loss of rare alleles and allele frequency shifts were noted; (2) a low to moderate level of overall genetic divergence was observed; (3) data suggest that some effects of genetic drift were mediated by continued transfer of individuals; (4) levels of heterozygosity were unexpectedly high given recent history; (5) average level of relatedness among individuals is high which may portend future inbreeding related problems and no substantial evidence of existing close inbreeding was observed in the data; and 6) the overall level of microsatellite variation retained in the GINS population was higher than anticipated.

Recommendations to manage the genetic variability within PKBM include: (1) preserving the natural population to the maximum extent possible since the loss of the GSP population resulted in the permanent loss of alleles; (2) using the GINS population as a donor for re-establishment of other populations because of the retention of a substantial amount of genetic variation; and (3) including transfers between donor and re-established populations in re-establishment plans (Wooten and Holler 1999). In addition, translocations should be accomplished in pairs.

Artificial Lighting

Artificial lighting increases the risk of predation and influences beach mouse foraging patterns and natural movements as it increases their perceived risk of predation. Foraging activities and other natural behaviors of beach mice are influenced by many factors. Artificial lighting alters behavior patterns causing beach mice to avoid otherwise suitable habitat and decreases the amount of time they are active (Bird et al. 2004).

Wildlife lighting is recommended for projects proposed on Perdido Key. These are light sources that emit long wavelength light, highly directed light or that do not emit significant light in the spectral range of 550 to 620nm. These long-wavelength light sources include low pressure sodium vapor lamps 8000 lumens or less, bug lamps 480 lumens or less, amber and red LEDs (light emitting diodes), true red neon, and some color-filtered compact fluorescent lamps that are housed in a full cut off or fully shielded fixture. Fixtures should be mounted as low in elevation (height) for the needed purpose. The Service continues to work with public and private land owners concerning light pollution on Perdido Key.

Predation

Beach mice have a number of natural predators including coachwhip (*Masticophis flagellum*) and corn snakes (*Elaphe guttata guttata*), pygmy rattlesnake (*Sistrurus miliarius*), and Eastern diamondback rattlesnake (*Crotalus adamanteus*), short-eared (*Asio flammeus*) and great-horned owls (*Bubo virginianus*), great blue heron (*Ardea herodias*), northern harrier (*Circus cyaneus*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*) skunk (*Mephitis mephitis*), weasel (*Mustela frenata*), and raccoon (*Procyon lotor*) (Blair 1951; Bowen 1968; Holler 1992; Novak 1997; Moyers et al. 1999; Van Zant and Wooten 2003). Predation in beach mouse populations that have sufficient recruitment and habitat availability is natural and not a concern. However, predation pressure from natural and non-native predators on populations already stressed from a variety of threats may result in the extirpation of small, local populations of beach mice.

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

In response to increasing depredation of sea turtle nests by coyote, fox, and raccoon, a multi-agency cooperative effort was initiated in northwest Florida in 1996. Ten Federal and State agencies have provided funding and/or in-kind services to implement a control program on coastal public lands across northwest Florida. The program is ongoing, and a permanent USDA position was established in northwest Florida to conduct the control work.

Climate Change

The varying and dynamic elements of climate science are inherently long term, complex and interrelated. At present, the science is not exact enough to precisely predict when and where climate impacts will occur. Although we may anticipate the direction of change it may not be possible to predict its precise timing or magnitude. These impacts may take place gradually or episodically in major leaps.

According to the Intergovernmental Panel on Climate Change Report (IPCC 2007), warming of the earth's climate is "unequivocal," as is now evident from observations of increases in average global air and ocean temperatures, widespread melting of snow and ice, and rising sea level. The IPCC Report (2007) describes changes in natural ecosystems with potential wide-spread effects on many organisms, including marine mammals and migratory birds. Scientific evidence indicates a rapid and abrupt climate change, rather than the gradual changes that have been currently forecasted (IPCC Report 2007), posing a significant challenge for fish, wildlife, and plant conservation. Species' abundance and distribution are dynamic, relative to a variety of factors, including climate. As climate changes, the abundance and distribution of fish and wildlife will also change. Highly specialized or endemic species are likely to be most susceptible to the stresses of changing climate. Based on these findings and other similar studies, the Fish and Wildlife Service will incorporate potential climate change effects as part of their long-range planning activities (Service 2009 a, b).

Climate change at the global level drives changes in weather at the regional level, although weather is also strongly affected by season and by local effects (e.g., elevation, topography, latitude, proximity to the ocean). Temperatures are predicted to rise from 2°C to 5°C for North America by the end of this century (IPCC 2007). Other processes to be affected by this projected warming include rainfall (amount, seasonal timing, and distribution), storms (frequency and intensity), and sea level. The 2007 IPCC report found a 90 percent probability of 7 to 23 inches of sea level rise by 2100. The exact magnitude, direction, and distribution of these changes at the regional level are not well understood or easy to predict. Seasonal change and local geography make prediction of the effects of climate change at any location variable. Current models project a wide range of regional changes.

Florida is one of the areas most vulnerable to the consequences of climate change. Climatic changes in Florida could amplify current land management challenges involving habitat fragmentation, urbanization, invasive species, disease, parasites, and water management (Pearlstine 2008). Global warming will be a particular challenge for endangered, threatened, and other "at risk" species. It is difficult to estimate, with any degree of precision, which species will be affected by climate change or exactly how they will be affected. The Service will use Strategic Habitat Conservation planning, an adaptive science-driven process that begins with explicit trust resource population objectives, as the framework for adjusting our management strategies in response to climate change (Service 2006b).

Increased sea levels, resulting from global warming, have accelerated shore line erosion rates in the Gulf of Mexico (Twilley et al. 2001). As the coastal shore line of Perdido Key erodes

gradually or rapidly during storm events, the frontal dune habitat of PKBM can be significantly degraded and reduced. A diminished frontal dune enables a hurricane storm surge to inundate secondary dunes and swales, killing vegetation and any burrowed mice. Perdido Key has relatively few high elevation dunes to provide refugia for PKBM during (and in the aftermath of) storms. The ability of PKBM to re-populate Perdido Key after a destructive hurricane is predicated on the successful re-establishment of dune vegetation. If late-succession dune species that occupy the higher elevation scrub dunes and provide refuge for beach mice during hurricanes (Pries *et al.* 2009) are damaged during an intense hurricane, it is unlikely they will have time to re-establish themselves between narrowing hurricane cycles (Feagin *et al.* 2005).

Analysis of the species/critical habitat likely to be affected

The property encompassing the proposed condominium development occurs on the south side of SR 292, in the primary and secondary dune system. Suitable habitat for the PKBM occurs on the property, as well as on lands to the north, east and west. No formal trapping surveys for PKBM have occurred at the project site. However, suitable habitat for the PKBM was observed during onsite inspections. Service and FWC personnel have documented presence of PKBM at GINS and PKSP in 2007 and 2009. Service personnel have also observed signs of beach mouse burrows and tracks near the Coquina Caye in 2005. The Action Area includes areas within the geographic range occupied by the subspecies at the time of listing, provides essential connectivity between public lands, and provides habitat for natural movements, behaviors, and long-term persistence of PKBM.

The Action Area includes all habitat within the PKBM critical habitat unit of West Perdido Key (refer to **Species/critical habitat description** for a detailed description of units). Beach mouse habitat within the critical habitat unit provides the primary constituent elements necessary to sustain the essential life history functions of the subspecies. These include: 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; 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; and, functional, unobstructed habitat connections that facilitate genetic exchange, dispersal, natural exploratory movements, and recolonization of locally extirpated areas.

ENVIRONMENTAL BASELINE

Status of the species within the Action Area

The Action Area for the project encompasses approximately 147 acres of frontal and scrub dune habitat.

While no long-term formal trapping surveys for PKBM have been conducted on the proposed development site, suitable habitat for the PKBM was observed during onsite inspections, and it is presumed to be occupied by PKBM. Beach mice currently occupy PKSP which is immediately adjacent to units of the Action Area. The Action Area provides essential connectivity between

two public land population areas (GSP and PKSP), provides habitat for use on a permanent basis, natural movements and behavior, refugia during storm events, and recolonization. This area is essential to the conservation of the species.

The beach mice and their habitat within the Action Area face the same threats as those identified for the subspecies as a whole. However, this area is particularly susceptible to habitat fragmentation and other threats from development as it is entirely in private ownership. While PKBM continue to inhabit PKSP and GINS, the populations are still recovering from the effects of the 2004 and 2005 hurricanes. Based on these data, we anticipate that PKBM may also be found but in reduced numbers within the Action Area including the subject developments. Areas with recovering or intact dune habitat remain especially important habitat for the PKBM.

Factors affecting species environment within the Action Area

Coastal development

The greatest factor threatening the status of PKBM is coastal development and the human-associated perturbations that result in habitat loss and fragmentation, excessive ambient artificial light, landscaping with non-native vegetation, free-roaming cats, and high numbers of natural predators. Habitat loss and fragmentation is one of the chief reasons for the precipitous decline of many endangered species (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. In the case of the PKBM, fragmentation began with the first active human use of the island when Fort McRee was constructed in 1831 and greatly increased as Perdido Key emerged as a beach resort development in the 1970's and 1980's (Work et al. 1991). Areas of most intense development (multi-family, high rises) occur along the curve of SR 292 within the Action Area. This fragmentation of habitat increases the obstacles faced by the PKBM when natural events such as hurricanes and predation occur, and likely contributed to the severe decline of the PKSP population following Hurricanes Ivan, Dennis, and Katrina. 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 PKBM, are especially susceptible to extinction from habitat loss because of their limited distributions. The prime example of the loss of a similar species is the extinction of the pallid beach mouse in Florida (Humphrey 1992).

Some mobile species can integrate a number of habitat patches (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). Studies on the ABM indicate that beach mouse 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 PKBM (*e.g.*, minimum width, amount of cover), we have evidence that PKBM use undeveloped habitat surrounding single-family residences and blocks

of habitat preserved within multi-family developments with HCPs. However, if a species is incapable of surviving in developed areas or in a fragmented landscape, then it is destined for eventual extinction (Noss and Csuti 1977). 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 PKBM movement depends upon a number of factors, such as location and size, and can include roads, parking lots, high-density residential developments, highly lit areas, and holding ponds. Fragmentation from SR 292 may have been a factor in the lack of detection of beach mice in frontal dunes during early trapping efforts at PKSP (*e.g.* separation of frontal dunes from scrub dunes (Meyers 1983). However, trapping/tracking surveys indicate that the existing two-lane SR 292 does not pose an impermeable barrier to the PKBM, although movement across the road may be inhibited. In 2010, PKBM were able to build up densities south of SR 292 and eventually cross the road and repopulate scrub dune habitat north of the road (**Figure 8**). The viability of populations may depend on enough movement of individuals among and between habitat patches to balance extirpation from other habitat patches (*e.g.*, if the GSP population had been able to move to another patch of habitat to the east, or if other populations in local habitat patches had been able to migrate to GSP [as a source population], then the GSP population would not have been extirpated after Hurricane Frederick). If essential habitat requisites are eliminated or habitat connectivity is severed, PKBM populations may be at increased risk. Therefore, PKBM requires habitat connectivity that allows the species to move between habitat patches containing vital resources (*e.g.* food, cover, burrowing habitat, and higher elevation refugia).

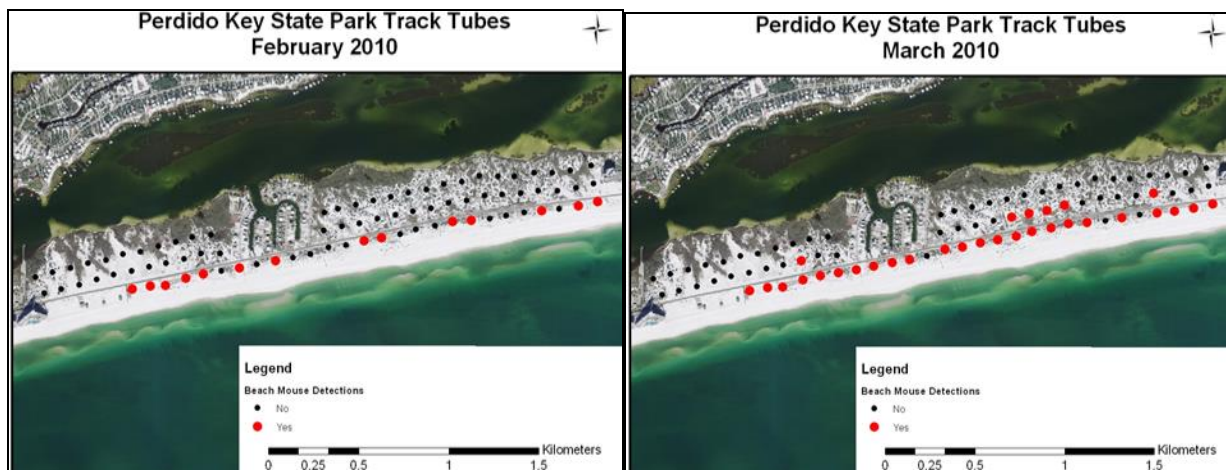


Figure 8. Track tube evidence of PKBM crossing the existing two-lane SR 292 (FWC 2010a).

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 scrub 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, such as dispersal and exploratory movements, as well as gene flow, to maintain genetic variability of the population within fragmented or isolated areas (Service 2009c).

The effects of barriers or loss of habitat connectivity on PKBM 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 beach mouse movement than a fully developed single-family subdivision, which in turn would impede beach mouse movement more than single-family homes on large lots. The cumulative effects of barriers are what finally extinguish populations in most cases (Noss and Csuti 1997).

How such development activities will affect the PKBM 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 PKBM is not totally understood. However, fragmentation can affect the biological integrity of the PKBM through isolation and possible local extirpation. It is believed that fragmentation contributed to the loss of PKBM at Florida Point (GSP) and the pallid beach mouse (Humphrey 1992; Lynn 2000).

Development of Perdido Key with residential homes, large condominiums, and commercial retail has undoubtedly reduced the amount of historic natural habitat available to the PKBM 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 PKBM behavior, attraction of non-native predators such as the domestic/feral cat, and fragmentation of PKBM habitat.

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; Wilkinson et al. 2010). 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). Efforts are being planned to address beachfront lighting within the range of the subspecies. Escambia County has drafted a wildlife lighting ordinance (not yet formally approved) that may help reduce artificial lighting impacts on beach mouse habitat in the Action Area.

Following documentation of PKBM on private lands in 2004 an interagency working group formed to address the new and re-development occurring on Perdido Key. The Service, FWC,

and Escambia County worked together to create other options to offset impacts to PKBM and their habitats from the development. A Conservation Strategy for the PKBM outlined the measures needed to conserve the subspecies (FWC et al. 2005) (see Status and Distribution, Coastal development above for more detail). A Business Plan (RCF 2005) determined the funding needed to implement the Conservation Strategy (Conservation Fund). Finally, an intergovernmental agreement between the three levels of government was signed in December 2005. The agreement establishes the Conservation Fund for implementing PKBM conservation activities and outlines the coordination and processes by which the Conservation Fund will be managed. As part of the Intergovernmental Agreement, Escambia County adopted an ordinance that prohibits building or placing structures seaward of the 1975 Coastal Construction Control Line. This is estimated to permanently protect an additional 5 acres of PKBM habitat.

Provided coastal development projects address the objectives and strategies identified in the Conservation Strategy, incidental take of PKBM can be minimized with the ability to compensate for unavoidable losses. Escambia County has the responsibility of managing the PKBM Conservation Fund and conducting compliance evaluation. While land acquisition is a component of the Conservation Strategy, funding for land acquisition within the Conservation Fund is minimal, keeping the cost of the initial and annual contributions low. Consequently, avoidance and minimization on each project site to the extent practicable must be accomplished before using the Fund to offset impacts.

Following each of the hurricanes in 2004 and 2005, the Service informed Federal and State agencies and local governments and landowners that repair and rebuilding of structures damaged by the storms within their original footprint would not likely adversely affect PKBM. No additional coordination was required. Most initial response and recovery actions were handled in this manner. As of September 2009, the Service has issued 76 “no permit needed” letters and 44 “permit needed” letters relative to the Endangered Species Act for projects on private property in Perdido Key, Florida. In response we have received 21 requests for a permit or federal agency consultation from the Service. Eleven have completed the process and have received permits or been covered under the federal consultation process. The remaining proposed projects are in various stages of the Service’s incidental take permit (section 10 of the Act) process or in consultation with a federal permitting agency (section 7 of the Act).

Table 6 estimates the PKBM habitat affected by developments (proposed and permitted) and other human actions within the Action Area. These are located within and outside of the Action Area and are important in the Service’s overall evaluation of the subspecies current status.

Table 6. Formal consultations/biological opinions completed or in progress for PKBM both within and outside of the Action Area.

PROJECT	YEAR	IMPACT (Habitat/critical habitat/individuals)
GINS Dune Protection (outside Action Area)	2000	0.01 acre
PKBM translocation to PKSP	2000	≤ 3 beach mice
PKBM supplemental translocation to PKSP	2003	≤ 3 beach mice
FEMA Berm Orange Beach, AL (outside Action Area)	2003	0.14 acre
PKBM FWS scientific collecting permit program	2004- 2005	1 beach mouse per 400 trap-nights per area
Florenzia Development	2005	3.5 acres
PKSP Re-build	2005	1.99 acres
FEMA Berm Emergency consultation	2005	Consultation not complete
GINS road rebuild (outside Action Area)	2005	1.7 acres
Magnolia West Development	2006	5.2 acres
Palazzo Development	2006	0.58 acre
Searinity Development	2006	0.32 acre
Retreat Development	2006	0.21 acre
Bond Residence	2006	0.17 acre
Paradise Island Development	2007	0.91 acre
SR 292 Turn Lane at River Road	2007	0.58 acre
Escambia County (Perdido Key) beach nourishment	2008	6.5 miles of frontal dunes
3- condo ITP (Loreli, Marquesas, and Island Club)	2008	0.95 acre
Seabreeze Condominiums	2009	0.37 acre
Spanish Key Parking Lot	2010	0.28 acre
Perdido Key Fire Station	2010	0.43 acre
4-condo ITP (Whalen, Evans, Carbone, and Stern (within Action Area)	2012	0.53 acre
Lost Key Development	2012	26.1 acres
Escambia County HCP (Perdido Key-wide) ¹	Submitted 6/2011 Modified 11/2011	66 acres over 30 years

¹Not included in existing baseline but under contemporaneous review.

Public Lands

Perdido Key State Park. This 247-acre state park is centrally located on Perdido Key and includes approximately 238 acres of designated critical habitat for the PKBM (Unit-3). It is managed by the Florida Park Service, Florida Department of Environmental Protection. SR 292 divides the frontal dunes from the scrub dunes within PKSP. The park boundaries exclude the SR 292 ROW. One of three core populations of PKBM occurs within PKSP. This population was severely depleted in size and range following Hurricanes Ivan, Dennis, and Katrina; the population has gradually rebounded as coastal habitat recovered.

Tropical Storms, Hurricanes, and Hurricane Recovery Actions

Post-Hurricanes Ivan/Dennis/Katrina (Category 3 storms) habitat assessments combined with subsequent trapping and tracking tube efforts at PKSP and GINS indicated that PKBM distribution and numbers were severely reduced as a result of the storms. An estimated 80% of PKBM habitat was impacted by storm surge, high winds, sand erosion, and salt spray. In 2005, the anticipated rate of PKBM recovery after these storms was unknown and believed to be largely dependent on the response of storm-impacted habitats and their connectivity to remaining habitat patches, pre-storm PKBM distribution, post-storm development and/or reconstruction efforts, post-storm dune restoration actions, and the frequency, extent and/or intensity of future storm events. No major storms have impacted the area since 2005. By 2010, tracking tube data suggested that PKBM distribution was recovering, likely the result of the improving condition of storm-impacted habitat and connectivity facilitated by a Gulf-side vegetated berm constructed between GINS and PKSP.

Large tropical storms and hurricanes will continue to impact PKBM habitat throughout its range in the future. To anticipate the habitat effects of future hurricanes, the Service conducted a modeling exercise using FEMA 100-year flood hazard data and 2009 LIDAR (Light Detection and Ranging) elevation data to predict inundated/uninundated habitat resulting from hurricane storm surge. Using this model, the Service estimates that PKBM may be restricted to 272 acres of uninundated habitat within the Action Area during catastrophic storms. This is approximately 76.4% of the 356 acres of uninundated habitat available throughout the PKBM's range. Within the project area, there are approximately 15.1 acres of uninundated habitat (5.6% of available uninundated habitat in the Action Area). Some minimum amount of dune habitat that is suitable for PKBM is necessary to allow beach mice to find refugia during these events and to persist over the long-term (Pergams et al. 2000).

Hurricane restoration efforts conducted by local, State, and Federal agencies are still underway in the Action Area. Some efforts may affect the PKBM and/or may adversely modify areas of critical habitat while other efforts are intended to restore habitats for PKBM.

The Federal Emergency Management Agency (FEMA) funded Escambia County to construct an emergency berm to provide storm protection along the Gulf of Mexico beachfront. The berm was completed in 2005 and was planted in 2006. This effort has expedited natural dune restoration which enhances beach mouse habitat within the Action Area. This vegetated berm

may have provided essential connectivity between GINS and PKSP, enhancing the repopulation of PKSP.

Storm-surge overtopped SR 292 during Hurricane Ivan and caused extensive pavement destruction and scour from weir-like flow traveling down the road's north side and undercutting the road (Douglass et al. 2004) (**Figure 9**). Chunks of asphalt and the old clay road base were widely distributed throughout PKBM habitat in West Perdido Key (Unit-2), PKSP (Unit-3) and Gulf Beach (Unit-4). Repairs were made in 2004-2005 and most debris was removed from PKBM habitat using FHWA funding. An emergency consultation was completed in 2005. Harvey (pers. comm. 2012) indicated that impacts to PKBM habitat persist to this day, including an approximately 48,000 cubic-foot pile of asphalt and sand left by the contractor, and areas with underlying clay and asphalt chunks (overwash plains north of PKSP's West Use Area and on the east end of the park near the Florencia development). Restoration plantings in these areas have been less successful than at other locations in the park.



Figure 9. Hurricane damage to SR 292 and nearby habitat for the Perdido Key beach mouse in 2004.

Escambia County is currently in the final permitting stages of a beach nourishment project for Perdido Key. The project would cover approximately 4 miles of beachfront along county and private lands, not including state and Federal lands. The Service completed an endangered species consultation for the project in 2008. The beach nourishment project is likely to enhance beach mouse habitat by providing an additional buffer to the dune habitats from storm events.

The Pensacola Naval Air Station (NAS) has proposed to dredge their navigation channel resulting in the need to place 8 million cubic yards of dredged material that is beach compatible. Because of cost, Perdido Key is the closest area to receive the material. Receiving areas include the Perdido Key Gulf beachfront (in lieu of the County implementing their project described above), PKSP, and GINS, Escambia County. The project could result in the placement of dredged material on 16 miles of beachfront including private, County, State, and Federal lands. The Navy has received their permits to complete the project. The Service completed an endangered species consultation for the project in 2007.

Non-Native Species

Any activities that modify coastal dune habitats (e.g., road building, land grading and development) can create avenues for non-native species, such as cogongrass (*Imperata cylindrica*) and fire ants (*Solenopsis invicta*) to invade PKBM habitats and impact local PKBM populations. Following Hurricane Ivan, FDOT brought in Bahama rock for shoulder stabilization in the West Use Area of PKSP that was contaminated with cogongrass. The FPS is treating it annually to reduce its coverage but expect eradication will take several years (Harvey 2012 pers. comm.). Cogongrass can replace native plants which are important in maintaining the structure and continuity of PKBM habitat, and provide food resources. Fire ants have been known to attack beach mice in live traps and may have impacts on nesting females and their pups (Service 2009c). 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 PKBM populations (see Threats to Perdido Key beach mice, Predation). Although outside the Action Area, in 2010 during the release of captive-bred PKBM in GSP, red foxes denning under Highway 182 were associated with the loss of 35 mice within a span of just a few days. There is potential for similar incidents throughout the Action Area.

Deepwater Horizon Oil Spill

The Deepwater Horizon Oil Spill (Oil Spill) that resulted from the April 20, 2010 explosion on the Deepwater Horizon oil platform off the coast of Louisiana had the potential to significantly impact the coastal ecosystem of the Gulf Coast. It will be a number of years until the damage has been fully assessed. However, at this time, it appears that the dune environment was not significantly harmed. There has been minor damage to the habitat of PKBM that resulted from response efforts in the form of dune destruction and trampling. These impacts were minimized through consultation with the Service, land managers, and Escambia County. There has also been some oil deposited in the dunes of Perdido Key during periodic summer storms, most notably tropical storm Alex. The low tropical activity during the hurricane season of 2010 enabled the damaged well to be capped, and cleanup efforts have been able to proceed almost unabated. Response efforts will continue as needed. Impacts to PKBM are being minimized through a continuing emergency consultation with the U.S. Coast Guard and will soon transition to non-emergency (standard) consultation.

Other Factors

Increases in sea level, temperature, precipitation and storms are expected with global climate change, as described above (see Threats to Perdido Key beach mice, Climate Change). Although the implications for changes to the Florida Gulf coast are far from clear, the possible effects of global warming/sea level rise may have significant impacts on PKBM 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 sea level and/or storm activity along the Gulf coast.

EFFECTS OF THE ACTION

This section is an analysis of the effects of the project on the species and critical habitat. This section addresses the future direct and indirect effects of the project, including the effects of any interrelated and interdependent activities. Our determination of total effects to the species and critical habitat in the “Conclusion” section is the sum of the effects evident in the baseline plus effects of the action and cumulative effects. The proposed action is likely to result in adverse effects to the PKBM and its habitat. In addition to effects realized by these species at the project site, we also evaluated effects to designated critical habitat.

Factors to be considered

The PKBM is found throughout its historic range in areas of suitable habitat and where other threats have been managed, controlled or ameliorated. Our recent estimates indicate that about 1,288 acres of suitable habitat exists in Florida (1,141 acres) and Alabama (147 acres). While various population estimates have been attempted for beach mouse populations and in select areas, differing sample methods and data gaps have rendered a total population estimate difficult. Similarly, because of fluctuations in PKBM populations, loss of a specific habitat area will represent different numbers of PKBM depending on season of the year, recent storm events, food supply, and other factors. Since impacts cannot be assessed accurately in fluctuating populations on the sole basis of number of PKBM affected, a corresponding measure is the amount of PKBM habitat lost due to a project, and subsequently the PKBM that depend on that habitat. Because of this population fluctuation, the exact number of PKBM will not be precisely determined during the project analysis. However, since the impact to PKBM will be determined by loss of habitat, the direct impact to habitat will be provided.

The proposed project will occur within habitat that is used by beach mice. Long-term and permanent impacts from the expanded roadway could include: loss of beach mice (*e.g.* at both the individual and population levels) and/or loss or alteration of their habitats including designated critical habitat (and the loss of essential PCEs) for the PKBM. Short-term and temporary impacts could include altered beach mouse behavior, movement, and dispersal. The proposed roadway and the subsequent human use (drivers, bicyclists, pedestrians, and recreational users) are anticipated to have direct and indirect impacts to beach mice.

The proposed work would result in heavy site demolition, site preparation and construction of residential structures, parking, a dune walkover and other associated development facilities and amenities. Direct impacts may consist of crushing individual beach mice, excavating or burying a beach mouse burrow, and loss of PKBM habitat. Indirect impacts may consist of artificially altering the behavior of beach mice on the property.

Proximity of Action: The development project would occur in habitat occupied or used by PKBM and designated as critical habitat. Beach mice spend their entire life cycle within the coastal dune system with peak reproduction periods occurring during late winter and early spring.

Distribution: PKBM would be found in suitable habitats on the project site covering about 0.92 acre of primary and secondary dunes.

Timing: The development activities may occur at any time of year. Beach mice reproduce year round with a peak in the late winter and early spring. Activities impacting habitat during peak breeding season could have a greater immediate impact on the mice than other times of year, but the long-term effect on beach mice populations would be the same as carry capacity and habitat connectivity would be diminished on a permanent basis.

Nature of the Effect: The direct loss of individual beach mice may be detrimental to the genetic diversity of the remaining population because population numbers are low already from the recent hurricanes. However, from a genetic perspective, beach mice are able to recover from population size reductions given sufficient habitat is available (Wooten 1994). Additionally, when population numbers are low as they are now, the subspecies is more vulnerable to stochastic events, such as hurricanes. The direct loss of habitat (0.43 acre) may contribute to habitat fragmentation in the Action Area. While the loss of habitat will adversely affect the species, we must also consider the importance of the habitat to the conservation of the species. Properly managing habitats to determine and protect habitat connections invaluable for mouse movements and expansion provides a greater benefit to the mouse than simply protecting all available habitat. While the project may reduce these important areas, connectivity will not be appreciably reduced. Additionally, the permanent protection of the remaining habitat (0.49 acre) through conservation easements on the sites will reduce future threats to the PKBM within the Action Area and aid in maintaining habitat connections. The contribution of monies to the PKBM Conservation Fund also will allow for additional conservation activities pursuant to the Conservation Strategy.

Critical habitat may be adversely affected by the proposed action through a direct reduction in the amount of habitat available to support the PKBM by providing food resources, burrow sites, and protection from predators, including both primary and secondary dunes. Additionally, the ability of the Action Area to provide functional, unobstructed habitat connections may be reduced.

Duration: The ITP would be in effect for 30 years. Following the initial impacts to PKBM during site demolition, preparation, and construction, the need for long-term maintenance of the habitat would be essential to recovery of the PKBM.

Disturbance frequency: Following the initial impacts to PKBM during site demolition, preparation, and construction the remaining habitat onsite would be permanently protected. Therefore, the proposed actions would only result in a one-time disturbance to the PKBM within the Action Area.

Disturbance intensity and severity: The proposed action would permanently alter 0.43 acre of beach mouse habitat within the Action Area consisting of a total of 147 acres of habitat, or less than one percent of the habitat available in the Action Area. Additionally, an increase in recreational use of the beach may occur from the pedestrian occupation of the site which may

result in additional disturbance or behavior modification of individual mice. Temporary impacts (0.15 acre) are expected to be limited to the construction phase of the project, which would be expected to be completed in one to one and a half years. The severity would be reduced by implementing many of the conservation measures in the proposal, including but not limited to, maintenance and restoration of dune habitats, construction of a dune walkover, the installation of educational signs, and installation of silt fencing to clearly mark limits of construction.

Analyses for effects of the action

Coastal habitats in the Action Area consist of the Gulf beachfront including the wet and dry unvegetated beach, developing foredunes, interdunal swales, and primary, secondary, and scrub dunes. Of these habitats, the primary, secondary, and scrub dunes, would be inhabited by PKBM and the other habitats may be used by PKBM on a daily or seasonal basis for foraging and movements. Frontal dunes and scrub dunes are considered to be habitats of high importance to the beach mouse (Sneckenberger 2001; Service 2006a). Higher elevation habitats provide necessary refugia for PKBM to survive flood events. Maintaining connectivity to these areas is likewise essential to the long-term survival and recovery of beach mice. Figure 10 shows the location of elevated habitats (uninundated) relative to SR 292 as determined using LIDAR data and 100-year flood elevation maps to predict storm surge. Except for the loss of PKBM habitat in the footprint of the condominium structure and the parking area, all PKBM habitat on the properties would be maintained. Thus, 0.43 acre of habitat used by PKBM for burrowing, feeding, shelter, or dispersal would be lost by the development (**Table 7**). This loss of PKBM habitat amounts to less than one percent of the Action Area.

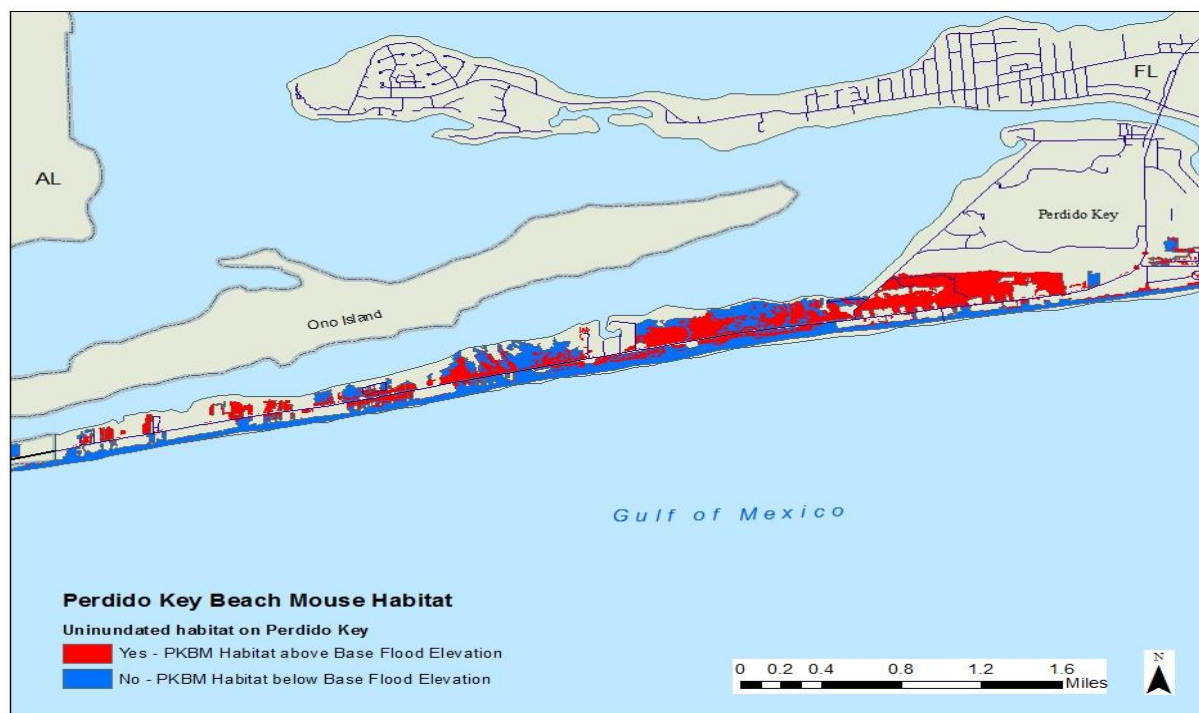


Figure 10. Effects of 100-year storm surge on Perdido Key beach mouse habitat. Areas above base flood elevation are uninundated storm refugia.

Table 7. Proposed impacts to PKBM habitat associated with the proposed Coquina Caye development.

Habitat Statistics	Impacts (acres)
Total area	1.21
Open beach	0.29
PKBM habitat	0.92
Permanent impacts	0.43
Temporary impacts to be restored	0.15
Avoided PKBM habitat	0.34
PKBM habitat in conservation easement	0.49

All beach mouse habitat within the proposed development sites is designated as critical habitat (**Table 8**). The 0.92 acre of PKBM habitat contains the constituent elements listed in **Species/critical habitat description** section.

Table 8. Perdido Key beach mouse critical habitat within Action Area and developments, Escambia County, Florida.

PKBM Habitat	Action Area (acres)			Coquina Caye (acres)		
	Total	To be permanently impacted	Percent permanently impacted	Total	To be permanently impacted	Percent permanently impacted
Beach mouse habitat (regardless of critical habitat designation)	147	0.43	<1%	0.92	0.43	47%
Critical habitat	147	0.43	<1%	0.92	0.43	47%

Activities that may destroy or adversely modify critical habitat include, but are not limited to:

(1) Actions that would significantly alter dune structure, soil compaction levels, and substrate characteristics. Such activities could include, but are not limited to, excessive foot traffic, the use of construction, utility, or off-road vehicles in beach mouse habitat, and sand contamination from gravel, clay, or construction debris. These activities, even if temporary, could alter burrow construction, reduce the availability of potential burrow sites, and degrade or permanently alter beach mouse habitat. *Analysis:* The proposed action may result in temporary soil compaction from the use of heavy construction equipment, and the temporary contamination of sand from construction debris. However, the conservation measures proposed include restoration of habitat after completion of the construction phase of the project. Escambia County “Sand” ordinance 2000-45 prohibits the use of clays or other soils that may have a negative effect on the natural light sands found on Perdido Key.

(2) Actions that would significantly alter the natural vegetation of the coastal dune community. Such activities could include, but are not limited to, allowing non-native species to establish in the area, landscaping with plants that do not reflect habitat type prior to disturbance, landscaping that yields excessive leaf litter. These activities could alter beach mouse foraging activities and degrade or destroy beach mouse habitat. *Analysis:* The proposed project will destroy 47% and

temporarily alter 16% of the PKBM habitat onsite; however, this is less than 1% of the remaining PKBM suitable habitat on Perdido Key. Proposed conservation measures include restoration and planting of 0.15 acre of temporary impacts with native Escambia County dune plants.

(3) Actions that would significantly alter the natural predator/prey balance of the coastal dune community. Such activities could include, but are not limited to, allowing unprotected refuse in the area, and allowing or encouraging feral cat communities. These activities could alter beach mouse foraging activities and the availability of foraging resources and directly alter beach mouse survival. *Analysis:* *The applicant has proposed conservation measures to avoid and minimize impacts of heightened predation. These include; prohibiting cats on the premises, the elimination of waste receptacles from all outdoor common areas with the exception of one in the pool area, the use of predator proof refuse containers, and the granting of access to the site for animal control.*

(4) Actions that would significantly alter natural lighting. Such activities could include, but are not limited to, allowing artificial lighting that does not comply with wildlife-friendly lighting specifications. These activities could alter beach mouse foraging activities, increase predation upon beach mice, and reduce the use of otherwise suitable beach mouse habitat. *Analysis:* *To address potential effects of the lighting associated with the Coquina Caye condominium development, the applicant has proposed to institute wildlife-friendly lighting for the parking lots, common areas, and exteriors of the structures. Additionally, all windows and glass doors will use appropriate materials to meet allow 45% light transmittance from inside to outside. An Escambia County Wildlife Lighting Ordinance has been proposed, although not yet approved. Wildlife lighting is considered to meet nocturnal wildlife specifications. While designed primarily to address sea turtle nesting and hatchling disorientation, one benefit of wildlife lighting for terrestrial wildlife (as compared to other artificial lighting) is the use of shielding to reduce the amount of light scatter, or the area impacted by the lighting. The behavior of nocturnal rodents is known to be influenced by light - likely as a perceived risk of predation (Orreck et al. 2004; Wilkinson et al. 2009). Bird et al. (2004) demonstrated that artificial light (even if wildlife-friendly) altered foraging behavior of beach mice in ways that affected resource acquisition (e.g. choice of foraging patch and length of foraging time). Despite the use of wildlife-friendly lighting, we can expect beach mice to have a localized avoidance response to artificial illumination. The applicant's proposed use of low pressure sodium lights along the roadway will result in indirect effects to the PKBM wherever suitable habitat is illuminated. Beach mouse avoidance of lighted areas will also contribute to the barrier effect of the road.*

(5) Actions that would directly result in a significant loss of habitat and/or elimination or degradation of functional pathways within and among critical habitat units. Such activities could include, but are not limited to residential or commercial development, road widening, or land clearing. These activities eliminate beach mouse habitat, reduce connectivity necessary for gene flow, reduce all necessary resources such as food, mates, burrow sites, refugia from storms; and decrease space available to conduct natural behaviors, thereby limiting their ability to persist. *Analysis:* *The proposed action would permanently alter 0.43 acre of beach mouse habitat within PKBM Unit 2 consisting of a total of 147 acres of habitat. This is less than 1 percent of the habitat available in Unit 2. However, proposed conservation measures to maintain 10 foot habitat corridors (minimum) on the east and west boundaries of the project, as well as*

maintenance of the primary and secondary dune habitat, would aid in the maintenance of connectivity. An additional conservation measure in the form of a conservation easement, on 0.49 acre of onsite beach mouse habitat would also result in the permanent protection of these important functional pathways.

The Applicants would provide for long-term assurances of PKBM conservation by implementing the HCP which would result in the minimization of impacts to PKBM habitats and mitigation of impacts, including existing structure demolition, site preparation, condominium and associated facilities (parking and pool) construction and footprint and the occupancy and use of the developments by people. Minimization efforts include relocation of the development landward of the existing development footprint, design of the parking area to provide additional native landscaping, reduction of pool and deck surface area, a dune walkover, protection and connection of habitat before, during and after construction. Post construction mitigation includes restoration of existing dune areas disturbed by previous development and hurricanes, and the project construction. Mitigation includes monitoring of the beach mouse population onsite following construction completion, controlling the type of pet allowed on the premises and free-roaming pets, fence installation to protect habitat and allow animal movements, native landscaping, a one-time endowment and subsequent annual unit assessments to the PKBM Conservation Fund, and permanent protection of remaining habitat onsite through a conservation easement. However, even with these measures, impacts to beach mice are expected to occur from the project site demolition, preparation, construction and use by humans. The activities are expected to directly or indirectly adversely affect beach mice and/or their habitat.

Direct and Indirect Impacts

Project activities including land clearing, site preparation, construction activities and operation have the potential to adversely affect beach mice of any life stage including those able to leave their burrows and search for food as well as those still in the burrow and dependent on a lactating female. Beach mice disturbed and able to leave the immediate area are subject to increased pressures from predation while they search out a new territory or move from one burrow to another. Pregnant and lactating females that are disturbed may abort their current litter or leave young in burrows. Effects to beach mice are expected to be a result of the following: (1) direct loss or injury of adult and sub-adult beach mice from physical injury caused by use of heavy equipment and placement of building materials during clearing, site preparation, construction activities, and operation of the condominium; (2) adult female beach mice aborting litters caused by physical injury or stress due to disturbance from heavy equipment use during construction activities; (3) loss of newly born or juvenile beach mice left alone in the burrow resulting from the loss of a lactating adult female; and (4) loss of adult, juvenile, and newborn beach mice resulting from the temporary and/or permanent destruction or damage to coastal habitat used by the PKBM for foraging, nesting, and refugia. In addition, beach mouse habitat may be affected by foot traffic from workers present on-site and increased human use of beach mouse habitat. No mortality data are available to document the effects of similar construction work in beach mouse habitat. Loss of PKBM individuals may occur.

In addition to direct impacts to individual mice, the permanent loss of PKBM habitat from the developments reduces the amount of habitat available to support the subspecies on the project

sites. The majority of the habitat to be lost is frontal dune habitat. While frontal dune habitat is important to the conservation of PKBM, the areas where the proposed projects are located have been previously developed and the habitat is fragmented. For beachfront projects there is always a trade-off between conserving the primary dunes to maintain the beachfront connection and conserving secondary dunes that provide the higher elevation habitats. In order to conserve more secondary dune habitat the project footprint would have to be moved significantly seaward. This would not be feasible because of various factors including requirements of coastal control line permitting by the County and the State and building construction standards.

The quality of and connectivity between PKBM habitats is an important factor in maintaining and facilitating beach mouse conservation. This is particularly true for species under the stresses of habitat loss and fragmentation (Fahrig and Merriam 1994). Functional pathways allow for natural behavior such as dispersal and exploratory movements, as well as gene flow to maintain genetic variability of the population within fragmented or isolated areas. To that end, contiguous tracts or functionally connected patches of suitable habitat are essential to the long-term conservation of PKBM.

The PKBM habitat on the proposed project site is not isolated. PKBM habitat is found on the adjacent properties to the north, east, and west of Coquina Caye. Currently, the proposed development consists mainly of beach mouse habitat outside the footprint of the previous structure. In addition to the PKBM habitat conserved seaward of the structure, the 10-foot (minimum) side setbacks combined with neighboring properties would result in a 20 foot wide by approximately 150 foot long habitat corridor for PKBM.

Research has shown that beach mice will travel more than 150 feet within one night in a natural landscape (Swilling et al. 1998; Moyers and Shea 2002; Lynn 2000), but travel distances and use of linear areas of habitat within commercial or residential development is unknown. The properties to the north are generally undeveloped except along the Old River shoreline and the remaining portions of the properties contain PKBM habitat. The project site is separated from habitat to the north by State Road 292 (approximately 100 feet). Research has shown that beach mice cross roadways (Gore and Schaefer 1993; Lynn and Kovatch 2004). Thus, PKBM may travel through the project area and cross the road to disperse and colonize the northern habitat and vice versa. This habitat would also help maintain the connection between the east-west habitat areas occurring north of SR 292. Including adjacent east and west properties, and the county installed berm/primary dune across the Action Area, there will remain a connected primary dune system. This would help maintain the connection between the three main populations at Gulf State Park (AL), Perdido Key State Park (FL) and GINS (FL). Additionally, all of the PKBM habitat areas to be restored onsite will be planted with dune vegetation native to Perdido Key, assuring suitable cover and food sources will be available for the mice.

Creating a connection between these areas is important in aiding PKBM dispersal, population expansion, and refuge during and after storm events. Maintaining the connectivity between the recovery populations centered at Gulf State Park (AL), Perdido Key State Park (FL) and GINS (FL) is vital to persistence of the PKBM. Actions that prevent or temporarily prevent the dune connectivity hinder the movement of PKBM between populations. Recovery actions needed to

assure the connectivity include working with Escambia County and private property owners to restore and maintain the dune system between the recovery populations.

In addition to the direct effects of the proposed condominium development, indirect affects to beach mice may occur due to the increased human population and presence. Increased human use of beach mouse habitats is expected to occur as the residential units are occupied and recreational opportunities are sought by the occupants. Foot traffic across sand dunes destroys vegetation essential for dune development and maintenance. Wind and water erosion becomes widespread in areas denuded of vegetation. As primary dunes erode, they lose their ability to protect the secondary dunes also used by the PKBM. To protect PKBM, a dune walkover will be constructed to protect habitat, predators (including domestic pets) will be controlled on the project site, and native dune vegetation will be used to restore and maintain dune habitats.

Injury or death to individual beach mice may occur incidentally to the site demolition, preparation, construction work, and future maintenance of the dune walkover. Effects to beach mice are expected to be a result of the following: (1) direct loss or injury of adult and sub-adult beach mice from physical injury caused by use of heavy equipment and placement of building materials during demolition, site prep, and construction activities; (2) adult female beach mice aborting litters caused by physical injury or stress from heavy equipment use and placement of building materials during construction activities; (3) the loss of newly born or juvenile beach mice left alone in the burrow resulting from the loss of a lactating adult female; and (4) temporary and/or permanent destruction or damage to coastal habitat used by the PKBM for foraging, nesting, and refugia. In addition, beach mouse habitat may be affected by foot traffic from workers present on-site and from the condominium occupants. No mortality data is available to document the effects of similar construction work in beach mouse habitat.

For the Service to determine if the impacts of the proposed developments on critical habitat would be an adverse modification, we must determine if the impact on this acreage would appreciably diminish the capability (or ecological function) of the critical habitat to satisfy essential requirements of the PKBM in the Action Area population. The long-term maintenance of the PKBM population in this area could be compromised if the impacts to the habitat affected the physical, chemical, and biotic resources identified as primary constituent elements of the critical habitat.

1. The PKBM habitat on the project site will continue to provide a contiguous mosaic of habitats onsite and with adjacent properties.
2. The higher secondary dune habitats on the project sites will remain connected to primary dune habitats.
3. Primary and secondary dunes will remain on all sites and will be maintained and restored following storm events.
4. Unobstructed habitat corridors will be provided along the east-west and north-south boundaries of project site.

5. The project site will continue to provide and connect to areas for population expansion.
6. The development is required to install appropriate lighting for coastal areas, will prohibit cats and free ranging dogs, and will be responsible for contacting County animal control to handle predator issues.
7. The development will permanently protect 0.49 acre of habitat through conservation easements, removing future threats to these critical habitat areas.

The PKBM critical habitat to be impacted on the project sites is less than 1 percent of the Action Area. The habitat loss within the Action Area resulting from these projects would not appreciably reduce the essential ecological functions it provides for beach mice. Additionally, even though there will be a loss of 0.43 acre of habitat, the carrying capacity of habitat is dependent on the quality of that habitat and, because remaining beach mouse habitats onsite will be restored and enhanced through permanent protection, and future threats to these areas removed, we do not expect that the carrying capacity will be appreciably reduced.

Species Response to a Proposed Action

As noted above, the permanent loss of 0.43 acres of PKBM habitat in the West Perdido Key (Action Area) population will not appreciably reduce the carrying capacity of the population. The applicant has minimized the project footprint such that approximately 53 percent of the PKBM habitat on the development would be restored or maintained.

Some habitat connectivity important to sustaining the beach mice during and after storm events would be reduced. Thus, the ability of the population to survive storm events that inundate the primary dune system may be similarly decreased, but not eliminated. Except where permanently lost, impacts to the primary and secondary dunes would be expected to be minimized because of the conservation measures included in the project (dune walkover, fencing, conservation easement, native landscaping, and restoration). The protection of the remaining habitat following project construction would be assured through the conservation easements and dune walkovers.

The temporary loss of habitat due to demolition and construction activities may result in the loss of individuals. Additionally, the proposed action would result in only a one-time disturbance to the PKBM within the Action Area. Temporary impacts are expected to be limited to the construction phase of the projects, which would be expected to be completed between 1 ½ years. As the life span of a beach mouse is estimated to be approximately 9 months, the temporary impacts of the proposed action may effect several generations of PKBM. Colonization or recolonization of the restored and protected habitat remaining onsite would be expected within several months/generations if populations nearby were healthy.

While the PKBM has evolved to adapt to catastrophic weather events, additional factors such as surrounding development pressure and non-native predators may affect the species' ability to recover from further loss of individuals. However, the temporary loss of the habitat itself is not

expected to permanently impact the population as all PKBM habitat not permanently destroyed would be restored and maintained as part of the conservation measures committed to by the applicants. Similarly, the indirect impacts of greater recreational use of the developments would be reduced by construction of a dune walkover on the property. Commitments to provide educational material to the development owners and visitors would also reduce the impacts of increased recreational use of the areas. Other commitments related to trash and garbage storage and maintenance, and pesticide use would also contribute to the maintenance of PKBM on the project sites and within the Action Area population. Therefore, while minor impacts to dune habitats may occur intermittently, the function and conservation role of the remaining PKBM habitat, including designated critical habitat, is not expected to be altered.

The applicants have also committed to provide a one-time contribution to the PKBM Conservation Fund with subsequent annual assessment of the units to compensate for the unavoidable impacts. These funds will be used to implement conservation and recovery needs for PKBM that would have a greater benefit to the PKBM range wide versus the project sites. Activities that may be funded with these contributions include those identified in the Conservation Strategy and include, but are not limited to; conducting surveys to determine the current status and distribution of PKBM, predator control, establishment of educational programs to inform beach users of the importance of the dune habitats for beach mice and property protection, beach mouse habitat restoration and/or enhancement, creation and maintenance of a captive colony of PKBM, protection of beach mouse habitat through permanent easement or purchase of important properties, translocation of mice to re-establish additional populations, construction of dune walkovers to funnel recreational beach users to the beachfronts, protecting the dune systems, or research to develop the information necessary to achieve conservation.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the Action Area considered in this biological opinion. Future Federal actions that are unrelated to the proposed project are not considered in this opinion because they require separate consultation pursuant to section 7 of the Act. Except areas set aside for wildlife and natural resources within the public areas, existing land uses on Perdido Key are primarily related to coastal development for human recreation and habitation.

It is reasonably certain to expect that human occupancy and recreational use of Perdido Key will increase in the future. As identified in the Environmental Baseline, there has been an increase in the number of multi-family developments on the Key since 1995, typically being developed at the maximum density allowed. Development and re-development activities have continued. Single-family residences and small multi-family complexes have been sold for construction of high-rise/high density complexes (Perdido Key Neighborhood Plan 1997 as referenced in Escambia County 2003) and this trend continues. Projects that are within endangered or threatened species habitat will require section 7 or 10 permitting from the Service. Those that are not will nonetheless add to the infrastructural and recreational pressures on the beaches and dunes of Perdido Key. We expect that the conservation activities to be conducted through the PKBM Conservation Fund will reduce some detrimental affects of the increasing infrastructural and recreational pressure.

The Florida – Alabama Transportation Planning Organization (FATPO) recently amended the 2020 Cost Feasible Long Range Transportation Plan to include four-laning Perdido Key Drive (SR 292) from the Alabama Line to Innerarity Road. The roadway runs adjacent to critical habitat for the PKBM on both north and south sides of SR 292. Additional right-of-way acquisition may be needed for the future widening. Dependent on whether or not federal funds are used for this project, the Service may conduct a section 7 consultation on the project or recommend a section 10 permit.

While we are not aware of any additional future actions that are reasonably certain to occur within the Action Area that will not require separate section 7 or 10 permitting in the future, we nonetheless mention several of the more significant actions below to demonstrate the coordination efforts and large scale conservation efforts that are likely to result from these actions.

Prior to and immediately following the hurricane season of 2004, coastal development and redevelopment of Perdido Key began to substantially increase. Land values rose considerably. The traditional method of land acquisition for offsetting impacts to listed species was hindered due to the high cost of land. Further, recovery efforts for the PKBM were needed Key-wide and would be best managed from a centralized entity rather than on an individual property basis. Because of the current and anticipated requests for permits, the Service, FWC, and County realized that consistency and streamlining of the process were needed. Formalizing the process and objectives was recognized by the three entities through participation in an intergovernmental agreement. The Intergovernmental Agreement, signed in December 2005, established a Conservation Fund for PKBM that is based on a Conservation Strategy and Business Plan completed for the PKBM. The Conservation Fund donations, obtained through state and federal sections 7 and 10 permitting actions, will be used to fund conservation actions intended to perpetuate a viable population of PKBM in native habitat on Perdido Key.

Based on the number of issued County Development orders for projects on Perdido Key in Florida, we estimate receiving a total of 30 ITP applications or requests for section 7 consultations for similar and single-family projects on the Key. We have no estimates of how many will be in the Action Area. These actions will undergo separate (or batched/programmatic) section 10 permit process or section 7 consultations and will be required to minimize and offset their impacts to the maximum extent practicable. The applicants/permittees may choose to use the compensation option of contributing to the Conservation Fund. If the majority of the applicants/permittees choose the Conservation Fund option, we anticipate that the Fund will receive significant contributions in the next several years. Anticipated contributions for the first year of implementation were estimated at a minimum of \$628,000 (estimated based on expected permit issuance time lines) while the Business Plan predicted \$738,700 (PKBM Business Plan 2005) in the first year of implementation.

After Hurricane Ivan, the Federal Emergency Management Agency (FEMA) provided funds for Escambia County to construct an emergency berm for storm protection along the Gulf of Mexico beachfront. While the berm project may potentially have adversely affected the PKBM during construction, the project restored dune habitats and connectivity to over 4 miles of beachfront

PKBM habitat. The berm protected landward PKBM habitats that are naturally restoring after the 2004 and 2005 hurricane seasons. An emergency consultation was completed for this work. The Service provided the following recommended guidance for minimizing and avoiding project impacts to listed species which will be followed by a biological opinion after the emergency work is complete. Measures pertinent to the PKBM include: (1) berm material needed to be placed as far landward as possible except where dunes remain to maximize the extent of dune growth and provide habitat connectivity; (2) berm material needed to be placed in a low, wide configuration to encourage dune vegetation growth and natural acceleration of the dune restoration process; (3) material for the berm needed to be compatible with existing beach sand as determined by the FDEP, and should not contain more than 10 percent fines, and be free of cobbles, gravel, or debris; (4) the berm needed to be planted with native dune species of vegetation to accelerate the berm stabilization process; (5) equipment staging and storage needed to be located outside of vegetated dune habitat and public lands; (6) vehicle and equipment beach access sites needed to be minimal in number, designated and marked, and be in areas devoid of vegetation; and (7) all areas impacted by the work needed to be restored upon completion of the berm construction. Remediation may be required if adverse impacts to listed species habitat are documented. The berm has been constructed and vegetation has been planted. Upon receipt of the final report for the project, the Service will complete the biological opinion and consultation for the work.

Escambia County is currently planning a beach nourishment project for Perdido Key. The County received funds from the State of Florida to conduct a feasibility study for the nourishment project. A large portion of the feasibility study was to locate suitable offshore borrow areas that contain an adequate quantity and quality (beach compatible) nourishment material. The study was completed in 2006. Permits were obtained from the Florida Department of Environmental Protection and Army Corps of Engineers in 2009 for the planned nourishment project. Funding sources are under consideration. While the nourishment project may potentially adversely affect the PKBM during construction, the project would help restore beach and dune habitats and connectivity within over 4 miles of beachfront. The nourished beach and restored dunes would also protect landward PKBM habitats that are naturally recovering after the 2004 and 2005 hurricane seasons.

A second beach nourishment project is under Section 7 consultation with the Service which could benefit Perdido Key. The Pensacola Naval Air Station (Navy) has proposed to dredge their navigation channel resulting in the need to place 8 million cubic yards of dredged material that is beach compatible. Because of the cost to pump the dredged material, Perdido Key is the closest and most logical area to receive the material. An interagency working group has been meeting since 2004 to determine the best use of the material. Receiving areas include the Perdido Key offshore borrow site, the Pensacola offshore borrow site, a nearshore site at the eastern end of Perdido Key, and the beachfront of GINS at Johnson Beach (Perdido Key) and Fort Pickens. Because Perdido Key has suffered erosion from the 2004 and 2005 storm seasons, a portion of the 8.0 million cubic yards could help in restoring beach and dune habitats Key-wide. The Service is working with our partners to assure the dredged material placement is conducted to enhance the natural dune restoration process and minimize negative affects to the PKBM. While the Navy project may potentially adversely affect the PKBM during construction, it could help restore beach and dune habitats and connectivity within over 16 miles of

beachfront. The project would also protect landward PKBM habitats that are naturally recovering after the 2004 and 2005 hurricane seasons. The project is ongoing in planning and funding discussions.

In 2010, Escambia County submitted a Habitat Conservation Plan for Perdido Key prepared in partnership with the Service, FWC, and FPS to strategically plan for conservation of the PKBM and other federally protected species while addressing development on private lands and facilities/infrastructure on county property. The ITP will authorize take in the form of habitat loss of up to 66 acres of PKBM habitat phased in 5-year increments over 30 years. At the end of each 5-year increment, a set of criteria must be met to move to the next phase of habitat loss. For example, after the first five years the following must be completed:

- Documentation of PKBM throughout 50% of suitable PKBM habitat in PKSP as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- Documentation of PKBM west of PKSP as determined by surveys agreed to by the Service, FWC, PKSP, GINS and the County.
- PKBM habitat impact (acres) meets each zoning district restriction (*e.g.* impacts meet a pre-determined distribution between zoning districts).

Any actions received by the Service and authorized within the HCP coverage area must be subtracted from the take in the form of 66 acres of habitat even if not processed under the HCP. One exception is the SR 292 road widening project. The Escambia County HCP is currently under review and a biological opinion will be required prior to a final issuance determination for the incidental take permit.

The Army Corps of Engineers (Corps) initiated formal consultation with the Service on November 2, 2011, on issuance of a section 404 permit to fill wetlands associated with the Lost Key Golf and Beach Club (Lost Key) multi-use development. Lost Key will result in 26.1 acres of permanent impacts to PKBM habitat within the Gulf Beach Unit (PKBM-4). The Service has completed our review and submitted our Biological Opinion to the Corps for use in their permitting process. These acres would be subtracted from the 66 acres available under the Escambia County HCP.

CONCLUSION

After reviewing the current status of the PKBM, the environmental baseline for the Action Area, the effects of the construction activities, proposed protective, avoidance, and minimization measures, and the cumulative effects, it is the Service's biological opinion that the projects, as proposed, are not likely to jeopardize the continued existence of PKBM, and are not likely to destroy or adversely modify critical habitat. This biological opinion does not rely on the regulatory definition of destruction or adverse modification of critical habitat at 50 Code of Federal Regulations [C.F.R.] 402.02. Instead, we have relied upon the statutory provisions of the Act to complete our analysis with respect to critical habitat.

The proposed project would directly and indirectly affect approximately 0.43 acre of PKBM critical habitat. Approximately 99.6 percent of PKBM habitat will remain within the Action

Area (West Perdido Key Unit) and 53 percent of the habitat within the project site will be permanently protected through easements.

As discussed in the Effects of the Action section of this opinion, we would not expect the carrying capacity of the Action Area to be appreciably reduced. While permanent impacts of the action would occur from a loss of 0.43 acre of habitat, this loss is mitigated by permanent protection of important habitat connections and the removal of threats to beach mouse habitat on the undeveloped portion of the sites in the form of conservation easements for 0.49 acre of beach mouse habitat. The PKBM habitat on the project sites will continue to provide for the biological needs of the species as demonstrated below:

1. They will provide a contiguous mosaic of habitats onsite and with adjacent properties.
2. The higher secondary dune habitats on the project sites will remain connected to primary dune habitats.
3. Primary and secondary dunes will remain onsite of the property and will be maintained and restored following storm events.
4. Unobstructed habitat corridors will be provided along the east-west and north-south boundaries of the project site.
5. The project sites will continue to provide and connect to areas for beach mouse population expansion.

Natural lighting and the number of predators will not be affected by the projects. The developments have proposed conservation measures to install appropriate lighting for coastal areas and will prohibit cats and free ranging dogs and will be responsible for contacting County animal control to handle predator issues.

The additional human and recreational use of the property and the adjacent beach would not result in additional habitat degradation. The development has proposed conservation measures that would funnel beach users across the dunes through the installation of dune walkovers, would educate the condominium users of the importance of the dunes through use of educational signs, and would fence the properties along the east and west boundaries to prevent access into beach mouse habitat.

Temporary impacts are expected to be limited to the construction phase of the projects, which would be expected to be completed in one to one and a half years. As the life span of a beach mouse is estimated to be approximately 9 months, the temporary impacts of the proposed action may effect several generations of PKBM. Colonization or recolonization of the restored and protected habitat remaining onsite would be expected within several months/generations if neighboring populations are healthy.

Also, we do not anticipate that the loss of the critical habitat would alter or affect the remaining critical habitat in the Action Area to the extent that it would appreciably diminish the habitat's capability to provide the intended conservation role for PKBM in the wild.

INCIDENTAL TAKE STATEMENT

Section 9 of the Endangered Species 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 to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Endangered Species Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The proposed Coquina Caye HCPs and their associated documents clearly identify expected impacts to affected species likely to result from the proposed taking and the measures that are necessary and proper to minimize those impacts. All conservation measures described in the proposed HCPs, and any section 10(a)(1)(B) permit[s] issued with respect to the proposed HCPs, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement under 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 permittees fail to adhere to these terms and conditions, the protective coverage of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse. The amount or extent of incidental take expected under the Applicants' proposed HCPs, associated reporting requirements, and provisions for disposition of dead or injured animals are as described in the HCPs and its accompanying section 10(a)(1)(B) permits.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service has reviewed the biological information and other information relevant to this action. Based on this review, incidental take is anticipated for: (1) all PKBM that may be within the 0.43 acre of PKBM habitat that will be permanently lost and within 0.15 acre of temporary impacts on the Coquina Caye development site; (2) behavior modification of all PKBM on the development site due to the changes onsite from the demolition, site preparation and construction, resulting in altered interactions with other beach mice, foraging or dispersal activities, and potential population expansion, and increased predation; and (3) behavior

modification of PKBM due to the occupation and use by the property owners, their guests and other visitors, resulting in altered interactions with other beach mice, foraging or dispersal activities, and potential population expansion, and increased predation.

Incidental take is anticipated from the project including demolition, site preparation, and construction for one to one and a half years and for the occupation and use of the development for the life of the permit. The Service anticipates incidental take of beach mice would be difficult to detect for the following reasons: (1) the inability to predict the timing of the project activities to occur during the peak beach mouse reproduction and dispersal seasons, (2) beach mice are nocturnal and are outside of their burrows only at night and consequently, mice affected by the project may not be found as a result of predation, or death within a burrow, and (3) an unknown number of beach mice may not be able to disperse for population expansion and may have reduced life spans. Therefore, the level of take is instead measured by the permanent loss of 0.43 acre and the temporary loss of 0.15 acre of PKBM habitat.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to PKBM, and would not result in destruction or adverse modification of PKBM critical habitat. Incidental take of PKBM is anticipated to occur during the life of the 30 year permits. However, measures to reduce potential impacts to beach mice have been incorporated into the activities and project plans for the developments.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measure is necessary and appropriate to minimize impacts of the incidental take to the PKBM:

- Issue the incidental take permit under section 10(a)(1)(B) with provisions to ensure full implementation of the HCP for the development known as Coquina Caye.

TERMS AND CONDITIONS

All conservation measures described in the project plans are hereby incorporated by reference as terms and conditions within this document pursuant to 50 CFR § 402.14(I) with the addition of the following terms and conditions. In order to be exempt from the prohibition of section 9 of the Act, the Applicants must comply with the following terms and conditions, which implement the reasonable and prudent measure. These terms and conditions are non-discretionary.

Species Monitoring

1. The Permittee shall establish and maintain an interest bearing account for purpose of funding the three (3) year PKBM monitoring requirements set forth in this Permit within sixty (60) days following issuance of a Development Order by Escambia County, Florida. The Permittee shall provide certification of the compliance with this requirement to the

Service. These accounts shall not be dissolved under any circumstances until the monitoring surveys are completed.

2. Monitoring for PKBM shall be conducted quarterly for 3 years post construction. The final monitoring design shall be determined by the Service in coordination with FWC and the County, based on the best available scientific data. The final design and schedule shall be provided to the development ninety (90) days prior to initiation of the monitoring program. The monitoring program is to begin within one-hundred and twenty (120) days following issuance of a certificate of occupancy by Escambia County, Florida for any unit in the Project.
3. Because these Permits are designed to minimize take of and to gather data on the impacts to PKBM resulting from the Project it is important that any PKBM occupying the Project site not be relocated. Therefore, the use of trapping or other methods to capture PKBM prior to the Project construction for purposes of relocation is not authorized.

Project Design and Construction

1. Wildlife and dark sky lighting shall be installed within the entire development. The lighting design shall be reviewed and approved by the Service. Guidelines for lighting are provided in Appendix B: Project Lighting Restrictions for Conservation of Protected Coastal Species.
2. All areas temporarily impacted during construction shall be restored to ambient or design grade. All remaining undeveloped areas (including temporarily impacted areas) shall be planted with coastal dune vegetation native to Escambia County as provided in Appendix A. Restoration of undeveloped and temporary impacted habitat shall be completed within one hundred and twenty (120) days following issuance of a certificate of occupancy by Escambia County, Florida for any unit in the Project.
3. Final landscape plans for the developments shall be reviewed and approved by the Service. The landscape design/plan shall be provided to the Service for review no later than 120 days prior to the landscape installation. All developments shall be planted with coastal dune vegetation native to Escambia County as provided in Appendix A. Any changes to the plant list will be considered upon written request to the Service. Request for changes shall provide information that provides verification that the plant is a coastal native dune plant species in Escambia County, Florida.
4. A summary of the permit requirements shall be provided to the general contractor and included in all sub-contracts for the project. The construction contract documents shall include a stipulation that conservation objectives be communicated to and agreed upon by all sub-contractors. Monetary fines shall be established to ensure that all sub-contractors work only within designated areas.
5. Boardwalks have been planned for the beach front sites, and signs shall be used to prohibit pedestrian traffic within beach mouse habitat (off the boardwalk).

6. The use of mulch and landscape fabric is prohibited in the dune habitats and the native landscaped areas.
7. Irrigation of planted dune vegetation shall be by backpack only. (No buried irrigation in native landscaped areas.)
8. All dune restoration material shall meet State of Florida requirements for beach quality material.

Post Construction and Operation and Maintenance

1. All covenants and restrictions, condominium documents or other appropriate legal instruments shall be further stipulated that no changes shall be made that would cause noncompliance with the requirements of the issued permit.
2. The educational signs shall be designed to increase awareness of coastal species conservation resulting in beneficial behavior modification of residents and guests at the development. Signs and/or fencing shall be used to prevent pedestrian traffic in PKBM habitat. The final design and wording of the signs shall be approved by the U.S. Fish and Wildlife Service. Draft design of the signs shall be provided to the Service within one-hundred and twenty (120) days after the effective date of the permit.
3. A Conservation Easement with the FWC as the easement grantee shall be placed on all acres of remaining PKBM habitat as indicated on the site plan. The boundaries of the Conservation Easement shall be surveyed by a licensed certified land surveyor. The Conservation Easement shall be recorded with the Clerk of Escambia County within 90 days of the receiving a Development Order from Escambia County. The Permittee shall work with the Service and FWC to finalize the draft Conservation Easement. A copy of the survey and recorded Conservation Easement shall be provided to the Service within ninety (90) days after the Conservation Easement is recorded.
4. Covenants and restrictions for the residences shall include limitations on landscaping (i.e., coastal dune vegetation native to Escambia County, no sod or mulch; no cats; no unleashed pets outdoors; no pesticide or herbicide use outdoors). The Permittee shall provide a copy of the draft covenants and restrictions to the Service for review and approval. An example shall be provided to the Service within ninety (90) days after unit has been sold. After that, this information shall be provided in the annual reports to the Service.
5. Trash collection shall be contained in the interior spaces, with the sole exception of pool and deck areas. These receptacles shall be animal proof.
6. Limits of construction shall be clearly marked on all construction plans and shall be clearly indicated on site with silt fence or other barrier fence. However, no barriers

which would limit PKBM movement through the site shall be constructed or temporarily set in place.

7. As noted in the Permittee's Project Plans, the Permittee shall contribute a one-time sum of \$100,000 per acre of impacts to the PKBM Conservation Fund held by Escambia County, Florida or such other entity as is designated by the Service for such purpose. This contribution shall be provided within 90 days of first occupancy. By January 31, of the year following the date of first occupancy and every year following for the 30 year life of the ITP, a fee of \$201.00 per unit per year shall be deposited in the PKBM Conservation Fund. The purpose of the Fund is to offset and implement compensation for development impacts on PKBM.
8. Within ninety (90) days of the date of this Permit issuance, the Permittee shall provide the U.S. Fish and Wildlife Service a final site layout that shows the final development design including the areas to be placed in conservation easement. The dimensions as provided in this Permit shall be accurately depicted on the layout. The layout shall be no smaller in scale than 1 inch = 30 feet.
9. Access to sites shall be granted to the Service, FWC, and their representatives to conduct permit and PKBM monitoring and predator control.
10. Cats (including pets) shall be prohibited from the exterior and interior premises of the Project. Dogs are permissible when kept confined inside the condominium units. Dogs may be walked on a 6-foot hand held leash, outside of beach and dune areas. All dog solid waste material must be picked up and disposed of properly by the pet owner/care taker.

Reporting

1. Prior to conveyance of title to any real property within each phase of the development, the Permittee shall record a separate legally binding declaration of condominium, covenants and restrictions or other appropriate legal instruments for that phase of development incorporating and requiring full and timely compliance with the pertinent terms and conditions of this Permit. The documents shall further stipulate that no changes shall be made that would cause noncompliance with the requirements of this Permit. All documents shall include a statement of the purposes of protecting PKBM including a brief description and information on the need, intent, and purposes of the terms and conditions, and conservation of PKBM. Within ninety (90) days after the initiation of construction for each phase of development, the Permittee shall provide certification of the compliance with this requirement, along with a copy of the said documents, to the Service.
2. Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification must be made to the Fish and Wildlife Service Law Enforcement Office, Clermont, Florida at (352) 429-1037 within 24 hours. Additional notification must be made to the Fish and Wildlife Services Field Office at Panama City, Florida at

(850) 769-0552 within 48 hours. 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.

3. Annual reports for the project shall be required for the life of the permit. The reports shall describe the actions taken to implement the terms and conditions of the issued permit and non-compliance and measures employed to remediate the non-compliance. The annual reports shall be submitted to the Field Supervisor, U.S. Fish and Wildlife Service, 1601 Balboa Avenue, Panama City, Florida, 32405, by January 31 of the next calendar year. The following certification from a responsible company official who supervised or directed the preparation of the report shall be included in the annual report:

“Under penalty of law, I certify that, to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of this report, the information submitted is true, accurate, and complete”.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action at the development. The Service believes that no more than 0.43 acre of PKBM habitat will be destroyed and all PKBM within the 0.43 acres of permanent impacts and 0.15 acre of temporary impacts may be incidentally taken as a result of our issuance of ITPs for this project.

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 that minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help carry out recovery actions, or to develop information.

The Recovery Plan for the Gulf coast subspecies of beach mice (including the PKBM), published in 1987, identified the following recovery objectives for the Gulf coast beach mouse species: stabilize populations by preventing further habitat deterioration, re-establish populations in areas from which they have been extirpated, and education of the general public. Efforts to achieve these objectives have been only moderately successful depending on the location, effects of weather events, land management and regulations, and funding. The Service will be revising the Recovery Plan in the future. However, in the interim the PKBM Conservation Strategy Plan will supplement the Recovery Plan in providing guidance for implementing recovery actions. The following conservation recommendations will serve as the Service’s long-term conservation strategy for the PKBM.

1. Complete revision of the 1987 Recovery Plan for the PKBM.
2. Implement the PKBM Conservation Strategy Plan and update the Plan as necessary. Conservation objectives for the PKBM mouse are:
 - a. To create, enhance, and maintain PKBM and habitats in PKSP, GINS, and GSP.

- b. To restore, enhance, and maintain beach mice and contiguous PKBM habitat in the primary, interdunal, secondary and scrub dune systems within and between GINS, PKSP, and GSP.
3. Continue to participate in the Northwest Florida Interagency Partnership to protect endangered and threatened species on public lands.
4. In coordination with FWC complete valuation of current management practices and their appropriateness for conservation and recovery of PKBM.
5. Continue to fund and participate in the FDEP Greenhouse project to provide beach mouse food source plants for dune restoration and maintenance.

REINITIATION NOTICE

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

Sincerely,

Dr. Donald W. Imm
Project Leader

cc:
FWS, Atlanta, Georgia (HC/TE)

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Appendix A

Species Plant List for Coastal Dune and Beaches in Escambia County, FL Species Plant List for Coastal Dune and Beaches in Escambia County, FL

Scientific Name	Common Name	Height	Container	Primary & Secondary Dune	Inter-dunal	Scrub dune
Trees						
Magnolia grandiflora	Southern Magnolia	60'-90'*	1gTP,3gTP,D			X
Osmanthus americanus	Wild Olive	70*	1gTP,3gTP,D			X
Pinus clausa	Sand Pine	20*	1gTP,3gTP,D			X
Pinus elliotii	Slash Pine	80'-100'*	1gTP,3gTP,D			X
Quercus geminata	Sand Live Oak	30*	1gTP,3gTP,D			X
Quercus myrtifolia	Myrtle Oak	40*	1gTP,3gTP,D			X
Quercus virginiana maritima	Sand Live Oak	40'-50'*	1gTP,3gTP,D			X
Medium to Large Shrubs & Small Trees						
Callicarpa americana	Beautyberry	5'	1gTP,TB,D			X
Ilex vomitoria	Yaupon Holly	20'	1gTP,TB,D			X
Iva frutescens	Marsh-Elder	11'	1gTP,TB,D		X	
Rhus copallina	Winged Sumac	10' (30')	1gTP,TB,D		X	X
Serenoa repens	Saw Palmetto	10' (30')	1gTP,TB,D			X
Small Shrubs & Ground Covers						
Schizachyrium (formerly maritimum)	Bluestem		LT,TB	X		X
Asclepias humistrata	Sandhill Milkweed		LT,TB			X
Bignonia capreolata	Cross Vine		LT,TB			X
Cakile constricta	Sea Rocket		LT,TB	X		
Ceratiola ericoides	Seaside Rosemary		LT,TB			X
Chrysoma pauciflorescens	Seaside Goldenrod		LT,TB	X		X
(T) Chrysopsis gossypina cruiseana	Cruise's Golden Aster		LT,TB	X		X
Conradina canescens	Beach Heather		LT,TB	X		X
Cyperus sp.	Sedge		LT,TB		X	
Heterotheca subaxillaris	Aster (Camphor weed)		LT,TB	X		X
Hydrocotyle bonariensis	Pennywort		LT,TB	X	X	X
Ipomoea pes-caprae	Railroad Vine		LT,TB	X		
Ipomoea imperati (formerly stolonifera)	Beach Morning Glory		LT,TB	X		
Licania michauxii	Gopher Apple		LT,TB			X
Panicum amarum	Beach Grass		LT,TB	X	X	
(E) Polygonella macrophylla	Large-leaved Jointweed		LT,TB			X
Tradescantia ohimensis	Spiderwort		LT,TB		X	X
Uniola paniculata	Sea Oats		LT,TB	X		X

The use of installed irrigation, mulch, whether artificial or natural material, and landscape fabric is prohibited.

T & E = State of Florida protected plant. Planting is strongly encouraged to help recover the species. Make sure the nursery you purchase the plant from is in the Association of Florida Native Plants; they follow all State regulations to grow and sell protected species.

*Trees living in coastal dunes do not reach "normal heights." They tend to be stunted and "pruned" by the wind, sand, and salt spray. Plant small specimens preferably in protected areas such as on the landward side of the dunes.

Appendix B

Project Lighting Restrictions for Conservation of Protected Coastal Species

To prevent adverse impacts to nesting and hatchling sea turtles, nocturnal movements of beach mice, and disturbance resting shorebirds, the minimal amount of exterior lighting for human safety and security shall be installed.

1. Lights shall not be placed within the developed footprint such that the light is visible outside the developed area.
2. Lights on dune walkovers or boardwalks shall not be located seaward of the landward toe of the dune (or its equivalent).
3. The light source or any reflective surface of a light fixture shall not be visible from any point beyond the developed footprint. There should be no illumination of any area outside the developed footprint, either through direct illumination, reflective illumination, or cumulative illumination.
4. Exterior wall light fixtures shall be either low pressure sodium lamps or low wattage (i.e., 480 lumens or less) "bug" type bulbs florescent bulbs. The light fixtures should be completely shielded without interior reflective surfaces and directed downward. Lights may also be louvered and/or recessed, with black baffles or without interior reflective surfaces as appropriate.
5. Light fixtures shall be mounted as low as feasible to provide light where it is needed (i.e. patios, balconies, pedestrian paths). This can be accomplished through the use of low bollards, ground level fixtures, or low wall mounts.
6. Lights for purely decorative or accent purposes shall not be visible outside of the developed footprint and shall be limited in number and intensity. Up-lights shall not be used.
7. Roadway lighting shall use shielded low pressure sodium (LPS) lamps. The height and number of fixtures should be kept to a minimum and should be positioned and mounted in a manner such that the point source of light or any reflective surface of the fixture is not visible on the development outside of the developed footprint.
8. Lighting in parking areas shall use shielded low pressure sodium (LPS) lamps, have a height of 20 feet or less and shall not be visible from any point outside the developed footprint. The lighting shall be positioned and shielded such that the point source of light or any reflective surface of the light fixture is not visible outside of the developed area. The light emanating from such fixtures may not directly or indirectly illuminate the area outside of the developed footprint.

Appendix B

Project Lighting Restrictions for Conservation of Protected Species (Page 2)

9. Car and other vehicle parking areas shall be designed or positioned such that vehicular headlights do not cast light outside the developed footprint. Native dune vegetation, and/or other ground-level barriers may be used to meet this objective.
10. Minimal temporary lighting during construction should only be used for security and safety. The lights should be completely shielded and low-mounted. Low pressure sodium lights or low wattage yellow "bug" type bulbs (480 lumens or less) shall be used. The lights should not directly or indirectly illuminate any area outside the construction site.
11. Light fixtures using natural gas as the light source shall not be used for fixtures unless they are fully shielded and the lighting is not visible outside the developed footprint.
12. Tinted glass or window film that meets a transmittance value of 45% or less (inside to outside transmittance) shall be used on all windows and glass doors throughout the development.
13. All ceiling-mounted light fixtures in the interior of the condominium units that could be visible from the outside shall minimize the amount of exposed light bulbs.

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