

Choctawhatchee Beach Mouse
(*Peromyscus polionotus allopshys*)

5-Year Review:
Summary and Evaluation



Photo by USFWS

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

5-YEAR REVIEW
Choctawhatchee Beach Mouse
(*Peromyscus polionotus allophrys*)

I. GENERAL INFORMATION

A. Methodology used to complete the review: In conducting this 5-year review, we relied on the best available information pertaining to historical and contemporary distributions, life histories, genetics, habitats, and threats of this species. We announced initiation of this review to the public and requested information in a published *Federal Register* notice with a 60-day comment period (81 FR 59650). We received no public comments during the 60-day open comment period. We used a variety of specific resources, including the final rule listing this species under the Endangered Species Act (ESA) (50 FR 23872); the Recovery Plan (Service 1987); peer reviewed scientific publications; unpublished field observations by Federal, State, and other experienced biologists; unpublished studies and survey reports; and notes and communications from other qualified individuals.

B. Reviewers

Lead Region: Southeast Region, Kelly Bibb, (404) 679-7132

Lead Field Office: Panama City Ecological Services Field Office, Kristi Yanchis, (850) 769-0552

C. Background:

- 1. Federal Register Notice citation announcing initiation of this review:** August 30, 2016. 81 FR 59650.
- 2. Species status:** Declining. In 2018, a Category 5 hurricane hit and severely affected the eastern portion of the Choctawhatchee Beach Mouse (CBM) population's habitat and caused a decline in beach mouse numbers with a storm surge in some parts up to 18 feet. Other state parks in the western portion of the range have also shown a decline or localized extirpation. Evidence suggests this may be from non-native predators, such as outdoor/feral cats (pers. comm. K. Yanchis and E. Grendel, 2018).
- 3. Recovery achieved:** 2 = 26-50% species' recovery objectives achieved.
- 4. Listing history**
 - Original Listing
 - FR notice: 50 FR 23872
 - Date listed: June 6, 1985
 - Entity listed: Subspecies
 - Classification: Endangered
- 5. Associated rulemakings:** Critical habitat was designated at the time of listing (1985), and revised October 12, 2006 (71 FR 60238).

6. Review History:

Recovery Plan: Recovery Plan for the Choctawhatchee Beach Mouse, Perdido Key Beach Mouse, and Alabama Beach Mouse (1987)

Each year, the U.S. Fish and Wildlife Service (USFWS) reviews and updates listed species information to benefit the required Recovery Report to Congress. Through 2013, we performed a recovery data call that included status recommendations, such as “declining” for this species. We continue to show this species’ status recommendation in 5-year reviews. The most recent evaluation for the Recovery Report to Congress was completed in 2019.

Five-year reviews:

November 6, 1991 (56 FR 56882)

In 1991, multiple species were simultaneously evaluated with no species-specific, in-depth assessment of the five factors or threats as they pertained to each species’ recovery. In particular, no changes to the status of Choctawhatchee beach mouse were recommended in the review.

September 4, 2007

In 2007, we completed a 5-year review for the Choctawhatchee beach mouse that did not recommend a change in its endangered status. The review indicated the degree of threat to this mammal continued to be high due to threats including residential and commercial development, feral cats, and hurricanes.

7. Species’ Recovery Priority Number at start of review (48 FR 43098): 3c

Degree of Threat: High

Recovery Potential: High

Taxonomy: Subspecies

8. Recovery Plan

Name of Plan: Recovery Plan for the Choctawhatchee Beach Mouse, Perdido Key Beach Mouse, and Alabama Beach Mouse

Date Issued: August 12, 1987

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 species as a DPS in accordance with the 1996 policy? No.**

B. Recovery Criteria

1. **Does the species have a final, approved recovery plan containing objective, measurable criteria?** Yes
2. **Adequacy of recovery criteria.**
 - a. **Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?** No, the approved recovery plan for the CBM is not up to date in regards to species status and threats. Recovery criteria may be considered subjective or not measurable, since “self-sustaining” and “protected” and even “occupied” can be difficult to define. The criteria do not address specific threats to the species. Also, as CBM critical habitat has been revised, the criterion involving a percentage of occupied and protected critical habitat may also warrant modification. Revision of the Recovery Plan and Recovery Criteria are recommended. New delisting criteria has been drafted and is in the process of being adopted. Our recommendations within this review are based on recent demographic information and the five factor or threat analysis.
 - b. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?** No, the five listing factors are not addressed in the current Recovery Plan’s recovery criteria.
3. **List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:**

Criteria: "Each subspecies of beach mouse can be considered for downlisting to threatened when there are 3 distinct, self-sustaining populations in each of the critical habitat areas, and a minimum of 50% of the critical habitat is protected and occupied by mice."

Status: The first criterion (minimum of 3 distinct, self-sustaining populations) has not been met. The current population estimate of mice on all public lands is unknown as no recent trapping has occurred. However, track tube monitoring, which allows us to measure presence/absence of mice and an indication of trends overtime, shows currently CBM are present at Topsail Hill Preserve State Park, Grayton Beach State Park, St. Andrews State Park, and Shell Island/West Crooked Island (FWC 2018). These data show a sharp decline at Deer Lake State Park and may indicate possible extirpation. These data also suggests the occurrence of mice at Topsail Hill Preserve State Park is relatively stable; Grayton Beach State Park is moderately stable with sharper fluctuations since the 2012 reintroduction, St. Andrews State Park is increasing since the 2016 reintroduction, and Shell Island/ West Crooked Island was severely impacted by Hurricane Michael in 2018 thus declined from previous years. We suspect there may be CBM on some adjacent private lands as evidence has been observed by USFWS CBM recovery biologist. The Grayton Beach and Deer Lake populations cannot be characterized as self-sustaining, as the occupancy continue to fluctuate since the 2012 translocation. Since the Recovery Plan was finalized (1987), historically several populations of CBM have been locally extirpated in the past.

Critical habitat was revised in 2006 (71 FR 60238). The second criterion (minimum of 50% of critical habitat is protected and occupied by mice) has not been met.

C. Updated Information and Current Species Status

1. Biology and Habitat

Information concerning their biology and habitat can be found in the revised critical habitat designation (70 FR 74426, 71 FR 60238) and is summarized below.

a. New information on the species' biology and life history:

No new information is available on the CBM's biology or life history since the last 5-year review.

In sections b and e (below), we will show new information gathered since the 2006 5-year review was completed using italics so it is easy to distinguish by readers.

b. Abundance, population trends, demographic features, or demographic trends:

Long-term trapping data have 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 1992b; Swilling et al. 1998; Swilling 2000; Sneckenberger 2001). Without suitable habitat sufficient in size to support the natural cyclic nature of beach mouse populations, subspecies are at risk from local extirpation, and may not attain the densities necessary to persist through storm events and seasonal fluctuations of resources.

Unlike many species that have annually-based life cycles and can be sampled annually to determine population parameters, beach mice breed year-round with up to 13 generations (overlapping and asynchronous among individuals) within one year. To calculate demographic and population growth rates for beach mouse populations, trapping would need to occur on a monthly or bi-monthly basis. Furthermore, because of annual and seasonal population fluctuations common to small mammals and differences between sites, abundance data alone carry little meaning, particularly when trapping is incidental. Consequently, as the data we currently collect or have access to are limited, population trends of CBM are based on occupation or simple comparisons in recent tracking, track tube monitoring, or trapping sessions, sometimes of only one site.

In 1979, the population estimate for CBM was over 515 individuals (Humphrey and Barbour 1981). While this estimate was obtained through a census of all suitable habitat, CBM were only captured on Shell Island/West Crooked Island and Topsail Hill. In 1982, the population at Shell Island appeared stable (Meyers 1983). More recent population estimates at Shell Island were 338, 105, 800-1200, and 195 in 1993, 1994, 1995, and 1998 (Moyers et al. 1996; 1999). Trapping in 2000 to 2003 yielded estimates of 24 to 67 individuals (Van Zant, unpublished data; Service 2002, 2003a). Shell Island/West Crooked Island has not been trapped in its entirety since 2003; *however, localized*

trapping efforts by USFWS and FWC in 2015 and 2016 in conjunction with the St. Andrews State Park translocation yielded high numbers of individual mice captured.

Tracking data collected in 2006 indicated low densities of CBM at the site. In 2011, the Florida Fish and Wildlife Conservation Commission (FWC) changed the monitoring protocol to track tubes at all public lands. Track tubes are a 1-foot section of PVC with a cap on one end and an elbow on the other. Inside is an inkpad and piece of card stock. The tubes are placed in the ground with metal stakes and baited with sunflower seeds. Since the inception of track tube monitoring, the Shell Island/West Crooked Island CBM populations have been shown to be increasing and stable, and at the highest occupancy across the habitat since they were listed in 1987. This is evidenced by consistent positive hits on the majority of track tubes across the habitat. However, in October 2018, Hurricane Michael directly hit that area and severely damaged the habitat and population. Track tube monitoring suggests there are still CBM in most of the areas of Shell Island/West Crooked Island post storm, and they are starting to move around more as the habitat rebounds (FWC 2019). It has only been a year since the Category 5 storm hit so it is too early to suggest that the population is increasing, but past evidence collected after other hurricanes or tropical storms suggests the CBM population in this area will increase over time as the habitat restores itself.

In 1987, two trapping sessions at Topsail yielded only two captures (Holler 1992). Trapping of four 100-trap transects yielded population estimates of 190, 250, <10 (too few to estimate), and 87 in 2003, 2005, 2006, and 2007, respectively (Service 2003b; 2005; 2006; unpublished data). Track tube monitoring suggests the population is occupying a large portion of the overall habitat and has been relatively stable since 2011, however, no population estimates have been obtained from trapping effort.

The Grayton Beach population (central unit) was reestablished in 1987 and 1988. Population estimates from 1995 to 1999 were 25 to 116 individuals (Moyers et al. 1999). In 2002, no CBM were captured in the central unit. Multiple tracking efforts indicated no signs of CBM within the western unit of the Grayton Beach State Park (Moyers et al. 1999). In 2012, the Florida Fish and Wildlife Conservation Commission (FWC), University of Florida, and the USFWS translocated mice from Topsail Hill State Park to Grayton Beach State Park. While the population numbers are not always stable according to track tube monitoring, the translocation does appear to have been a success as CBM are still occupying Grayton Beach State Park. Recent trapping impromptu during November 2019 to obtain genetics samples did not capture many beach mice at the two Grayton Beach units. A total of six mice were caught and no population estimate can be derived from that data set. We are meeting to determine the next steps. The initial thoughts are that feral/outdoor cats are the problem based on two cats being observed in the State Park while trapping and many cat tracks seen (pers. comm. K. Yanchis, 2019).

The Deer Lake site was reestablished through translocations from Topsail Hill to adjacent private lands in 2003 and 2005 (Service 2003b; 2005). Trapping on the adjacent private lands had been sporadic, but has yielded population estimates of 5 to 46 individuals in

2003 to 2006 (Moyers 2007). *Since 2011, track tube data shows Deer Lake State Park populations were always lower than some of the other larger State Parks, but still moderately stable occurrences with more fluctuations in detections across the habitat. However, between September and October 2017, the track tube detections showed a sharp decline and they remained that way until May 2018. From May 2018 to present, no CBM detections have been observed in the track tubes.*

In 2016, the USFWS and FWC worked with the Department of Environmental Protection's (DEP) State Parks District 1 Office to reintroduce CBM to St. Andrews State Park mainland unit. This has been a recovery goal since the Recovery Plan was drafted in 1987. This translocation appears to have been a success based on trapping results within the first two years and track tube monitoring since. Current track tube monitoring shows the population expanded from the translocation sites to other suitable habitat and is occupying a large portion of suitable habitat. Trapping efforts in 2018 found 24 new individuals to suggest the population is growing and breeding.

In summary, CBM populations fluctuate greatly, and many public land areas have not been trapped in several years. *Prior to Hurricane Michael in 2018, the population in the Shell Island/West Crooked Island Unit had increased and been relatively stable since 2011. The western portion of the range that includes the state parks in Walton County have struggled on and off with the exception of Topsail Hill Preserve. At present time, the entire CBM population is thought to be at lower densities or occupying less portions of their range than they should be to meet downlisting criteria. Trapping to obtain better population estimates is needed in all areas with CBM populations. Furthermore, as the area within CBM's historic range has experienced continued rapid growth, little suitable habitat on private lands remains and therefore CBM are primarily restricted to public lands and rely on these lands for recovery and persistence.*

Because of their close ancestry and analogous life histories, research on one beach mouse subspecies is often inferred to the other subspecies. Based on research on old-field mice and beach mouse subspecies, beach mice are considered monogamous (Smith 1966; Foltz 1981; Lynn 2000b). While a majority of individuals appear to pair for life, paired males may sire extra litters with unpaired females. Beach mice are considered sexually mature at 55 days of age; however some are capable of breeding earlier (Weston 2007). Gestation averages 28 to 30 days (Weston 2007) and the average litter size is four pups (Fleming and Holler 1990). Littering intervals may be as short as 26 days (Bowen 1968). Peak breeding season for beach mice is autumn and winter, declining in spring, and falling to low levels in summer (Blair 1951). However, pregnant and lactating beach mice have been observed in all seasons (Moyers et al. 1999).

Apparent survival rate estimates (products of true survival and site fidelity) of beach mice along the Gulf Coasts of Florida and Alabama have demonstrated that their average life span is about nine months (Swilling 2000). Other research indicated that 63 % of Alabama beach mice lived (or remained in the trapping area) for four months or less, 37% lived five months or greater, and 2% 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).

c. Genetics, genetic variation, or trends in genetic variation:

An electrophoretic study conducted on 30 populations of *Peromyscus polionotus* estimated that the level of allozyme variation found in beach mouse populations was at least 40 percent lower than the level of variation in nearby inland populations (Selander et al. 1971). This study indicates that beach mouse populations already have lower genetic variability before inbreeding, bottleneck events, or founder effects that may occur in a reintroduced population.

In 1995, the Service contracted a genetic analysis of: 1) post-re-establishment gene structure in the Perdido Key beach mouse and CBM; 2) microgeographic patterning and its relevance to alternate management approaches for the Alabama beach mouse on the Bon Secour National Wildlife Refuge; and 3) if feasible, the historical relationship of St. Andrews Beach Mouse from Crooked Island relative to CBM from Shell Island and SABM from St. Joseph Peninsula.

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

Management of the Grayton Beach State Park population for genetic characteristics was recommended; however, additional genetic analyses would be needed. Relocation of CBM to Grayton Beach State Park from Shell Island was suggested as an important future action (Wooten and Holler 1999).

Information from these genetic studies has been useful in managing CBM populations. Planning of translocations has become a more complex and informed process since isolated populations were determined to differ greatly. Furthermore, the results from Grayton Beach State Park indicated that regardless of population size, further translocation and exchange programs need to take place before the population is likely to be self-sustaining or persist in the long-term. Lastly, the findings regarding the uniqueness of the Topsail Hill Preserve State Park population should be reassessed to determine its current genetic status.

d. Taxonomic classification or changes in nomenclature:

Since the listing of the CBM, further research concerning the taxonomic validity of the subspecific classification of beach mice has been initiated and/or conducted. Final results from these studies support the separation of beach mice from inland forms, and support the currently accepted (Bowen 1968) taxonomy that each beach mouse group represents a unique and isolated subspecies (Selander et al., 1971, Wooten 1994, Mullen et al. 2009, ITIS 2008, Van Zant 2006).

e. Spatial distribution, trends in spatial distribution, or historical range:

The historic range of the CBM extended 53 miles between the Destin Pass, Choctawhatchee Bay in Okaloosa County and East Pass in St. Andrew Bay, Bay County in Florida (50 FR 23872). In the 1950s, the CBM was widespread and abundant according to Bowen (1968). Habitat loss and fragmentation associated with residential and commercial real estate development has reduced the distribution of the CBM to a portion of its historic range (Holler 1992; Humphrey 1992). By 1979, only 40 percent of the original habitat remained undeveloped in non-contiguous areas and CBM had been extirpated from seven of its nine historical localities (Humphrey and Barbour 1981). In 1985 when the CBM became federally protected, CBM were only known from the Topsail Hill area and Shell Island, an area consisting of about ten miles of coastline (50 FR 23872). In 1987 and 1988, a cooperative interagency effort reintroduced CBM onto the central and west units of Grayton Beach State Park increasing the occupied coastline by another mile (Holler and Mason 1989). In 1999, with the closing of East Pass and Shell Island connecting to West Crooked Island, CBM increased their range by approximately four miles (Lynn 2000a). Coastal development is the primary threat contributing to the endangered status of beach mice (Holler 1992; Humphrey 1992), and has fragmented the subspecies into the disjunct populations discussed above.

There are four populations of CBM that currently exist: 1) Topsail Hill Preserve State Park (and adjacent eastern and western private lands); 2) Shell Island/West Crooked Island [includes St. Andrew State Park mainland (recent translocation in 2016 is first documented population at this site) and Shell Island and Tyndall Air Force Base]; 3) Grayton Beach (and adjacent eastern private lands); and 4) Deer Lake State Park (and adjacent eastern private lands). Translocations to establish a fifth population of CBM occurred in March of 2003 and 2005. Twenty-six CBM from Topsail Hill Preserve State Park were moved to private lands at Camp Creek/WaterSound in Walton County, Florida (Service 2003b; Service 2005a, 2005b, 2005c, 2005d). *The reestablished population at WaterSound appeared to be successful, however recent data is insufficient to determine its current success. The recent track tube data suggests St Andrews State Park translocation was successful and the population is increasing there.*

Topsail Hill Preserve State Park consists of 1,637 acres of which 277 acres provide CBM habitat. Private lands on the east side total approximately 10 acres, seven acres of which is the development known as the Stallworth Preserve. The

remaining 3 acres was purchased by Walton County with a grant from the Service. Private lands on the west side of the Preserve consist of 24 acres and include Four-Mile Village, a low density single family development, and the Coffeen Nature Preserve managed by the Sierra Club. *In 2013, these lands were trapped and mice were found on Topsail Hill Preserve and the adjacent lands to the east and west, although no population estimate was derived.*

The Shell Island Unit consists of lands within the St. Andrew State Park (mainland and Shell Island), Tyndall Air Force Base, and private lands. The St. Andrew State Park mainland consists of 1,260 acres of which 123 acres are beach mouse habitat. Several tracking efforts looking for signs of CBM on the mainland were made between 1995 and 1998; no evidence was found that indicated the presence of the beach mouse (Moyers et al. 1996; Moyers et al. 1999). *In 2016, the USFWS and FWC translocated a total of 40 mice (20 during the initial phase and 20 during a second phase) to St. Andrews State Park mainland. This was an effort to establish another population to support recovery efforts. Currently, the reintroduction appears to have been a success. The last trapping effort in 2017 yielded 24 new individuals. Another trapping effort is needed to ensure mice are maintaining in the habitat within St Andrews State Park and potentially another round of reintroduced individuals to keep a genetically diverse population.*

While historically a healthy population (Novak 1995; Moyers et al. 1996; Moyers et al. 1999), Shell Island itself has not been trapped in its entirety since 2002 and has since weathered the tropical storms of 2004 and 2005 and *recently a catastrophic storm in 2018. Small areas of Shell Island were trapped during the St. Andrews State Park reintroduction efforts. Over a hundred new individuals were captured during that time; suggesting the population was relatively large and robust. Recreational pressure on the island has also increased greatly in the last 10-15 years. Current track tube data suggests the Shell Island CBM population and its habitat are rebounding since Hurricane Michael. Although an estimated 30 feet of primary dune was lost during that storm and many areas were inundated and completely washed over, the CBM persisted in high dunes and have begun to repopulate over the past year.*

West Crooked Island consists of 1,558 acres of which 730 acres provide CBM habitat. The West Crooked Island population resulted from its connection to Shell Island in 1998 -1999. The passes and barrier island connections are dynamic in this area; East Pass has opened and closed again since the colonization of CBM. *Hurricane Michael created inlets and washovers that are temporarily impeding connectivity. CBM in this area were severely impacted and are showing signs of rebuilding their population as the habitat restores itself. Track tube occurrence data suggests the mice are starting to use areas where the habitat and vegetation has started to recover (pers. comm. Ashley Warren 2019). Trapping efforts were not conducted on a wide scale prior to Hurricane Michael, but the small trapping efforts and track tube data suggests their population numbers were the highest they had been since being listed. Post hurricane trapping efforts are planned for the near future as a way to get a baseline to*

monitor post storm population trends. Other post storm efforts are being planned as well to monitor the CBM relationship to natural habitat restoration.

The Grayton Beach area consists of two units in Grayton Beach State Park. The Park is divided into a central and western unit and is connected by a narrow band of primary dunes. Total acreage of the Park is 2,236 acres with 162 acres providing suitable CBM habitat. CBM were extirpated from this area prior to listing, and translocations to Grayton Beach State Park have yielded mixed success (see Van Zant and Wooten 2003) and certainly are not stable. *However, the CBM are persisting at Grayton Beach State Park even though their detection rates with the track tube monitoring fluctuates more than other places. Portions of private lands (Water Color) on the east side of the central unit are occupied by CBM or provide suitable habitat.*

The Deer Lake area consists of 49 acres and encompasses beach mouse habitat within the boundary of Deer Lake State Park as well as adjacent private lands. CBM were translocated from Topsail Hill Preserve State Park to private lands adjacent to this unit in 2003 and 2005 (Service 2003b; 2005a, 2005b, 2005c, 2005d). *Track tube monitoring at Deer Lake State Park had documented CBM on the site up until May 2018. At Water Sound, mice have been present in declining numbers up until December 2015. At that time the data becomes insufficient due to gaps in collection. It is currently unknown what the CBM population or detection rate is at Water Sound. Very recent (November 2019) trapping only captured six mice at Grayton Beach State Park. This is a concern as feral/outdoor cats were observed during that trapping event (pers. comm. K. Yanchis). Future meetings will determine what actions are needed at this point in time.*

Henderson Beach State Park is not currently occupied, but translocation to the area has been identified as a potential recovery action.

While CBM benefit from having several populations - greatly increasing the probability of the subspecies' long-term persistence - further population data collection is warranted for all populations and sites to more accurately estimate population trends and spatial distribution. The Topsail Hill and Shell Island/West Crooked Island populations seem the most likely to persist in the near future. However, even these populations are vulnerable from recent storms. The Deer Lake and Grayton Beach populations do not appear to be self-sustaining in the long-term *without a concerted effort to provide connectivity to and between those populations.*

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 increased and dispersal occurred 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 residential and commercial 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 does not currently exist and any hurricane can impact the entire range of the subspecies, the probability of beach mice persisting would be enhanced by the restoration of contiguous tracts of suitable habitat occupied by multiple independent populations (Shaffer and Stein 2000; Danielson 2005).

f. Habitat:

Choctawhatchee beach mice inhabit coastal dune ecosystems. This 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*]).

Beach mice occupy both frontal (primary and secondary) and 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. 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). This suggests that access to primary, secondary and scrub dune habitat is essential to beach mice at the individual level.

Approximately 2,500 acres of CBM habitat currently exists. While approximately 96 percent of their remaining habitat is public land, due to recent hurricanes and increasing recreational pressure on public lands, habitat loss and degradation remain as threats to beach mice. Maintaining habitat on private lands continues to be imperative to preserve connectivity and allow for population expansion.

g. Other:

2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

a. Present or threatened destruction, modification or curtailment of its habitat or range:

Due to coastal development, from the CBM's historic range of 53 miles of coastal dune habitat (50 FR 23872), an estimated 10 to 15 miles remain. By 1979, only two populations remained (Humphrey and Barbour 1981). *Past and recent translocation efforts have increased the number of populations to five. However,*

the Deer Lake/Water Sound population appears to be extirpated, the Grayton Beach population is persisting but occupancy data appears to fluctuate widely, and the Shell Island/West Crooked Island Unit was severely impacted by Hurricane Michael and is undergoing a natural population and habitat rebuilding phase. Much of the remaining coastal dune habitat is degraded due to fragmentation from residential and commercial development, impacts from tropical storms, recreational pressure, introduction of non-native predators, and other anthropogenic factors.

The conservation of multiple large, contiguous tracts of habitat is a key to the persistence of beach mice. At present, large parcels exist mainly on public lands. Protection, management, and conservation of beach mice on public areas have been complicated by increased recreational use by humans as public lands are rapidly becoming the only natural areas left on the coast. Where protection of large contiguous tracts of beach mouse habitat along the coast is not possible, establishing multiple independent populations is the best defense against local and complete extinctions due to storms and other stochastic events (Shaffer and Stein 2000; Oli et al. 2001; Danielson 2005). Protecting multiple populations increases the chance of at least one population within the range of a subspecies will survive episodic storm events and persist while vegetation and dune structure recover.

Isolation of small populations of beach mice also reduces or precludes gene flow between populations and can result in the loss of genetic diversity. Demographic factors such as predation (especially by free roaming domestic or feral 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 tropical storms, reduced food availability, and/or reduced reproductive success, isolated populations may experience severe declines or extirpation (Caughley and Gunn 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 (Sneckenberger 2001). 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.

Numerous guidelines, conservation measures, and regulatory mechanisms are in place to minimize impacts to CBM and their habitat. Construction conservation measures and best management practices for road projects developed by the Service are provided to developers, consultants, and the Florida Department of Transportation. These documents indicate conservation measures aimed to minimize impacts pre-construction, during construction, and in operation and management following construction. Such measures include prohibiting cats and unleashed dogs, providing controlled access to the beach, use of predator-proof refuse containers, prohibiting use of clay materials in roadbeds within coastal areas, and use of wildlife-friendly lighting.

c. Overutilization for commercial, recreational, scientific, or educational purposes:

Not known as a threat at the time of listing or at present. Although scientific research does involve trapping and taking genetic samples (i.e., ear clips), there has not been a significant loss of CBM to scientific purposes.

d. Disease or predation:

Beach mice have a number of natural predators including the coach whip (*Masticophis flagellum*), com snake (*Elaphe guttata guttata*), pygmy rattlesnake (*Sistrurus miliarius*), Eastern diamondback rattlesnake (*Crotalus adamanteus*), short-eared (*Asia jlammeus*) and great-homed owl (*Bubo virginianus*), great blue heron (*Ardea herodias*), northern harrier (*Circus cyaneus*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*) skunk (*Mephitis mephitis*), weasel (*Mustela Jenata*), 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.

Conversely, increased predation pressure on isolated beach mouse populations from natural and non-native predators can have a substantial impact.

Free-roaming domestic and feral cats are believed to have a devastating effect on beach mouse persistence (Bowen 1968; Linzey 1978) and are considered to be the primary cause of the extirpation of isolated populations of beach mice, and a contributing factor to the extinction of the Pallid beach mouse (Bowen 1968; Holliman 1983; Humphrey 1992). Predation of beach mice by feral cats has been documented (Van Zant and Wooten 2003), and with habitat loss is considered the most serious threats to beach mouse populations (Gore in litt. 1994). Cat tracks have been observed in areas of low trapping success for beach mice (Moyers et al. 1999).

Evidence suggests that outdoor/feral cats may be the cause of the localized extirpation at Deer Lake State Park and the fluctuations in track tube detection at Grayton Beach State Park. Cat tracks have been observed near track tubes at both parks and cats have been observed in both State Parks and the surrounding private lands. Biologists have tracked the cats back to specific residences in the

Grayton area. Stronger efforts by USFWS, FWC, Counties, and residents are needed to curtail any outdoor/feral cat problems as they arise.

A predator control program was implemented 1996 on coastal public lands across northwest Florida. The program has shifted focus but efforts are still ongoing. Better coordination is needed to determine the impact outdoor/feral cats are having on State Park beach mouse populations near private lands.

Diseases and parasites pose no known threat to beach mouse populations at this time.

e. Inadequacy of existing regulatory mechanisms:

Choctawhatchee beach mice are also a state-listed species. However, the FWC typically defers regulatory decisions to the USFWS.

Coastal dunes are protected from pedestrian traffic and disturbance of vegetation on state and federal lands (through the Florida Administrative Code 62D-2.013(2) and park or base-specific laws and policies, respectively), but there are no such regulations pertaining to coastal dunes on private lands. The Florida Beach and Shore Preservation Act protects beach and dune systems from imprudent upland construction that could weaken, damage, or destroy the integrity of the beach and dune system. While construction is not prohibited, projects must meet special siting and design criteria. *In Walton County, parcels that are identified as Tier 1 or 2 are required to follow specific conservation measures prior to obtaining a County permit. This is a newer initiative and more proactive participation by County staff is needed and hopefully forthcoming.*

Walton County has an ordinance that addresses animal control. Pets are not permitted to roam at large off one's property; nor are they permitted on the public beaches (county residences with permits may bring leashed dogs to the beach during restricted time periods). Feeding or harboring of feral cats is also prohibited. Bay County prohibits pets from public beaches. Animals repeatedly at large are declared nuisance animals. Okaloosa County ordinances state that pets not confined to property must be under direct control. Harboring of stray animals must be reported to the county. Despite these regulations, feral cats remain a problem in these counties. Enforcement of these ordinances by the counties is difficult and is often unpopular with the public.

f. Other natural or manmade factors affecting its continued existence:

Hurricanes affect beach mouse population densities in various habitats. Possible mechanisms for effects include direct mortality of individuals, relocation/dispersal, and subsequent long-term effects of habitat alterations (i.e., impact on food resource availability and dune structure). Habitat impacts can be widespread, encompassing the range of the subspecies.

Hurricanes affect CBM habitat in the following ways:

- 1) tidal surge and wave action overwashes habitat leaving a flat sand surface denuded of vegetation;
- 2) sand deposition completely or partially covers vegetation;
- 3) blowouts occurs between the Gulf and bay/lagoon leaving a patchy landscape of bare sand, dune, and scrub habitat;
- 4) the frontal portion of the primary dune habitat is sheared (damage to landward areas varies in severity);
- 5) vegetation is killed by salt spray; and
- 6) islands may be breached entirely and channels from the Gulf to bay/lagoon may be created.

Although hurricanes can significantly alter CBM habitat and population densities in certain habitats, some physical effects may benefit the subspecies. Hurricanes are responsible for maintaining coastal dune habitat upon which beach mice depend through repeated cycles of destruction, alteration, and recovery of dune habitat. Hurricanes could 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 moderate effects of genetic drift and bottlenecks. *Also, vegetated berms are often installed on beaches following hurricanes. These berms can act as a dispersal highway for mice searching for new territories or food resources, thus spreading beyond their normal home ranges and mixing with other populations.*

Effects of Hurricane Michael

On October 10, 2018, Hurricane Michael made landfall along the Florida Panhandle as a massive Category 5 hurricane with maximum sustained winds of 161 mph and a pressure of 919 mega bars (<https://www.weather.gov/tae/HurricaneMichael2018>). All residents including wildlife on the northern Gulf of Mexico's coast experienced a storm surge of 9 to 14 feet. This storm continued inland all the way to interior southern Georgia as a high Category hurricane resulting in excessive wind damage and destruction to an area from Panama City Beach to Mexico Beach to Cape San Blas (<https://www.weather.gov/tae/HurricaneMichael2018>).

Artificial lighting increases the risk of predation and influences beach mouse foraging patterns and natural movements as it increases their perceived risk of predation. 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). In 2000, the Service provided funds under the Partners for Fish and Wildlife Program for wildlife lighting changes on private lands in Walton County, additional efforts were started by FWC to continue this funding opportunity. More coordinated effort by all partners is needed to continue to identify and correct poor lighting, specifically in the dunes and scrub habitats associated with private lands. The Service has also partnered with the State of Florida to produce a website to assist property owners and local governments locate and purchase

wildlife lighting. *Also, a better understanding of how current wildlife friendly lighting affects beach mice specifically is needed.*

Sea level rise is an increasing threat to CBM and all other coastal dependent species based on numerous prediction models. According to the Third National Climate Assessment, release May 2014, sea level rise and increasing storm surge events are occurring and are impacting coastal species and ecosystems (Melillo et al. 2014 and Wolf 2014). It is expected that low-lying coastal habitat will be affected most severely by sea level rise. According to the NOAA Sea Level Rise and Coastal Flooding Impacts Viewer (NOAA 2014), the western portion of the range (including Topsail Hill, Grayton Beach, and Deer Lake/Water Color) the mean high water line of the Gulf of Mexico encroaches significantly closer to the dunes at a 3-ft rise in sea level, thus creating an atmosphere for more erosion during high tide or storm events. The dune lakes also rise, thus causing the outfalls to be continually open and creating a more persistent barrier preventing habitat connectivity for CBM. The eastern portion of the range has much more drastic changes with sea level rise. At a 2-ft rise in sea level, the bay and sound side of Shell Island and West Crooked Island begins to show permanent water in the swales and some breaches from the Gulf to Bay. At 3-ft rise in sea level, these conditions multiply and begin to create islands and permanent barriers preventing CBM connectivity to other suitable habitat. Significant loss of CBM habitat in the western portion of the range becomes apparent around 4-ft of sea level rise and around 3-ft in the eastern portion of the range. The existing development would not allow for the natural regression of the dune habitat. This could result in a shrinking of available frontal dune habitat, thus securing coastal strand habitat would be important for long term subsistence. However, a young patch of sea oats can accumulate a foot of sand in one year, which is faster than sea level rise. For this reason, barrier islands are a persistent (though dynamic) component of the coastal landscape through eons of fluctuating sea levels.

D. Synthesis

No change is recommended to the classification or priority ranking of the endangered Choctawhatchee beach mouse. The degree of threat to its persistence remains high. It is a subspecies with high level of taxonomic distinctness, and its potential for recovery is considerable if threats can be eliminated or minimized. Recovery of the Choctawhatchee beach mouse is in conflict with some economic activities, more so today than at the time of listing, which further elevates its priority ranking.

The approved recovery plan for CBM (1987) does contain recovery criteria, though it is not up-to-date in regard to species' status and threats. Impacts to CBM and their habitat quality have increased in the recent past from feral cat populations and residential and commercial development. With the additional stress of recent active hurricane seasons, many populations are currently fragile. Specifically, about 2,500 acres of CBM habitat remains, the previous stronghold in the Shell Island/West Crooked Island Unit was severely impacted by Hurricane Michael in 2018. The habitat and CBM populations will continue to rebound over the next several years, *however, another severe impact in the*

same population could have devastating effects. The western population units in Walton County are fragile and need specific attention to identify and address causes in population declines. CBM populations need to be trapped and assessed to identify current trends and develop a proactive plan to reach our recovery objectives.

Better regulatory mechanisms need to be developed to track impacts to CBM habitat identify and aid in minimizing impacts from development on public lands. However, the subspecies' requirements for corridor size and level of tolerance for fragmentation are unknown. Predator control programs have been in place on public lands since 1996, though non-native predators continue to pose a major threat to beach mice.

At this time, Choctawhatchee Beach Mice continue to meet the definition of an endangered species under the Act.

III.RESULTS

A. Recommended Classification:

- ☐ Downlist to Threatened
- ☐ Uplist to Endangered
- ☐ Delist
- ☒ No change needed

IV.RECOMMENDATIONS FOR FUTURE ACTIONS

The following suggested recommendations are in order of priority. Please note that these actions are not necessarily specific to CBM. To that end, many actions listed are appropriate for all beach mouse subspecies, and in most cases research conducted or plans developed for one subspecies would serve all subspecies.

A. Additional Biologist

A second biologist position is imperative to aid in the identified recovery actions. Another biologist is needed to assist in the heavy workload for all beach mice and allow for in-office coordination and consistency with Section 7 and 10 permitting aspects, monitoring and trapping, permit compliance, research, and recovery activities such as translocations and outreach. This position could be an entry level or student trainee position and should work under the lead Recovery biologist. Without such a position, few of the recommendations suggested can be accomplished for CBM and other beach mouse subspecies. The USFWS could really make advances towards recovery actions with another biologist.

B. Revise Recovery Plan

The recovery plan should be updated to define objective measurable criteria and better address the five factors. However, delisting criteria has been developed and is awaiting finalization.

C. Population and Habitat Assessment program

The track tube monitoring program has been developed since our last 5-year review and should continue to be implemented for CBM. The development of a habitat mapping tool has also been initiated. This can be used to see landscape connectivity and potential dispersal routes as well as identify restoration opportunities and guide post-hurricane restoration efforts. An updated PVA needs to be done to estimate future population trends and the likelihood of extinction.

D. Emergency Response Plan

A contingency plan to outline actions taken in case of severe threats to the persistence of CBM needs to be developed. Actions should be identified that outline when specific management actions are needed once a specific trigger is reached. This would provide for a proactive emergency management approach instead of reactive.

E. Land Acquisition

Parcels should be identified for potential future acquisition. This list should include adding on to public lands to further the connected acreage available for CBM. Purchasing development rights should also be a future option.

F. Corridor size persistence, HCP, genetic studies

Research should be conducted to investigate the effectiveness of corridors currently set aside in HCPs. Studies should determine the minimum dimensions needed by CBM to ensure movement of individuals and genetic exchange through corridors. The use of genetic markers to evaluate the effectiveness and trends of existing corridors (i.e., frontal berms) is a promising tool to examine dispersal given the resources needed to conduct traditional capture-mark-recapture studies.

G. Translocation

While translocations are not needed at present time, future actions may once again require. Multiple core populations of CBM are crucial for their long-term persistence. A comprehensive translocation plan is needed to identify key sites, set criteria for when translocations are needed, consider genetic as well as demographic characteristics of the donor and recipient populations, and should include an assessment of the suitability of the recipient habitat (i.e., habitat quality, have feral cats and other threats been minimized or removed). Public-private partnerships and easements should also be explored.

H. Outreach/Education

Opportunities to convey the importance of coastal dune habitat to the public should be sought and pursued whenever possible. In addition, an outreach/education program focused on the threats feral cats pose to wildlife and people should also be developed.

I. Hurricane response studies

Further research should be implemented to determine the response of beach mice to storm events. This could determine whether (or to what extent) beach mice retreat to the scrub dunes, remain in their burrows, or perish. Further studies to investigate the effects of revegetation and habitat modification on beach mouse habitat use and foraging patterns following storm events should be conducted.

J. Coastal dune habitat restoration protocol

A coastal dune restoration protocol has been developed and adopted to inform partners and applicants of proper, sustainable dune restoration practices. Phase 2 is needed to implement and monitor some test sites to ensure long term success of these projects.

There is a need for cultivating and producing coastal dune plants that are currently commercially unavailable for restoration. A researcher developed a manual to inform growers how to propagate and grow these plants. Efforts to get the DEP greenhouse or a commercial grower to mass produce and sell these plants is needed.

K. Lighting

Additional research on the effects of artificial lighting on beach mice should be undertaken. The research should focus on the current types of “wildlife lighting lamps” and how they affect beach mouse breeding, foraging and movement behavior and home range.

L. Coordination with stakeholders and partners

Continue fostering a working partnership with the State Parks, Gulf Islands National Seashore, Escambia, Walton, and Gulf Counties, the City of Orange Beach, and Eglin and Tyndall Air Force Bases for recovery of all beach mice subspecies.

M. Enforcement

A tool to track enforcement of permits is needed. This should be a spatial tool available and open to stakeholders. This would be a good project for a student to do through the Pathways Program, Directorate Resource Assistants Fellows Program, or some other high quality intern program.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Choctawhatchee Beach Mouse
(*Peromyscus polionotus allophrys*)

Current Classification:

Recommendation resulting from the 5-Year Review:

- ☐ Downlist to Threatened
- ☐ Uplist to Endangered
- ☐ Delist
- ☒ No change needed

Review Conducted By: Kristi Yanchis, Panama City Ecological Services Field Office.

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve: _____ Date: 11/15/2019