St. Andrew beach mouse

Peromyscus polionotus peninsularis

5-year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Southeast Region
Panama City Field Office
Panama City, Florida

5-YEAR REVIEW

St. Andrew Beach Mouse / *Peromyscus polionotus peninsularis*

I. GENERAL INFORMATION

A. Method used to complete this 5-year review

In conducting this review, we relied on the best available information and data on the St. Andrew beach mouse including, unpublished field survey results, the final rule listing the subspecies, critical habitat for the subspecies, peer reviewed scientific publications, and unpublished field observations by Service, State and other experienced biologists. This review was completed by the Service's lead recovery biologist in the Panama City Field Office. A *Federal Register* notice announcing the review and requesting information was published on June 21, 2005 (70 FR 35689). No new information was received subsequent to the request. All literature and documents, used for this review, are on file at the Panama City Field Office (see Appendix A for a summary of peer review of this document).

B. Reviewers

Lead Region – Southeast Region: Kelly Bibb, 404-679-7132

Lead Field Office – Panama City, FL, Ecological Services: Caroline Stahala, 850-769-0552

C. Background

1. **FR Notice citation announcing initiation of this review:** June 21, 2005: 70 FR 35689

2. **Species Status:** Stable (Recovery Data Call 2008). St. Andrew beach mouse (SABM) continues to recover from the 2004-2005 hurricane seasons. SABM continue to be distributed throughout much of the St. Joseph Peninsula and all of East Crooked Island. On private lands to the west of Mexico Beach, SABM still occur and development is proposed. Coastal development on private lands is sharply increasing on the St. Joseph peninsula in Gulf County and continues to need to be addressed. SABM probably still occurs on 15 miles of habitat of the total historic range (38 miles; 39 percent) but in lower numbers.

3. **Recovery Achieved:** 1 (0-25% recovery objectives achieved)

4. **Listing History:**
   Original Listing
   Federal Register Notice: 63 FR 70053
   Date Listed: December 18, 1998
   Entity Listed: Subspecies
   Classification: Endangered

5. **Associated Actions**: Critical habitat was designated for this subspecies on October 12, 2006 (71 FR 60238).

6. **Review History**:

   Recovery Data Call: 2008, 2007, 2006; 2005; 2004; 2003; 2002; 2001; 2000
   Recovery Plan: in preparation.

7. **Species' Recovery Priority Number at start of review (48 FR 43098):** 3c (degree of threat is high, potential for recovery is high, taxonomy is at the subspecies level, and there is a potential for conflict with development.)

8. **Recovery Plan:** A draft recovery plan for the St. Andrew beach mouse is under development.

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy

1. Is the species under review listed as a DPS? No

2. Is there relevant new information that would lead you to consider listing this subspecies as a DPS in accordance with the 1996 policy? No

B. Recovery Criteria

1. Does the species have a final, approved recovery plan? No, a recovery plan for the St. Andrew beach mouse is under development.

C. Updated Information and Current Species Status

1. Biology and Habitat

Currently, there are two core populations of the St. Andrew beach mouse: East Crooked Island in Bay County, and St. Joseph Peninsula in Gulf County, Florida. The St. Andrew beach mouse is the easternmost beach mouse subspecies occurring along the northern Gulf coast (James 1992). Its range is defined as extending from the East Crooked Island in Bay County, Florida, southward along the mainland coastline adjacent to St. Joseph Bay, to St. Joseph Peninsula and east to Money Bayou along the Gulf of Mexico in Gulf County, Florida (Bowen 1968, James 1992).

a. Population trends and demography

An attempt was made to quantify the percent decline of this subspecies when it was listed. Analysis of historic habitat showed approximately 41 miles of suitable habitat encompassed the range of the mouse (63 FR 70053). During the mid to

late 1980s, concerns were raised when trapping efforts failed to result in captures on West Crooked Island (Gore, *in litt.* 1987). By 1990, the St. Andrew beach mouse appeared to only inhabit a small portion of its original range. By the mid 1990s, only about 12.4 miles were known to be occupied (Gore, *in litt*. 1994, 1995), indicating a marked reduction in its historic distribution (63 FR 70053). In 1994, the population on East Crooked Island was presumed to be extirpated (Wooten and Holler 1999), leaving only one known population on St. Joseph Peninsula (Moyers *et al.* 1999), occupying only the northern portion of the peninsula (Gore, *in litt.*, 1994, 1995).

The known range of the St. Andrew beach mouse, prior to listing, included the west end of East Crooked Island and coastal dune habitat within St. Joseph Peninsula State Park (Gore, *in litt*. 1990). Reintroduction efforts began in 1997-1998 to re-establish a population on East Crooked Island (Moyers *et al.* 1999).

Reintroduction of 43 individuals from St. Joseph Peninsula State Park to East Crooked Island took place in November 1997 (16 individuals) and January 1998 (27 individuals). Subsequent monitoring efforts to assess the effectiveness of the reintroduction resulted in the capture of 38 individuals in February 1998 and 34 individuals in May 1998 (Moyers *et al.* 1999). An additional 4 individuals were translocated in December 1998. Trapping efforts in 2000 and 2002 resulted in the capture of 132 individuals and 41 individuals, respectively (Lynn, unpub. data 2000; Lynn, *in litt*. 2002). Furthermore, in April 2001, 55 St. Andrew beach mice were captured on adjacent private lands south of Tyndall Air Force Base property (Moyers and Shea, *in litt*. 2002).

Surveys conducted on East Crooked Island between May 2005 and January 2007 found beach mice were present on Tyndall AFB property and also on adjacent private lands southeast of Tyndall AFB property (Loggins *et al*. 2008). Loggins *et al*. (2008) estimated an average of 59.5 +/- 4% of East Crooked Island was occupied by St. Andrew beach mice. These results indicate that St. Andrew beach mice have become reestablished on East Crooked Island. Recent trapping and tracking tube work (Loggins et al. 2008) confirms the presence of SABM in 2008.

Trapping and track surveys continued on St. Joseph Peninsula after listing. These efforts showed a constant presence of St. Andrew beach mice on St. Joseph Peninsula State Park (Moyers *et al.* 1999; J. Mitchell, FL Park Service, personal communication 2005). In November 2004, track surveys south of the park showed a presence of beach mice from the Park boundary south to approximately the area just north of Cape San Blas, (J. Gore, FWC, pers. comm. 2005). Surveys from 2004 by the FWC have shown that mice continued to be present at St. Joseph Peninsula State Park (Slaby, *in litt*. 2005). Loggins *et al*. (2008) estimated an average of 61.0 +/- 9% of St. Joseph Peninsula State Park was occupied by St. Andrew beach mice and confirmed the presence of SABM at St. Joseph Peninsula State Park, private property south of the park and at Rish Park on the St. Joseph Peninsula.

Track and/or trapping surveys have been conducted outside areas supporting the two known populations of St. Andrew beach mouse. The following survey efforts were unsuccessful in identifying mice activity or capturing St. Andrew beach mice.

1987 Between Tyndall AFB and St. Joseph Peninsula State Park (James 1987)
1988 East of Mexico Beach (Gore, *in litt*., 1990)
1989 Money Bayou (Gore, *in litt*., 1994),
1990 East of Mexico Beach (Gore, *in litt*., 1994)
1992 East of Mexico Beach (Gore, *in litt*., 1994)
1994 Cape San Blas (Lamont *et al.* 1997)
2001 St. Joe Beach and at Dixie Bell Curve, (Moyers and Shea, *in litt*., 2002)
2003 Between Money Bayou and Cape San Blas area, Eglin AFB (J. Gore, FWC, pers. comm., 2005)

Loggins *et a*l (2008) compared population estimates, along with distribution data, and found indications that the population at East Crooked Island has grown following the translocation of mice from St. Joseph State Park in 1997-1999 and that the population in the park has not declined since previous surveys (Moyers et al. 1999). Current population estimates (Loggins *et al* 2008) of 3,000 mice at East Crooked Island is much larger than any previous estimate (James 1992, U. S. Fish and Wildlife Service 1998), and the estimate of 1,775 mice in the front dunes at St. Joseph State Park is much larger than the estimate of 342-655 mice extrapolated from the trapping data of Bates (1992) and Moyers et al. (1999).

b. Genetics

Selander *et al.* (1971) conducted an enzyme electrophoresis study on 30 populations of *P. polionotus* in 8-13 subspecies, 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. However, Van Zant (2006) demonstrates higher haplotypic diversity within Gulf Coast beach mouse populations when compared to inland *P. polionotus* populations. Wooten and Holler (1999) used microsatellite sequencing to assess intrapopulation variability and determined greater than expected variability in the St. Andrew beach mouse population.

Wooten and Holler (1999) looked at the historic relationship of the two known populations of St. Andrew beach mouse (St. Joseph Peninsula State Park and Crooked Island) and the population of Choctawhatchee beach mouse (*Peromyscus*

polionotus allophyrs) found on Shell Island in Bay County using genetic analysis. When comparing the alleles of the three populations they found the St. Joseph Peninsula State Park population's alleles were unique and their allele frequencies are substantially different from that of the Choctawhatchee beach mice population on Shell Island. They found, however, that all the alleles of the St. Andrew beach mouse population on Crooked Island were found in both of the other two populations. Furthermore, they found two of the alleles were "uniquely shared" with either the St. Andrew beach mouse population on St. Joseph Peninsula State Park or the Choctawhatchee beach mouse population on Shell Island. They noted that this would seem to indicate that it was likely that there was limited gene flow between the St. Andrew beach mouse populations on Crooked Island and the Choctawhatchee beach mouse population on Shell Island, however this assessment was based on a very limited sample of 3 mice. Since this time, the Crooked Island beach mouse population was extirpated and a reintroduction was carried out thus today the beach mouse population on E. Crooked Island is genetically descendent from the St. Joseph State Park beach mouse population.

In recent work, the genetic relationship of the St. Andrew beach mouse has been further investigated. This work, based on DNA sequencing, has shown that the St. Andrew beach mouse is genetically distinct from all the other inland and beach mouse subspecies (Van Zant 2006).

c. Taxonomy and Classification

Since the listing of the St. Andrew beach mouse, 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 place the separation of beach mouse populations as far as 300,000 years before present (Van Zant 2006), and support the currently accepted taxonomy that each beach mouse group represents a unique and isolated subspecies (Bowen 1968).

d. Spatial Distribution

P. polionotus exhibit a typical nocturnal behavior (Wolf and Esher 1978). Beach mice are most active during stormy, rainy, and dark nights, while their activity levels decreased during periods of increasing moonlight (Blair 1951). Under periods of the full moon, *P. polionotus* surface activity decreased by around 70%. Furthermore, under a three-quarter moon, half moon, and quarter moon, surface activity levels decreased by 56%, 32%, and 23%, respectively (Wolfe and Summerlin 1989). Artificial lighting can have significant impacts on the behavior and survivability beach mice. Bird (Bird, et. al. 2004) showed that beach mice spend less time foraging for food in areas with brighter lighting.

Beach mice appear to inhabit a single home range during their lifetime (Blair 1951). The sizes of home ranges reported by others varied among

species/subspecies and technique used to determine home range size. The mean home range size of Santa Rosa beach mice ranged from 1.97 +/- 0.26 acres (ac) (0.80 +/- 0.11 hectares (ha)) to 10.66 +/- 1.46 ac (4.31 +/- 0.59 ha) (Blair 1951). Blair found that home range size was significantly larger during the spring than during the fall in both beach-dune habitat and open areas (4.28 +/- 1.67 ac (1.73 +/- 0.68 ha)). Based on trapping data, Swilling and Wooten (2002) found that the mean home range size of Alabama beach mice was 0.89 ac (0.36 ha). Lynn (2000) also used trapping data to determine the mean home range size of Alabama beach mice. He found the mean home range size of males was 1.01 +/- 0.16 ac (0.41 +/- 0.06 ha) and for females, 1.36 +/- 0.19 ac (0.55 +/- 0.08 ha). Looking at home range sizes based on trapping data, Novak (1997) found the mean home range size of Choctawhatchee beach mice was 0.78 +/- 0.93 ac (0.32 +/- 0.38 ha). While we have no specific data for SABM, we would expect similar home range sizes to other gulf coast subspecies as identified above.

The average dispersal distance of Santa Rosa beach mice was 1,415 +/- 89 feet, with a minimum distance of 980 ft and a maximum distance of 1,970 feet (Blair 1951). Swilling and Wooten (2002) looked at the dispersal distance of subadult Alabama beach mice. They found the average dispersal distance was 525.6 +/- 853.02 feet. A dispersal study also showed that Alabama beach mice that disperse from their natal grounds persisted significantly longer (males: 138 ± 19 days; females: 125 ± 18 days) than mice that remain in their natal grounds (males: 96 ± 10 days; females: 92 ± 8 days) (Swilling *et al*. 2000). Greater dispersal can occur when translocated mice are placed in an already occupied habitat (Van Zant and Wooten 2003).

e. 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 historically not considered to be of great importance to beach mice (Swilling 2000), and little attention was paid to this habitat (Sneckenberger 2001). More recent research has illustrated that beach mice use interior scrub habitat on a permanent basis, and that this habitat has an invaluable role in the persistence of beach mouse populations after storm events (Swilling *et al*. 1998; Sneckenberger 2001). Recent studies have also shown no significant difference between the two habitat types in availability of food resources or burrow sites, beach mouse body mass, survival rate, reproductive rate, and home range size (Swilling 2000; Sneckenberger 2001). Trapping efforts in the scrub dune system showed that Alabama beach mice were regularly found in high densities in the more open, patchy areas (Sneckenberger 2001). Furthermore, the scrub dunes appear to serve as refugia for beach mice during and after a tropical cyclone event (Holliman 1983, Swilling *et al.* 1998), from which recolonization of the frontal dunes takes

place (Swilling *et al*. 1998, Sneckenberger 2001). Critical habitat that included the scrub dunes was designated in 2006 for the St. Andrew beach mouse (71 FR 60238).

The habitat in which the two known/primary populations of St. Andrew beach mice occur differ primarily in the dune structure. In St. Joseph Peninsula State Park the mice inhabit "well-developed high front dunes," where sea oats are the dominant plant cover and the higher secondary dunes are vegetated by sea oats and rosemary (James 1992). The high primary dunes, in which mice were found, were made up of a matrix of open sand and herbaceous cover (James 1987). On Crooked Island, the mice inhabit the low frontal dunes and even lower secondary dunes that are vegetated by bunch grass (*Andropogon*) and beach grass (*Panicum*) (James 1992). Loggins *et al*. (2008) conducted surveys of beach mice habitat (primary, secondary and scrub dune habitats) along the St. Joseph Peninsula, at Eglin AFB's Cape San Blas property, and across East Crooked Island between May 2005 and January 2007. They described the habitat at each of the sites surveyed as follows: East Crooked Island, the habitat was "generally of good quality"; Cape San Blas, the habitat was "narrow and generally of poor quality"; St Joseph Peninsula south of the State Park, the habitat was "highly fragmented and of varying quality"; St. Joseph Peninsula State Park, the habitat quality was not noted; however, mice were detected in all habitats surveyed, likely indicating higher quality habitat. Optimal habitat is best described as an undisturbed, intact and functioning system of unconsolidated marine substrate, beach sand, primary natural sand dunes, secondary and scrub dunes.

2. Five Factor Analysis

The following contains current status information for the St. Andrew beach mouse.

Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Land Development. Along the coastline of the Gulf of Mexico, development continues to occur. Land development tends to destroy the secondary and scrub dunes (63 FR 70053). Typically, hurricanes wash away the primary dunes, leaving vast areas of open sand where the dunes existed and islands of secondary dunes surrounded by water. Beach mice appear to take refuge on these "islands" and within the scrub dunes (Swilling *et al.* 1998). It is from these dunes that the beach mice appear to repopulate the frontal dunes as they recover from the storm's impact (Swilling *et al.* 1998, Sneckenberger 2001). When development destroys or degrades the secondary and scrub dune systems, beach mice are not able to find refuge from the storm's impact within these dune systems. Furthermore, land development segregates the population into small groups isolating them from one another (Meyers 1983). Overall this could result in a greater likelihood that a population may be extirpated or reduced in numbers to a point that they may not be able to recover (63 FR 70053).

Military Exercises on East Crooked Island. In 1987, James (1987) noted that military exercises conducted on Tyndall Air Force Base's lands at East Crooked Island, were severely impacting the dune systems. These military exercises, noted at the time of listing, have ceased. Conservation measures are in place to address other proposed military missions on East Crooked Island.

Dune Encroachment. Dune encroachment by vehicles and pedestrians, in the form of driving on or walking over dunes, was identified as a threat to the St. Andrew beach mouse (63 FR 70053). These activities result in the destruction and/or degradation of the dune habitat, killing vegetation, and compacting soil. This leads to the potential for blowouts at these points from wave and wind action (Kimball *in litt*. 1996). The degree or severity to which this occurs is dependent upon the type of activity and the inherent susceptibility of the system (Leatherman 1979).

Dune encroachment by vehicles and pedestrians still poses a threat; however, it is believed to be less now then at the time of listing (L. Patrick, pers. comm., 2008). This is due, in part, to management actions that have been conducted on public lands and beach driving regulations established on the St. Joseph Peninsula and Cape San Blas. Management actions like boardwalks, fencing, signage, etc., have been put in place on public beaches to protect the dunes from human encroachment (J. Mobley, Tyndall AFB, pers. comm., 2005; H. Mitchell, FWS, pers. comm., 2009; L. Patrick, FWS, pers. comm., 2008). The Land Unit Management Plan for the St. Joseph Peninsula State Park includes protection of dune habitats through the use of boardwalks or designated paths and planting of native dune vegetation where necessary to recover the dune system. St. Joseph Peninsula State Park prohibits driving on the beach except for Park related work and emergency response.

Gulf County has constructed boardwalks at Cape Palm and Salinas County Parks. These boardwalks provide protection of the dunes from pedestrians walking directly on the dune in order to access the beaches (L. Patrick, FWS, pers. comm. 2008). Gulf County Ordinance 97-02 allows driving by the public on Indian Pass, Cape San Blas, and St. Joseph Peninsula. The ordinance prohibits the driving of any vehicles in, on, or over any coastal sand dunes within the County. Furthermore, it prohibits driving in, on, or over vegetation. Beach access, for individuals issued a Beach Driving Permit, is limited to four designated vehicle access points; all other vehicle access is prohibited (Gulf County Board of Commissioners 1997). In 2003, Ordinance 2003-7, an amendment to Gulf County Ordinance 97-02 (Gulf County Board of Commissioners 2003), established enforcement of the County ordinance on Eglin Air Force Base lands at Cape San Blas.

On the developed beaches of Bay County, little dune habitat exists. Vehicular driving is conducted mostly by Panama City Beach Patrol, the Sheriff's

Department, beach vendors and garbage pick up service. Bay County has a beach driving ordinance for unincorporated areas which prohibits driving on beach and dunes with an exemption for emergency and work vehicles (Sec 5-26).

Private landowners have taken additional measures to prevent beach driving on their property on St. Joe beach in order to protect the dunes from being destroyed by vehicular traffic (Moyers and Shea, *in litt*. 2002).

Tyndall AFB provides dune walkover or designated beach access paths at their Non-commissioned Officer's beach and Crooked Island East beach. Tyndall AFB prohibits driving on the beach except for military missions, natural resource conservation, or emergency response.

Natural Shoreline Erosion. Throughout the range of the St. Andrew beach mouse, non-storm related shoreline erosion is seen to some degree along parts of East Crooked Island (J. Gore, pers. comm. 2005), but is greatest from Cape San Blas to St. Joseph Peninsula State Park (Foster and Cheng 2001, Coastal Tech 2006). Approximately 2 to 15 feet per year are eroding on St. Joseph Peninsula (Coastal Tech 2006). Although shoreline erosion destroys habitat, it is considered a natural event in which the species that inhabit coastal systems have adapted. However, when combined with loss of habitat, caused by land development, this natural threat is exacerbated. The beach mice would naturally move further inland to secondary and scrub habitat as the effects of erosion are seen in the frontal dune systems. When development destroys this inland habitat, the mice are prevented from moving inland (J. Gore, pers. comm., 2005).

The combination of impacts to beach mouse habitat can result in the reduction, fragmentation, and isolation of beach mouse populations. This prevents movement of individuals between habitat blocks, ultimately resulting in a reduction or lack of gene flow. This lack of gene flow can result in a reduction of the fitness of the population. Furthermore, fragmentation breaks up the population into small groups further isolating them and potentially making them more susceptible to extinction due to catastrophic events or the combination of cumulative threats (63 FR 70053).

The State of Florida, Department of Environmental Protection, Bureau of Beach and Coastal Systems monitors Florida's beaches for critical erosion and has a statewide beach management plan. Specific erosion studies have been conducted for St. Joseph Peninsula in 1998 and 2006 (Coastal Tech -Preble-Rish 1998, Coastal Tech 2006). Gulf County received a permit to conduct a beach nourishment project on 6 miles of critically eroding beach. The beach nourishment project included 1.5 miles of beachfront on St. Joseph Peninsula State Park and was completed in 2008.

Listing Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

There are no data indicating that this factor has historically or is currently affecting the subspecies.

Listing Factor C. Disease or predation

There are no data indicating that disease or parasites have been or are currently a threat to the St. Andrew beach mouse. However, non-native predators, primarily feral and free-ranging domestic cats, pose a threat to beach mice (Bowen 1968; Humphrey and Barbour 1981; Gore, *in litt.*, 1990; Moyers *et al.* 1999; Traylor-Holzer *et al.* 2005). This threat in conjunction with other threats may result in "significant adverse impacts" to the St. Andrew beach mouse (63 FR 70053).

Feral/Cat Colonies/Free Roaming Domestic Cats. Bowen (1968) reported that feral cats were becoming such a problem that they discontinued trapping for beach mice wherever they found cat tracks. In fact, they were unable to find any mice tracks or burrows over a 2-mile stretch that corresponded with a 1-mile stretch of beach abundant with cat tracks. This was not an isolated incident; the results of data collected by Humphrey and Barbour (1981) supported this growing concern. In 2002, Van Zant and Wooten (2003) tracked a house cat for two days that had consumed a beach mouse fitted with a radio collar. This added credence to the notion that cats preyed on beach mice. Gore (*in litt*., 1994) lists the introduction of house cats, in addition to habitat loss, as one of the "most serious threats to beach mice populations." When the effects of predation by cats on the Alabama beach mouse were modeled, the results showed a tremendous impact on the population. The PHVA analysis referenced is a model. It was developed to show the potential effects of cats on mice when mice are in a depressed population condition from storms or other events. Most people working with beach mice accept this model. It was not intended for large healthy populations. In the situations where this model is applicable, every mouse mortality is significant to the successful continuation of the population and cats in this scenario could be the deciding factor in whether a population of beach mice survives.

Other Non-native Predators. Other non-native predators, such as red foxes (*Vulpes vulpes*) and coyotes (*Canis latrans*), are thought to be potential predators of beach mice (Meyers 1983, Van Zant and Wooten 2003). Their tracks have been seen within dune systems where St. Andrew beach mice are known to occur (Bates 1992; H. Mitchell, FWS, pers. comm 2009; L. Patrick, FWS, pers. comm 2008). Non natives move into natural systems for many reasons; vacuums created by the absence of native predators, non natives out compete natives and/or drive them off, high numbers of non natives enter an area as a result of nearby development, etc.

Foxes have been documented more frequently predating beach mice, and the presence of coyotes may actually help reduce fox densities. Both coyote and red

fox are known to prey on sea turtle eggs and hatchlings and shorebird eggs and young (Daniel 2002, Lamonte and Douglass 2004, Leland 1997, Northwest Florida Partnership 2002, M. Nicholas, NPS, pers. comm 2006). However, the degree to which they pose a threat to the St. Andrew beach mouse is unknown. The concern is that these non-native predators are not part of the natural system in which beach mice existed; they have moved or been introduced into these areas relatively recently and, therefore, pose a potential additive threat to the subspecies (63 FR 70053).

Since 1996, the Service, the State of Florida, U.S. Dept of Agriculture-Wildlife Services and other government agencies including the Florida Park Service and Tyndall AFB have worked in partnership to protect threatened and endangered species on coastal public lands through predator control. Private land owners have also joined the partnership to control predators on their lands. Included in the Federal/State/Private Predator Control partnership is the control of domestic and feral cats including cat colonies on public and private lands.

Both Gulf and Bay counties have ordinances that address animal control (98-11 and 89-20, respectively) (Gulf County Board of Commissioners 1998 & 2005-24, Bay County Board of Commissioners 1994); however these ordinances do not specifically address or prohibit feral cat colonies or require pet cats to be controlled.

Predator control has been implemented on St. Joseph Peninsula State Park since 1997 and on Tyndall AFB since 2001.

Listing Factor D. The Inadequacy of Existing Regulatory Mechanisms

The St. Andrew beach mouse is listed by the state of Florida as endangered (Chapter 39-27, Florida Administrative Code). This legislation prohibits take, except under permit, but does not provide any direct habitat protection. Currently there are other additional state and/or local level regulatory mechanisms (laws, ordinances, policies, directives, etc) in place related to many of the threats identified for the St. Andrew beach mouse. These regulations were developed for the general protection of the environment or for the common good of the people. They were not designed specifically with beach mice in mind. Therefore, many of them are inadequate in their current state to remove threats facing the St. Andrew beach mouse because 1) The language may not be protective enough for the conservation of the beach mouse (e.g., land development); 2) They may not be fully implemented or enforced due to limitations in staffing or expertise and or public unpopularity, or 3) They may not be effective in their primary intent.

Beach Driving. One of the threats listed under Factor D at the time of listing was lack of enforcement of beach driving regulations restricting people from driving vehicles within the dunes on Eglin Air Force Base's property at Cape San Blas.

Beach driving can compact the sand, exacerbate erosion of dunes from the ground loading, and result in lost and/or degraded habitat quality.

The limited ability to keep people from driving on the dunes was attributed to the lack of Air Force enforcement personnel and the difficulty of enforcement due to the distance from the main base (63 FR 70053). In 2003, Ordinance 2003-7, an amendment to Gulf County Ordinance 97-02 beach driving (Gulf County Board of Commissioners 2003), established enforcement of the County ordinance on Eglin Air Force Base land. In addition to enforcement responsibility being provided by Gulf County, lack of enforcement is not believed to be a threat, because St. Andrew beach mice are not currently known to inhabit Cape San Blas (Eglin Air Force Base 2002) and have not been found there during surveys (Lamont *et al.* 1997; J. Gore, pers. comm., 2005). It is doubtful that the limited enforcement of dune driving was a factor in the disappearance of St. Andrew beach mice from Eglin AFB property at Cape San Blas (Gore, pers. comm., 2006). However, if reestablishment of St. Andrew beach mice on Eglin AFB property at Cape San Blas were to occur in the future, the enforcement of beach/dune driving restrictions within the dune systems would need to be reassessed to determine if beach driving would pose a threat to the mice.

On the developed beaches of Bay County, little dune habitat exists. Vehicular driving is conducted mostly by Panama City Beach Patrol, the Sheriff's Department, beach vendors and garbage pick up service. Bay County has a beach driving ordinance (Sec 5-26) with an exemption for emergency and work vehicles.

Tyndall AFB limits driving on their beaches to natural resource conservation, military missions and emergency response.

Coastal Barrier Resources Act. In recognizing the importance of coastal barrier islands along the Atlantic and Gulf coasts, Congress passed the Coastal Barrier Resources Act (CBRA) of 1982 and Coastal Barrier Improvement Act (CBIA) in 1991. The purpose of CBRA is "to minimize the loss of human life, wasteful expenditure of Federal revenues, and the damage to fish, wildlife, and other natural resources associated with the coastal barriers along the Atlantic and Gulf coasts by restricting future Federal expenditures and financial assistance which have the effect of encouraging development of coastal barriers." One such restriction is the lack of federally subsidized flood insurance. Within the known range of St. Andrew beach mice the following units were established: P30/P30P (Cape San Blas unit, which includes all of St. Joseph Peninsula) and P31 (St. Andrew unit, which includes East and West Crooked Islands). Development has continued within these areas supported by non-federal funds or interest. Currently only a few private insurance companies provide insurance for homes in these areas. In 2005, Congressman Boyd introduced H.R. 3280 that proposed exempting any areas within units P30 (Cape San Blas unit) and FL-92 (Indian Peninsula unit) from limitations imposed by CBRA on Federal expenditures and financial assistance. It also proposed exempting the limitations imposed by the

National Flood Insurance Act of 1968 on flood insurance coverage. As reported by the Library of Congress (2007) the following actions took place: The bill was referred to both the Committee on Financial Services and the Committee on Resources. The Committee on Financial Services then referred the bill to the Subcommittee on Housing and Community Opportunity. No further action was reported within the Subcommitte on Housing and Community Opportunity. The Committee on Resources referred the bill to the Subcommittee on Fisheries and Oceans. The Subcommittee held a hearing in April 2006 on this proposed bill. The Service testified at the hearing reaffirming the appropriate designation of P30 and FL-92 as defined by the law at the time of designation (U.S. Fish and Wildlife Service 2006). No further action was reported for H.R. 3280 (Library of Congress 2007).

If unit P30 was removed from the CBRS, the landowners in that unit within beach mice habitat would be eligible for all Federal assistance. Furthermore the limitations of the National Flood Insurance Act placed on these landowners would be removed, allowing them to receive flood insurance (National Flood Insurance Act 1968). By removing the restrictions CBRA and the National Flood Insurance Act places on these lands, in effect, the disincentive to develop this area would be removed. This could make the area more desirable for development; thereby, seriously compromising the original intent of CBRA to: "…minimize the loss of human life, wasteful expenditure of Federal revenues, and the damage to fish, wildlife, and other natural resources associated with the coastal barriers…" (Coastal Barrier Resource Act 1982).

Feral Cats/Feral Cat Colonies Both Gulf and Bay counties have ordinances that address animal control (98-11, 05-24 and 89-20, respectively) (Gulf County Board of Commissioners 1998 & 2005, Bay County Board of Commissioners 1994); however these ordinances do not specifically address or prohibit feral cat colonies or require pet cats be controlled.

Land Development Bay County has passed land development regulations "to protect and promote the public health, safety, comfort, convenience, prosperity, and general welfare of residents, landowners, and businesses within the County and to protect and preserve the natural, cultural, and historic resources therein" (Bay County Board of Commissioners 2004). These codes include regulations on construction in coastal areas; however, they are general (e.g., "shall make every effort to avoid damaging dunes") and do not provide guidance on how to minimize impact to dunes. Specific language is needed to guide landowners and developers within these systems so as to maintain connectivity between the dunes and minimize impacts to the habitat.

Gulf County's Unified Land Development Regulations set forth requirements for land development within the county. These regulations address a wide variety of land development issues. Some of these relate directly to the protection of the natural resources and the coastal areas. While some level of protection of coastal

areas exists, these regulations tend to be general (Gulf County 1996). In order for these land development regulations to provide protection and/or the removal of some of the threats to the St. Andrew beach mouse, Gulf County land development regulations need to have clearer, more specific language. This language must provide clear, detailed guidance on how to protect and minimize impacts to the coastal dune systems. Without the more detailed regulations and enforcement, development will continue to pose one of the greatest threats to the recovery of the St. Andrew beach mice since the habitat on private lands is very important in providing connectivity and resiliency of the beach mice populations.

Development constructed at or seaward of the coastal construction control line (CCCL) is permitted by the State of Florida (Dept. of Environmental Regulation, Bureau of Beaches and Coastal Systems). Projects are reviewed for potential impacts to the beach dune system, adjacent properties, native salt resistant vegetation, and marine turtles. Projects within beach mouse habitat are advised of ESA responsibilities.

Listing Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

Hurricanes. Natural habitat alteration, as a result of severe tropical storm events, poses a threat to beach mice. Hurricanes potentially could result in catastrophic impact to beach mice and their habitat given their very limited distribution (FWS 1987, Gore, *in litt*., 1994). Every year the threat of a hurricane(s) hitting within the range of the St. Andrew beach mouse is eminent. From 1851 to 2004 there have been a total of 55 hurricanes (27 Category-1, 16 Category-2, 12 Category-3, 0 Category-4, and 0 Category-5) that have hit northwest Florida (Blake *et al.* 2005).

In the past 30 years, several major hurricanes, in particular, have impacted the St. Andrew beach mouse. In 1975, Hurricane Eloise cut through Crooked Island, separating the island into two disjunct segments (James 1987, Moyers *et al.* 1999). Subsequent trapping efforts on the western part of the island did not yield captures of beach mice (Gore, *in litt*., 1987; Moyers *et al.* 1999). The population on the eastern part of the island continued to exist into the mid to late 1980s (Gore, *in litt*., 1987, 1990; James 1987). By 1992-1993, however, mice did not appear to be present on the eastern part of the island and the population was believed to be extirpated (Gore, *in litt*., 1994; Alabama Cooperative Fish and Wildlife Research Unit, *in litt*., 1997). Hurricanes Elena and Kate hit the Gulf Coast in 1985, causing extensive damage to the dune systems within the range of the St. Andrew beach mouse. These hurricanes created “huge blowouts in the high dunes of the St. Joseph spit” (James 1992). In 1995, the Gulf Coast was hit by another major hurricane, Hurricane Opal. Hurricane Opal impacted the dune systems throughout the St. Andrew beach mouse’s range (Gore, *in litt*., 1995, Moyers *et al.* 1999), severely eroding the beaches and dune system (Leadon

1996). Gore (*in litt*., 1995) estimated that 40% of the available habitat along each kilometer was lost due to the washing away of the frontal dunes, resulting in a loss of potentially half the St. Andrew beach mouse population. In 1998 Hurricanes Earl and Georges caused severe erosion to the eastern portion of Crooked Island. Hurricane Earl caused minor erosion along the northern 7.5 mi. (12.0 km) of St. Joseph Peninsula and minor to major erosion south of the State Park to Cape San Blas (Leadon *et al.* 1999). Six years later Hurricane Ivan made landfall just west of Pensacola, FL. The western end of Mexico Beach (just east of East Crooked Island) sustained moderate/minor beach erosion, while the St. Joseph Peninsula just south of the State Park to Cape San Blas sustained major beach and dune erosion (Leadon 2004). However, since the extent of the impact to dune habitat was concentrated south of the Park, the St. Andrew beach mouse was relatively unaffected by the passage of Hurricane Ivan (L. Patrick, pers. comm., 2008). This was not the case, however, in 2005 when Hurricane Dennis caused extensive coastal erosion and flooding throughout the entire St. Joseph Peninsula (FDEP 2005).

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

The Service continues to work with the Federal Emergency Management agency (FEMA), Florida Department of Emergency Management (FDEM) and other state and federal agencies to include protection of coastal species in disaster response guidelines.

House Mouse Competition. Another potential threat to St. Andrew beach mice is competition from house mice (*Mus musculus*) (Gore *in litt*. 1987, 1990, 1994; 63 FR 70053). As development encroaches upon beach mice habitat, house mice are found in increasing numbers (Gore, *in litt*. 1987, 1990, 1994). In some instances, only house mice are found or predominantly house mice are found at sites historically occupied by St. Andrew beach mice (Gore, *in litt*. 1987). There appears to be an inverse relationship between densities of house mice and inland oldfield mice (Caldwell and Gentry 1965, Gentry 1966). This relationship takes the form of a mutually exclusive distribution pattern (Humphrey and Barbour 1981). Briese and Smith (1973) suggested that house mice invade disturbed areas or areas with suitable structures. Therefore, the presence of house mice within known or former St. Andrew beach mouse habitat may indicate a degradation of habitat. The degree at which this potential competition affects beach mice populations is unclear and no beach mouse populations have been eliminated due

to house mice (63 FR 70053). With continued land development, however, this potential threat may be increasing.

Use of predator-proof trash receptacles can minimize house mouse occupation. Florida State Park lands use predator proof trash receptacles; however Gulf County Parks are not currently using predator proof trash receptacles. Tyndall AFB uses dumpsters as primary garbage disposal method.

Intra-specific Cross-breeding. A new, potential threat to the St. Andrew beach mouse on East Crooked Island is the presence of the Choctawhatchee beach mouse on West Crooked Island. In 2000, Choctawhatchee beach mice were confirmed to expand their range from Shell Island into unoccupied St. Andrew beach mice habitat on West Crooked Island via a land bridge created when East Pass closed and the islands became connected (Lynn 2004, Loggins *et al*. 2008). There is concern that East Crooked Island and West Crooked Island might join back together again at some point in time removing the separation of the two subspecies. This would result in the potential for cross-breeding of Choctawhatchee and St. Andrew beach mice. Hybridization can also occur if mice use routes such as roads adjacent to habitat to disperse. Currently, we do not know the implications of this threat; therefore, research is needed to look at the genetic effect of this potential threat (S. Sneckenberger, FWS, pers. comm., 2007).

Artificial Lighting. The negative effects of artificial lighting are well documented for sea turtles (Witherington and Martin 2003); however, the effects of artificial lighting within the habitat of the beach mouse 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. As natural illumination increases beach mouse activity levels decrease (Blair 1951, Wolfe and Summerlin 1989). Bird *et al.* (2004) found that beach mouse foraging behavior was altered as a result of artificial light. They found mice behavior was altered in two ways: 1) reduction in use of foraging patches around illuminated areas, and 2) reduction in seed harvest. They also suggested that artificial lights may cause habitat fragmentation due to altered movement patterns of mice.

Efforts are in place, proposed or on-going to address beachfront lighting within the range of the subspecies. Gulf County and City of Mexico Beach lighting ordinance have been in place since 2001.

Tyndall AFB continues to address lighting that cause disorientation of sea turtles on their beaches. While no specific regulations are in place concerning base lighting, Tyndall AFB is undergoing a lighting renovation that is converting existing base lighting to sea turtle lighting, which is also expected to benefit beach mice.

St. Joseph State Park controls lighting on the State Park using the appropriate lighting where needed for visitor safety and security.

Feral Hogs. As non-native feral hog (*Sus scrofa*) populations continue to grow, more evidence of their destructive activities within the dune systems are being seen on some of the areas in which beach mice occur (J. Mobley, Tyndall AFB, pers. comm. 2005). Feral hogs may pose a potential threat to beach mice. They can be very destructive to the habitat as they root-up large areas of vegetation while foraging. However, little is known at this time as to the degree of the potential threat (J. Gore, pers. comm. 2005).

D. Synthesis

Habitat loss and fragmentation associated with residential and commercial development is the primary threat contributing to the endangered status of beach mice (Holler 1992, Humphrey and Barbour1981, Holliman 1983). 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. Impacts 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 land managers are under increased pressure to manage for both the recovery of endangered species and recreational use. Where protection of large contiguous tracts of beach mouse habitat along the coast is not possible, establishing multiple independent populations is the most effective defense against local and complete extinctions due to storms and other stochastic events (Danielson 2005). Protecting multiple populations increases the likelihood that at least one population within the range of a subspecies will survive episodic storm events and persist while vegetation and dune structure recover.

The threats to the St. Andrew beach mouse have in some cases been reduced and in others have increased. Habitat loss through development and other dune encroachment still threatens the species, particularly on the St. Joseph Peninsula. However, the reintroduced population at East Crooked Island has been extremely

successful and faces few threats. Predation by native and non-native predators is a continuing concern but is being managed through a partnership with USDA-Wildlife Services. Inadequate regulations exist right now to protect the species. However, the Florida Fish and Wildlife Conservation Commission is leading an effort to amend Land Development Codes to better protect the SABM and other native wildlife. Based on the existing threats faced by the St. Andrew beach mouse, its restricted range, low population size, this mouse continues to meet the definition of an endangered species.

III. RESULTS

A. Recommended Classification:

__X__ **No change is needed**

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

The conservation of St. Andrew beach mice on rapidly developing private lands will need to be addressed. These lands also include areas designated as critical habitat for the subspecies. Development can be addressed in a variety of ways including: working with the State and local governments on the sighting of structures and facilities and landscaping with native vegetation within St. Andrew beach mouse habitat, regulatory requirements, and education of property owners. Public land managers are under pressure to manage natural resources while providing for other uses of the resource such as military training and recreation. These public land managers will need to balance these often competing mandates to ensure the conservation of the St. Andrew beach mouse.

Another necessary action includes the control of free ranging pet and feral cats and other predators on public and private lands. This can be accomplished through local animal control organizations, the established state-federal land partnership, and implementation of best management practices on private and public lands (adequate refuse management, predator proof trash receptacles, and landscaping with native plant species).

Conservation of St. Andrew beach mouse (and other wildlife) should be included in local emergency response plans. The plans could incorporate best management practices for debris clean up, responder and public access to affected areas, and infrastructure repair or rebuild. Additional perturbations on already stressed St. Andrew beach mouse habitat by storm passage could have significant effects on the recovery of the species following emergency events.

Other actions to facilitate recovery include the implementation of consistent range-wide monitoring of the beach mouse. A St. Andrew beach mouse recovery plan needs to be completed which should include plans for long-term monitoring, role of captive breeding and

translocations of mice into unoccupied habitat where reasons for the mouse's extirpation have been addressed or ameliorated.

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U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of the St. Andrew beach mouse (*Peromyscus polionotus peninsularis*)

Current Classification Endangered

Recommendation resulting from the 5-Year Review

X No Change is Needed

Review Conducted By Caroline Stahala and updated by Janet Mizzi

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve Lee A. Carmody Date 3/30/09

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.

REGIONAL OFFICE APPROVAL:

The Regional Director or the Assistant Regional Director, if authority has been delegated to the Assistant Regional Director, must sign all 5-year reviews.

Acting
Lead Regional Director, Fish and Wildlife Service

Approve Aaron L Valer Date 4-6-09

Appendix A: Summary of peer review for the 5-year review of St. Andrew beach mouse (*Peromyscus polionotus peninsularis*)

A. Peer Review Method:
The Service conducted external peer review of this document. Draft versions of the 5-year review were sent to five independent scientific reviewers with expertise in beach mouse biology, population genetics, conservation biology, and coastal resource management.

B. Peer Review Charge
Reviewers were asked to provide all comments they had on the document but we especially sought their appraisal of the overall assessment of the data on the St. Andrew beach mouse.

C. Summary of Peer Review Comments/Report

Peer reviewers provided editorial comment, additional information, requests for clarification, as well as several concerns. Additional information was provided concerning ongoing conservation actions, the genetic relationship between the St. Andrew beach mouse and Choctawhatchee beach mouse, the phylogeny and time of divergence between inland old field mice and beach mice subspecies, the home range estimates of beach mice, and the Gulf County animal control ordinance.

One reviewer did not agree with the Service's Recovery Priority number of 3C for the St. Andrew beach mouse, suggesting that the potential for recovery was not high given that the primary threat to the subspecies is habitat loss and recovering lost habitat is not likely. Another reviewer expressed concern over the viability of the Crooked Island population of the St. Andrew beach mouse because of the Islands' susceptibility to fragmentation and flooding and the threat from military exercises.

D. Response to Peer Review

All editorial comments and additional information were incorporated into the final document, where appropriate. While we reassessed the Recovery Priority number, we did not change it based on the reviewers' comments. The 3C classification indicates a subspecies with a high degree of threat and a high recovery potential in conflict with development or other forms of economic activity. We agree with the reviewer that there is a high degree of threat facing this subspecies, but we disagree about the recovery potential. The rating of high or low recovery potential is based on the table below (48 FR 43101).

	High Recovery Potential	**Low Recovery Potential**
Biological and ecological limiting factors	Well understood	Poorly understood
Threats to species existence	Well understood, easily alleviated	Poorly understood or pervasive and difficult to alleviate
Management needed*	Intensive management not needed, or techniques well documented with high probability of success.	Intensive management with uncertain probability of success, or techniques uncertain or still experimental.

*When possible and biologically feasible, data pertinent to the recovery of a particular taxon will be extrapolated from known ecological requirements or management techniques for closely related taxa.

The biological and ecological limiting factors are fairly well understood, the threats are well understood, and the management techniques are well documented with a high probability of success. Therefore, the rating of "high recovery potential" is appropriate for this subspecies.

The range of the St. Andrew beach mouse is fairly limited, it is located entirely in the work region of the Panama City Field Office, the number of individuals with species expertise is limited, and we have species experts on staff. Therefore, the review was drafted by the field office and sent out to other experts for Peer Review.