

The Cumberland Island Cotton Mouse: A Unique Subspecies?

By James L. Boone, Joshua Laerm, and Michael H. Smith

The systematics of rare species often is problematic and may lead to the conservation and management of apparently rare organisms which are not truly rare (e.g. dusky seaside sparrow, Avise and Nelson, 1989; colonial pocket gopher, Laerm et al., 1982). Alternatively, inattention to the systematics of even common organisms may lead to the lack of concern for unique populations, subspecies, or even species that have not yet been identified. The cotton mouse (*Peromyscus gossypinus anastasiae*), occurring only on Cumberland Island National Seashore, GA, is an example of an apparently rare organism that has generated management concern. This population was considered the only extant representative of its subspecies, and therefore should have qualified for rare and endangered status. However, it never was listed because of questions concerning the validity of its taxonomic status.

This mouse originally was described in 1898 as *P. insularis*, a distinct species, based on its small size and light colored pelage. Osgood (1909) reduced the species to a subspecies of *P. gossypinus* and classified it with the population of mice on Anastasia Island, FL as *P. g. anastasiae*. The Florida population was considered for state and federal protection in the 1970s, but because of uncertain taxonomy, its status was listed as uncertain. The Florida population again was considered for federal protection in the mid-1980s, but it was found to be extinct, and the subspecies was declared UR-3 (no longer under consideration for listing due to the pervasive evidence of extinction.)

Although there were no data, federal officials stated they did not believe the Cumberland Island population was referable to *P. g. anastasiae*. However, in the scientific literature, the extinction of the Anastasia population leaves Cumberland Island with the only extant population of *P. g. anastasiae*. The subspecific status of this mouse was questioned by Osgood himself, but no systematic assessment had been conducted since his study. Recently, Boone (1990) reviewed the taxonomic

affinities of the cotton mouse population on Cumberland Island to determine if this population was unique and if it deserved management and protection.

Populations representing 4 subspecies of cotton mice from throughout Georgia, Florida, and Alabama were examined. Genetic analysis involved electrophoresis of the products of 44 loci in 379 mice from 14 populations, including 6 insular populations. (Figure 1). Morphological analysis involved examination of 27, mainly cranial, characters of 683 specimens from 20 populations, including the extinct Anastasia Island population.

Genetically, this species is highly variable both within and between populations. The percentage of polymorphic loci and heterozygosity per population is quite high, and their heterozygosity is twice the average reported for mammals. There is no evidence for inbreeding, drift, or founder effects reducing genetic variability on the islands despite large fluctuations in the numbers of mice on the islands. If migration between the mainland and the islands occurs, it appears to be limited, so the mechanism for maintaining genetic variability on the islands is unclear. Genetic distances among populations (Rogers, 1972) are relatively high for conspecific populations of mammals, and are comparable to the genetic differences among some *Peromyscus* species. As a group, the insular populations tended to have a greater degree of genetic differentiation than did the mainland populations.

Using genetic variance partitioning (Fst analysis) with the genetic data and discriminant analysis with the morphological data, essentially every population is significantly different from all others when tested in pairwise comparisons. Mice on Cumberland Island are genetically and morphologically significantly different from those on the mainland opposite Cumberland, and significantly different from these on the islands immediately north and south of Cumberland. If only these populations had been sampled, the Cumberland population probably would have retained its subspecific status. However, when all populations were examined simultaneously, the pairwise interpopulation differences became trivial and were not significant ($p > 0.05$), as shown in Figure 2 for the morphological data. While each population was genetically and morphologically unique, no population was unusually distinct, and neither the Cumberland Island nor Anastasia Island populations of *P. g. anastasiae* was sufficiently different from other populations to warrant recognition as a separate subspecies. Thus, there is no basis to support the subspecific status of *P. g. anastasiae*, and these mice should be designated *P. g. gossypinus*, the common mainland species.

Removing subspecific status from the mice on Cumberland Island, *P. g. anastasiae*, and grouping them with *P. g. gossypinus*, does not imply that the Cumberland Island mice are genetically or morphologically identical to any other population or subspecies of *P. gossypinus*. Genetically, the Cumberland Island mice are unique and are well differentiated from other populations. For example, they have 5 alleles not found in any other population, and therefore represent a genetic resource that deserves conservation.

Other biota on the islands also will probably be found to be genetically differentiated. Rowland (1989) found

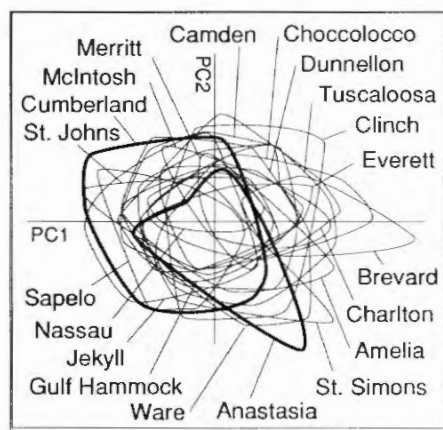


Figure 2. Distributions of 20 populations of *Peromyscus gossypinus* on the first two principal component axes extracted from the covariance matrix constructed with data from 27 morphological characters.

the white-tail deer (*Odocoileus virginianus*) on Cumberland Island to be genetically significantly different from deer on the mainland, and deer on Black Beard Island just north of Sapelo are genetically the most divergent of any white-tail deer population studied in various parts of the southeastern United States (Hillestad, 1984). These deer populations tend to have relatively high frequencies of rare alleles similar to the situation in the Cumberland mice. Thus, even if the islands do not provide habitat for any known unique subspecies, if our goal is to conserve biological diversity, then conservation of biota on these islands is particularly important because in many cases this biota contains the most genetically divergent populations in the species.

This study was supported by the NPS/CPSU at U/GA, the U/GA Museum of Natural History, and Savanna River Ecology Laboratory under contract between the US Dept. of Energy and U/GA's Institute of Ecology. Final reports concerning the taxonomy and conservation of this mouse will be submitted for publication elsewhere.

Boone is with the U/GA School of Forest Resources and Laerm is with the U/GA Museum of Natural History, Athens, GA; Smith is with the Savannah River Ecology Lab, Aiken, SC.

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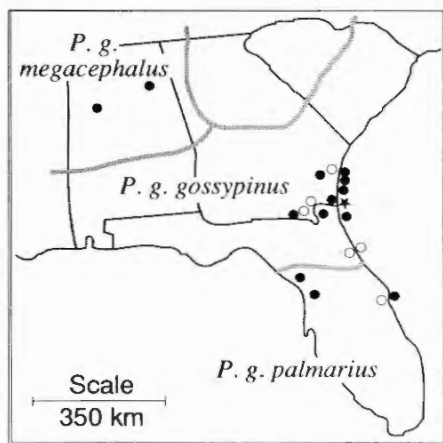


Figure 1. Southeastern United States showing locations (black symbols) from which specimens of 4 recognized subspecies of *Peromyscus gossypinus* were collected. Gray lines indicate subspecies boundaries. Cumberland Island is indicated with a star, and unfilled symbols indicate sites from which genetic data were collected.