Florida Mouse

Podomys floridanus

Photograph by Fiona Sunquist.

Species Overview

Status: Removed from Florida's Endangered and Threatened Species List.

Current protections

- 68A-4.001, F.A.C., General Prohibitions and Requirement –Prohibits the take, transport, sale, and possession of wildlife.
- 68A-1.004, F.A.C., Take – The term take shall include taking, attempting to take, pursuing, hunting, molesting, capturing, or killing any wildlife or freshwater fish, or their nests or eggs by any means whether or not such actions result in obtaining possession of such wildlife or freshwater fish or their nests or eggs.
- 68A-29.002(1)a, F.A.C., Regulations Relating to the Taking of Mammals – Prohibits take, transport, sale, purchase or possession of Florida mice (*Podomys floridanus*) unless authorized by 68A-9, F.A.C.

Biological Background

This section describes the biological background for this species and provides context for the following sections. It focuses on the habitats that support Florida mice, and the threats faced by the species.

Endemic to Florida, the Florida mouse (*Podomys floridanus*) is the only member of the monotypic genus, Podomys (Carleton 1980). Florida mice are largely restricted to fire-maintained xeric uplands that occur on deep, well-drained, sandy soils. The Florida mouse primarily occupies scrub (includes scrubby flatwoods, oak scrub, sand pine scrub, and rosemary scrub) and sandhill, though the species sometimes occurs in drier mesic flatwoods. Occasionally, individuals have been recorded in other natural communities such as flatwoods, hammocks, and wetland edges, likely when they were dispersing (Layne 1990).

The Florida mouse is a relatively large mouse that shares similar characteristics to other native mice inhabiting Florida, such as large ears and large eyes. Pelage color can vary among populations, but adults generally have a dorsal color of brown to brownish gray with orange coloration on the shoulders, cheeks, and lower sides (Layne 1992, Jones and Layne 1993). The underside and feet are white, and the tail is brown above and white below (Chapman 1889). Florida mice are distinguished by the number of plantar tubercles on the hind feet; Florida mice typically have only 5 (sometimes 4, rarely 6), while *Peromyscus* spp. have 6 tubercles (Figure 1). The Florida mouse is larger than both the old field mouse (*Peromyscus polionotus*) and the cotton mouse (*Peromyscus gossypinus*). The average body size of the Florida mouse can differ across the species range (Jones and Layne 1993). More significant is that *Podomys* individuals occupying sandhill sites are significantly smaller than individuals occupying scrub sites (Layne 1990, Austin et al. 2019). Austin et al. (2019) suggests those morphological differences may indicate possible ecological differences between *Podomys* occupying scrub habitat compared to those occupying sandhill habitat.

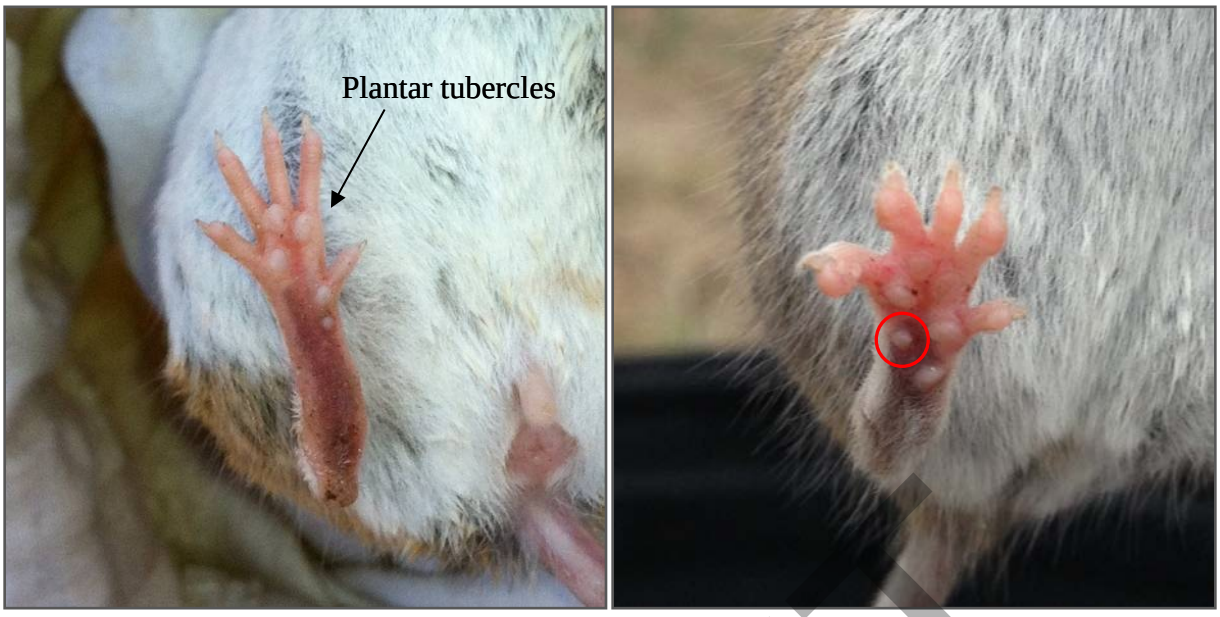


Figure 1. Rear foot of a Florida mouse (left), and a cotton mouse (right), showing the plantar tubercles (pads) on the bottom of each. The circle highlights the sixth tubercle on the foot of the cotton mouse that is not present on the foot of the Florida mouse. Photographs by Travis Blunden (left) and Anni Mitchell (right).

The reported average home range size for male Florida mice is 4,042 m^2 (1 acre), whereas the average home range size for female Florida mice is reported as 2,601 m^2 (0.64 acres) (Jones 1990). Population densities vary seasonally and between vegetative communities. Generally, scrub communities tend to have greater densities of mice than sandhill communities (1.6 – 16.5 mice/ha in scrub, as compared to 5 mice/ha in sandhill) Layne (1990). In sandhill and scrub communities, ground cover is typically sparse, especially in scrub, but the number of Florida mice in a sandhill may be correlated with ground cover diversity (T. Doonan, Florida Fish and Wildlife Conservation Commission [FWC], personal communication). Reproductive activity in Florida mice can occur throughout the year but is highest in fall and winter. Gestation is 3 to 4 weeks, and litter size typically ranges from 2 to 4 individuals (Jones and Layne 1993). Weaning occurs between 3 and 4 weeks, and mice reach sexual maturity around 5 weeks for females and 11 weeks for males (Layne 1992).

Figure 2. Gopher tortoise burrows, such as this one in an open, sandhill community, are considered important resources for Florida mice. Photograph by Terry Doonan, Florida Fish and Wildlife Conservation Commission.

Florida mice are exclusively burrow dwelling rodents. They are closely associated with burrows of gopher tortoises (*Gopherus polyphemus*) and are considered a commensal species of the tortoise. Florida mice use gopher tortoise burrows (Figure 2) for shelter and protection from fire and adverse weather conditions (Layne 1990). Florida mice can be sensitive to colder temperatures and begin to show signs of cold stress at

10°C (50°F) (Jones 1990). For these reasons, the ecology of the Florida mouse is tightly linked to the gopher tortoise (Jones and Layne 1993). This association may leave the Florida mouse vulnerable to gopher tortoise population declines. Florida mice typically construct small side tunnels within gopher tortoise burrows. The mice create nest areas lined with leaves and grass as chambers off the side tunnels. Additionally, Florida mice typically construct a smaller, chimney-like entrance into the main tortoise burrow that can provide a second means of escape (Jones and Layne 1993). Side tunnels and nest chambers have been found up to 5 m (16.4 ft) inside the entrance of tortoise burrows (Layne, 1990). Florida mice are also known to occasionally use the burrows of nine-banded armadillos (*Dasypus novemcinctus*), old-field mice, cotton rats (*Sigmodon hispidus*), and pocket gophers (*Geomys pinetis*) (Layne and Jackson 1994). They also will opportunistically occupy stump holes or other holes, especially in scrub (Jones 1990, Layne 1990, 1992; Lips 1991, Jones and Layne 1993, Layne and Jackson 1994).

Recent genetic work has shown significant genetic structuring across the range of the Florida mouse, reflecting little or no gene flow among populations occupying discrete patches of xeric habitat (Austin et al. 2019). This indicates unique Florida mouse populations are defined by the geologic ridge systems where they occur (White 1970, Austin et al. 2019). Austin et al. (2019) reported that *Podomys* populations in Manatee Co., along the Lake Wales Ridge, and across the Atlantic coast ridge, had the greatest genetic differences from other populations. Population groups occupying different ridge systems have had different historical (e.g. late Pleistocene/Holocene) demographic histories; *Podomys* populations on the southern Atlantic Coastal ridge system apparently had been isolated from ridges to the west for a considerable portion of time, whereas populations on the Lake Wales Ridge were "particularly diverse, with numerous, highly divergent haplotypes identified" there (Austin et al. 2019). For Lake Wales Ridge populations, "contemporary habitat suitability models correlate better with genetic distance than does historical habitat, suggesting that [recent] reduced connectivity at the landscape scale is having a negative effect on [the genetic] connectivity" of those populations. Populations occupying ridge systems near the northern part of the species' range (the Brooksville, Trail, Mount Dora, Deland, and Bell ridge systems) had greater genetic similarity with "the greatest extent of haplotype sharing" (Austin et al. 2019). Populations on the Atlantic coast ridge system also appear to be genetically unique, however Austin et al. (2019) reported they were largely unsuccessful at detecting individuals in these populations during recent surveys. Based on this research, Austin et al. (2019) recommended that evolutionary genetic considerations should be an important part of translocation strategies. A map of Florida's ridge systems and other significant geographic areas for Florida mice can be found on the FWC Gopher Tortoise Commensals page.

Threats

A Biological Status Review (BSR) found that the Florida mouse did not meet the criteria for state listing in Florida (FWC 2011). However, there are ongoing threats that may affect the Florida mouse in the future. The Florida mouse depends on fire-maintained, xeric uplands occurring on deep, well-drained soils, especially scrub and sandhill (Jones and Layne 1993). Because of this habitat specificity, the major threat to the Florida mouse is loss and degradation of habitat caused by conversion to other uses (e.g., development and agricultural use) and insufficient management (e.g., fire suppression) (Layne 1990, 1992). Over the last 100 years, there has been substantial fragmentation and loss of xeric communities used by Florida mice (Austin et al. 2019). For example, in Highlands County, 64% of the species' habitat was destroyed between 1940 and 1980, with an additional 10% considered disturbed or degraded (Layne 1992). Historically, the distribution of sandhill and scrub communities in Florida was naturally fragmented and discontinuous (Myers 1990). These communities have become increasingly fragmented, and gene flow in Florida mouse populations has been reduced as a consequence (Layne 1992, Austin et al. 2019). Effects of such increased isolation can be reduced genetic connectivity (Austin et al. 2019) and more frequent extirpation of local populations (Hilty et al. 2006).

The Florida mouse also can be threatened by insufficient or inappropriate habitat management. In sandhill

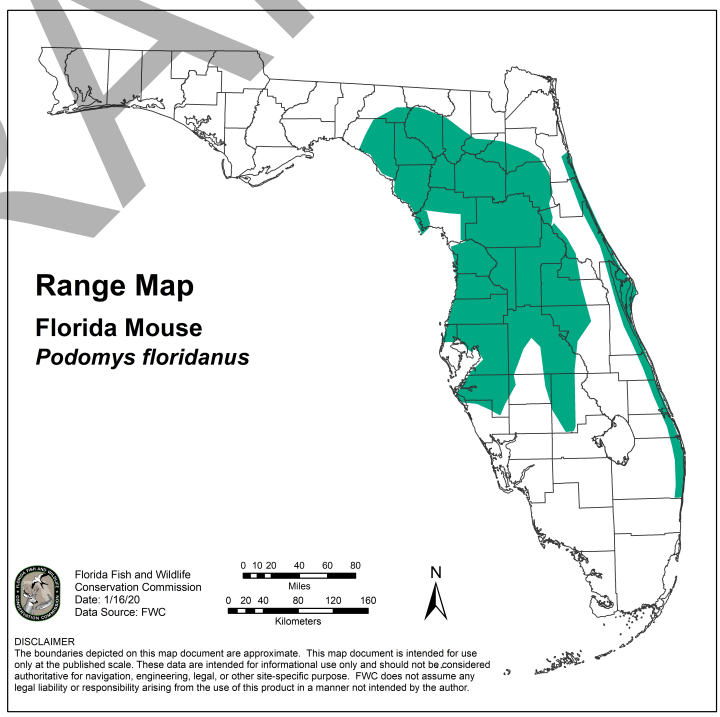
areas, this species shows a preference for early successional vegetative communities which are maintained or created by frequent fire cycles (Layne 1990). The availability of these habitats declines as natural and prescribed fires are suppressed (Hafner et al. 1998). This could be problematic on private lands, where prescribed fire return intervals may be longer than is recommended by land managers to maintain the habitat quality necessary for robust Florida mouse populations. In scrub areas, Florida mice can tolerate a much longer fire-return interval, but the quality of Florida mouse habitat will decline if fire is excluded for too long (Layne 1990). Reduction in habitat quality can result in lower population densities (Layne 1990).

Loss or declines of gopher tortoises in some communities, especially sandhill communities, may leave Florida mice vulnerable to population declines (Jones and Layne 1993). It has been estimated that gopher tortoise populations in Florida declined 50-60% between 1910 and 2003 (Enge et al. 2006). However, most estimated gopher tortoise declines associated with habitat loss occurred prior to the last 20 years (Cox and Kautz 2000, Enge et al. 2006, Endries et al. 2009).

Red imported fire ants (*Solenopsis invicta*) may be a potential predatory threat to Florida mice (Wetterer and Moore 2005). Florida mice are also preyed upon by a range of other species including several snakes, foxes, raccoons, and bobcats (Layne 1992, Jones and Layne 1993). Some of these predator species benefit from close association with people, which may increase the threat of predation to Florida mice as habitats become fragmented and natural areas are increasingly interspersed with developed areas. Developed areas may also bring an increased threat of predation by free-ranging domestic cats (*Felis catus*) (Loss et al. 2013).

Distribution and Survey Methodology

The map (right) represents the principle geographic range (green) of this species, including intervening areas of unoccupied habitat. This map is for information purposes only and not for regulatory use.



Counties: Alachua, Bradford, Brevard, Citrus, Clay, Columbia, Dixie, Flagler, Gilchrist, Hardee, Hernando, Highlands, Indian River, Lafayette, Lake, Levy, Manatee, Marion, Martin, Orange, Osceola, Palm Beach, Pasco, Pinellas, Polk, Putnam, Sarasota, Seminole, St. Johns, St. Lucie, Suwannee, Sumter, Taylor, Union, Volusia.

Recommended Survey Methodology

Florida mice are endemic to Florida and only inhabit xeric scrub and sandhill habitats within the northern 2/3 of the Florida peninsula. Surveys, though not required, can be used to determine if Florida mice are present in an area.

Live-trapping may be used as a method to detect the presence of Florida mice. The following survey guidelines are recommended for Florida mice:

- An FWC scientific collecting permit and documented experience showing appropriate skills in mammal trapping is needed for any trapping.

- Appropriately sized live traps, such as Sherman live traps (or similar to that in style) should be used. Two traps should be placed at each trapping station.
- Trapping stations should be distributed at a density of 10 stations/8 ha (20 ac).
- In areas containing gopher tortoise burrows, trapping stations should be established within 1 m (3.2 ft) of a burrow.
- If surveys occur in areas without gopher tortoise burrows, trapping stations should be arranged using a transect method, with a spacing of 15 m (50 ft) between stations.
- Traps can be baited with a mixture of seeds (e.g., sunflower seeds), grains (e.g., crimped oats or scratch grain), and rolled oats.
- Baits that may attract fire ants, such as peanut butter, should not be used.
- Surveyors should avoid placing traps in areas where fire ants are likely to enter, and traps should be moved whenever fire ants are present. If fire ants are in a trap, the trap should be cleaned of ants and moved to new location. If ants continue to be a problem, the trap should be closed to prevent mortality.
- Traps should be active for 4 consecutive nights without capturing a Florida mouse to conclude the species is likely absent from an area but can be closed as soon as Florida mouse presence is documented.
- Trapping should not be conducted during a full moon, when overnight rain is forecast, or when nighttime temperatures are forecast to be less than 50°F. If nighttime temperatures are forecast to be less than 60°F, a ball of cotton (or similar synthetic material) should be placed in each trap for insulation purposes.
- Traps should remain closed during the day and set in the late afternoon. All captures should be released no later than 2 hours after sunrise the following morning.
- All traps should be visually inspected to ensure no captured animals remain in the trap, then closed.

Florida mice may also be encountered during gopher tortoise burrow surveys, or during gopher tortoise relocation activities. Mice may be incidentally encountered while using a burrow scoping system, while excavating gopher tortoise burrows, or while checking bucket traps set for gopher tortoises. The presence of Florida mice in tortoise burrows that are permitted for relocation should be recorded during data collection and submitted to FWC in accordance with gopher tortoise relocation permit conditions. Mice can be retained and transported in Sherman traps or small, ventilated animal carriers for 24 hours, as long as they are carefully protected from extremes of heat and cold; sunflower seeds should be provided. Further information regarding gopher tortoise surveys and relocated permitting needs may be found in Appendix 9 of the Gopher Tortoise Permitting Guidelines (FWC 2017)

Recommended Conservation Practices

Recommendations are general measures that could benefit the Florida mouse but are not required. No FWC permit is required to conduct these activities. Further assistance on recommended conservation practices may be provided by the FWC Landowner Assistance Program.

- Implement and maintain optimal fire return intervals for sandhill and scrub communities to improve habitat quality for Florida mice. Detailed guidance for managing habitats suitable for Florida mice can be found in the FWC Scrub Management Guidelines and the Florida Natural Areas Inventory Guide to the Natural Communities of Florida
- Manage lands where suitable habitat for the Florida mouse occurs in ways that promote a stable gopher tortoise population and maintain a diversity of herbaceous ground cover plants including oaks in the shrub or midstory layers. Appropriate management practices can be found in the USFWS Habitat Management Guidelines for the Gopher Tortoise in Longleaf Pine Habitat

- In areas where prescribed fire cannot be applied, use mechanical treatments such as timber thinning, roller chopping, and brush hogging or mowing to produce results that mimic conditions expected with prescribed fire used at appropriate return intervals.
- Maintain functional metapopulations of Florida mice wherever possible, especially in fragmented scrub communities, by maintaining or creating travel corridors between patches of suitable habitat.
- Because the maximum dispersal distance for Florida mice is not well known, whenever possible, sites occupied by Florida mice should not be separated by more than 1 km (0.6 mi) from other occupied sites to maximize the probability that individuals can move successfully among sites.
- Restrict the translocation of Florida mice to maintain or conserve the evolutionarily unique population units that have been identified:
    - Limit translocations to the same geologic ridge system, or upland area, as well as the same type of habitat (sandhill or scrub), where the mice were captured.
    - Avoid the translocation of mice beyond short (10s of kms) distances, and not across major potential barriers such as mesic habitat or rivers.
    - Encourage appropriate translocations to supplement populations, repopulate vacant conservation lands, or maintain genetic diversity, especially in areas such as the Atlantic Ridge and Lake Wales Ridge. To achieve these conservation objectives, movement of mice longer distances within the same ridge system would not be unreasonable when pursuing limited relocation of Florida mice.
- Work with FWC to identify priority information needs that will further conservation efforts for Florida mice.
- Work with local municipalities to manage trash and other potential food sources to avoid higher than normal rates of predation by native predator species that benefit from close association with people in areas such as the Lake Wales Ridge, where natural habitats have become increasingly fragmented and interspersed with development.
- Control or remove non-native, invasive animal species that may prey on Florida mice. Promote programs to keep cats indoors. Discourage practices that maintain feral cat colonies that may negatively impact *Podomys* populations on publicly managed lands.

Prohibitions and Permitting

Florida mice are protected by the general prohibitions outlined in Rule 68A-4.001, F.A.C.: no wildlife or freshwater fish or their nests, eggs, young, homes, or dens shall be taken, transported, stored, served, bought, sold or possessed in any manner or quantity at any time except as specifically permitted by these rules nor shall anyone take, poison, store, buy, sell, possess or wantonly or willfully waste the same except as specifically permitted those rules. They are also protected by 68A-29.002, F.A.C. which states that no person shall take, buy, sell, transport, or possess Florida mice, their nests, or young, with take being as defined in rule 68A-1.004, F.A.C. A permit is required for any other activity that involves the possession, capture, sell, purchase, transport, hunting or killing of Florida mice. These permits are issued for justifiable purposes as outlined in Rule 68A-9.002, F.A.C. Justifiable purposes are scientific, educational, exhibition, propagation, management or other justifiable purposes.

No Permit Needed

The following activities could cause take, but are authorized to be conducted without a permit:

- Florida mice may be taken as nuisance wildlife without a permit if following the methods outlined in Rule 68A-9.010 (2) and (3), F.A.C.
- Vegetation removal or trimming in the linear right of way for power restoration. This applies only in cases where there is an immediate danger to the public's health and/or safety (including imminent

or existing power outages that threaten public safety, or in direct response to an official declaration of a state of emergency by the Governor of Florida or a local government entity), and only to non-routine removal or trimming of vegetation within the linear right of way, in accordance with a vegetation management plan that meets applicable federal and state standards. If conducted under these circumstances, no FWC take permit is required.

Gopher Tortoise Commensal Species Guidelines

The Florida mouse is listed as a priority commensal species of gopher tortoises within the FWC Policy on the Relocation of Priority Commensals (FWC 2017). In accordance with this policy, limited relocation of Florida mice may be a suitable option to consider when applying for a gopher tortoise relocation permit. A summary of guidance for relocation of Florida mice is found in Table 1, below. Authorization for the limited relocation of priority commensals will be included as a permit condition in the applicant's gopher tortoise relocation permit. Under certain circumstances, FWC may work with permitted individuals to collect Florida mice for purposes of meeting specific actions identified in the Species Action Plan. Consultants and professionals who are working on landscape modifications in which no habitat will remain should contact FWC during the permitting process to inquire about these circumstances.

Table 1: Summarized guidance from Gopher Tortoise Permitting Guidelines, Appendix 9, FWC Policy on the Relocation of Priority Commensals.

Post-development site characteristics	If a gopher tortoise burrow will be impacted from development activities and **some habitat will remain on-site**	If a gopher tortoise burrow will be impacted from development activities and **adjacent habitat is available off-site**	If a gopher tortoise burrow will be impacted/ destroyed from development activities and **no habitat will remain**
Florida mouse	Any captured Florida mouse may be released on-site, outside of the area to be developed and within the property boundary or allowed to escape unharmed if some habitat will remain post-development activities.	Any captured Florida mouse may be released on-site as close to original habitat as possible. If possible, mice should be released at the mouth of an abandoned gopher tortoise burrow.	Any captured Florida mouse may be allowed to escape unharmed or relocated offsite within the same geologic ridge or ridge system with the same habitat type as the site where the mice were captured.

Permits for Justifiable Purposes - Scientific Collecting and Educational Use

Any survey methodology that requires handling or capture of a Florida mouse will require a scientific collecting permit. Maintaining Florida mice in captivity for educational use will also require a permit. Camera-based surveys do not require a scientific collecting permit.

- Scientific collection and education use permits are no-fee permits. Applications must be submitted using the information provided in the Scientific Collecting Permit Application Checklist.

- A trapping protocol must be included with the permit application, with sufficient detail to allow evaluation, and should identify measures to minimize mortality to Florida mice and non-target species.
- Applicants for scientific collecting permits should identify if trapping will occur on lands owned by other entities. Coordination with county land managers, state foresters, and national parks should be addressed in the scientific collecting application.
- A summary of the applicant's expertise relative to the proposed work must be included in the application.
- Applicants should have met all conditions of previously issued permits for Florida mice or other species.
- A summary of any survey data collected at each study site should be reported to the FWC.
    - Standard data should include numbers captured by species, location information (GPS coordinates, county, property/site name), and habitat type.
    - Report standard data for every Florida mouse collected or observed.
    - Any mortality should be reported immediately to the FWC. Specimens should be provided to the FWC or deposited in the collection of the Florida Museum of Natural History in Gainesville.

Other Permits

For any other justifiable purpose permit that does not fall under scientific collection or educational use, please submit your request to WildlifePermits@myfwc.com.

Additional information

Information on the Economic Assessment of the Species Conservation Measures and Permitting Guidelines for the Florida mouse can be found at http://myfwc.com/wildlifehabitats/imperiled/management-plans/

Contact

For more species specific information or related permitting questions, contact the FWC at (850) 921-5990 or WildlifePermits@myfwc.com. For regional information, visit http://myfwc.com/contact/.

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