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Geomys pinetis.

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Geomys pinetis Rafinesque, 1817

Southeastern Pocket Gopher

Mus tuza Barton, 1806:488. Type locality restricted to pine barrens near Augusta, Georgia, by Bangs (1898:175). Regarded as of uncertain identity by Harper (1952), and hence not used.

Geomys pinetis Rafinesque, 1817:45. Type locality, Georgia in the region of the pines (restricted by Harper, 1952:36, to Screven County).

CONTEXT AND CONTENT. Order Rodentia, Family Geomyidae, Subfamily Geomyinae. The genus *Geomys* contains eight species. Five subspecies of *Geomys pinetis* are recognized as follows:

G. p. austrinus Bangs, 1898:177. Type locality, Belleair, Pinellas Co., Florida.

G. p. floridanus (Audubon and Bachman, 1854:242). Type locality, St. Augustine, St. Johns Co., Florida.

G. p. goffi Sherman, 1944:38. Type locality, Eau Gallie, Brevard Co., Florida.

G. p. mobilensis Merriam, 1895:119. Type locality, Point Clear, Mobile Bay, Baldwin Co., Alabama.

G. p. pinetis Rafinesque, 1817, see above.

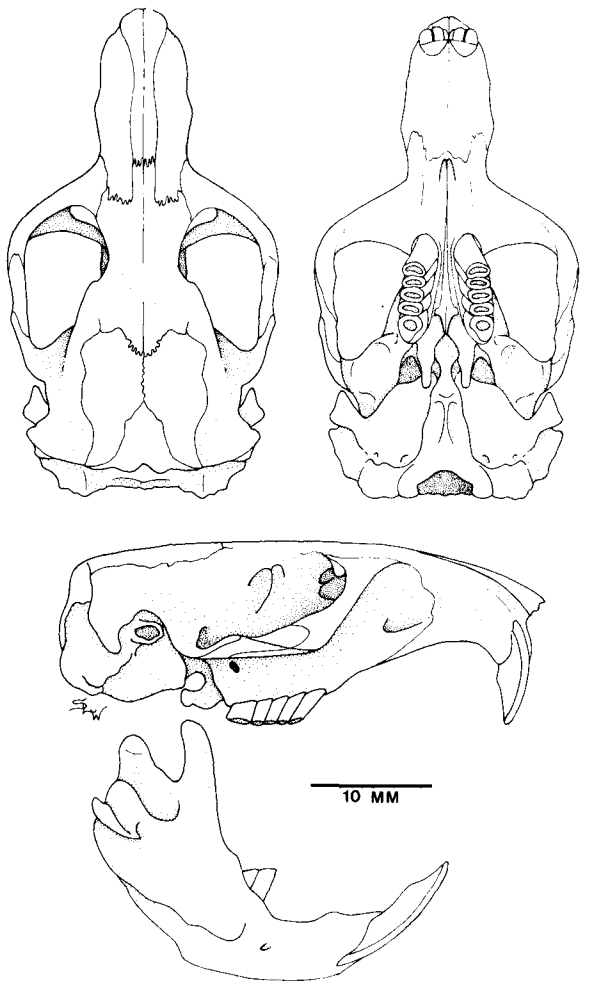

FIGURE 1. Dorsal, ventral, and lateral views of cranium, and lateral view of lower jaw of a female *Geomys pinetis pinetis* (TTU 16640) from 1.1 mi. SSE Kingsland, Camden Co., Georgia.

DIAGNOSIS. *Geomys pinetis* is more closely related to *G. colonus*, *G. cumberlandius*, and *G. fontanelus* than to any other living species of *Geomys* (Russell, 1968). The *pinetis* species group of pocket gophers may be differentiated by nasals that are constricted near the middle, resulting in an hourglass shape, as opposed to wedge-shaped nasals lacking constrictions (figure 1). *Geomys pinetis* may be further differentiated from: *G. fontanelus* by the lack of a fontanel on each side of the skull between the parietal and squamosal bones; *G. cumberlandius* by the zygomatic arch forming a greater angle with skull, and not extending posteriorly; *G. colonus* by having a broad V-shaped, instead of broad U-shaped, interpterygoid space (Baker and Williams, 1974; Blair *et al.*, 1968; Hall and Kelson, 1959).

Geomys pinetis has a diploid number of 42 chromosomes and a fundamental number of 80 (Williams and Genoways, 1975).

GENERAL CHARACTERS. Exemplifying the genus, *G. pinetis* is a medium-sized rodent with the typical geomyid adaptations for a fossorial way of life: small eyes; reduced pinnae; stout, strong-clawed forelimbs; nearly naked tail; external, fur-lined cheek pouches; and thickset body (figure 2). The dental formula is i 1/1, c 0/0, p 1/1, m 3/3, total 20. All teeth are evergrowing and the enamel on the cheekteeth is greatly reduced. Enamel on the upper incisors is typically bisulcate, but supernumerary grooves are common in this species (Akersten, 1973).

DISTRIBUTION. This species occupies northern and central Florida, southern Georgia, and southeastern Alabama (figure 3). Its association with sandy soils and long leaf pine was first noted by Lyell (1845) and others (Goode, 1875; Harper, 1912; Howell, 1921; Harper, 1929; Quay, 1949; Pournelle, 1950) have reaffirmed this observation. Shelford (1963) even designated this association as the "Longleaf pine-Turkey Oak-Wiregrass pocket gopher community."

Specific published localities are as follows (Bangs, 1898; Elliot, 1901; Gesner, 1861; Hall and Kelson, 1959; Hamilton, 1943; Harper, 1927, 1929, 1952; Hickman and Brown, 1973*a*, 1973*b*; Howell, 1920, 1921; Merriam, 1895; Moore, 1946; Pournelle, 1950; Quay, 1949; Sherman, 1937, 1940, 1944; Williams and Genoways, 1975):

G. p. austrinus.—FLORIDA. *Alachua County*, 2½ mi. E Gainsville; *De Soto County*, Arcadia; *Hillsborough County*, Tampa; *Pinellas County*, Belleair, Tarpon Springs.

G. p. floridanus.—FLORIDA. *Alachua County*, Gainsville, 1.9 mi. NW jct. hwy. 24 and hwy. 41 on hwy. 41, 1.4 mi. NW jct. hwy. 24 and hwy. 41 on hwy. 41; *Baker County*, N of Macclenny; *Duval County*, 1.0 mi. NW Bayard, New Berlin; *Gadsden County*, Chattahoochee; *Marion County*, 1 mi. W Silver Springs; *Nassau County*, Boulogne, Rose Bluff, 2 mi. NE St. George, Georgia; *Orange County*, Orlando; *Putnam County*, Pomona, San Mateo; *St. Johns County*, St. Augustine, Carterville. GEORGIA. *Thomas County*, 10 mi. SSW Thomasville.

FIGURE 2. Adult female *Geomys pinetis pinetis* from Camden Co., Georgia.

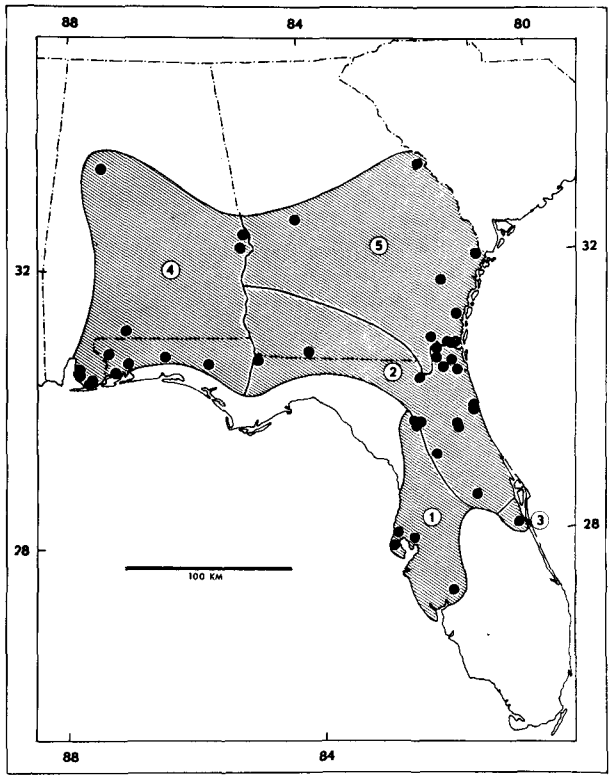

FIGURE 3. Geographic distribution of *Geomys pinetis* and its subspecies: 1, *G. p. austrinus*; 2, *G. p. floridanus*; 3, *G. p. goffi*; 4, *G. p. mobilensis*; 5, *G. p. pinetis*. Dots represent recorded localities from Alabama, Florida, and Georgia.

G. p. goffi.—FLORIDA. *Brevard County*, Eau Gallie, ½ mi. W Eau Gallie.

G. p. mobilensis.—ALABAMA. *Baldwind County*, 1 mi. N Fairhope, Orange Beach, Point Clear; *Escambia County*, Brewton, Steadham; *Russell County*, 7 mi. from Columbus, Seale; *Tuscallosa County*, Warrior River near Lock 14. FLORIDA. *Escambia County*, Pensacola; *Okaloosa County*, 0.5 mi. W county line on hwy. 90; *Santa Rosa County*, Milton; *Washington County*, 6 mi. S, ½ mi. W Wausaw.

G. p. pinetis.—GEORGIA. *Camden County*, Kingsland, 3 mi. SE Kingsland, 5.9 mi. W St. Marys; *Charlton County*, St. Marys River near Camp Pinckney; *Chatham County*, Savannah; *Glynn County*, Sterling; *Jefferson County*, Pinetucky; *Richmond County*, Adam, 12 mi. S Augusta; *Screven County*, Hursmans' Lake; *Taylor County*, Butler; *Wayne County*, Doctortown.

FOSSIL RECORD. Russell (1968) stated that *G. bursarius* and *G. pinetis* species groups had differentiated by Sangamon time, both evolving from Illinoian species (possibly *G. bisulcatus*). Pleistocene fossils of *G. pinetis* have been found in Irvingtonian to Recent deposits in Florida (Webb, 1974). Martin's (in Webb, 1974) study of *Geomys* fossils in the Coleman IIA and Haili XIVA faunas led him to believe that Recent *G. pinetis* and *G. personatus* represent remnants of a common Pleistocene population. He proposed that *G. personatus* is a relictual population of the western ancestor of *G. pinetis* and stated that these two populations may even be conspecific. Martin and Webb (in Webb, 1974) found no characters in the dentition, mandibles or postcranial skeletons, that would separate *G. pinetis* from *G. personatus*. Therefore, they postulated that *G. personatus* may be more closely related to *G. pinetis* than to the *G. bursarius* group as suggested by Russell (1968).

FORM AND FUNCTION. Measurements given by Bangs (1898), Moore (1946), Sherman (1944), and Merriam (1895), indicate sexual dimorphism in all the subspecies. External measurements of adult males average about 10% larger than those for adult females.

The following physiological data for this species come from McNab's (1966) study of fossorial rodents. *Geomys pinetis* has a thermal neutral zone in ambient temperatures (T_A) ranging from 26 to 35° Centigrade (C), and maintains a mean body temperature (T_B) of 36° from T_A 10 to 30°C. Above T_A 30°C the body temperature increases. but a temperature differential ($\Delta T = T_B - T_A$) of about 4.5°C is maintained until a lethal body temperature, 35 to 37°C, is reached. The rate of heat loss (conductance) is greater than expected for a mammal of this size. Thermoregulation at high temperatures is accomplished by engorging the naked tail with blood to further increase heat loss.

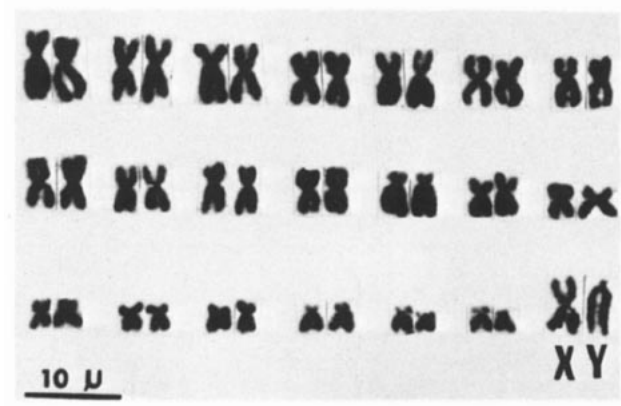

FIGURE 4. Representative karyotype of a male *Geomys pinetis floridanus* from 1 mi. NW Bayard, Duval Co., Florida.

Basal metabolism, as measured by oxygen consumption, is 74% of that expected for a mammal of this size. Reduced metabolic rate and increased rate of heat loss apparently are adaptations that prevent over heating rather than mechanisms that lower gas exchange requirements of this species.

Rate of incisor growth averaged 0.35 mm and 0.67 mm per day for upper and lower incisors, respectively (Manaro, 1959).

ECOLOGY. McNab (1966) demonstrated a correlation between the distribution of *G. pinetis* in Florida and the distribution of soils having a low waterholding capacity. He contended that any decrease in soil porosity could be correlated with an increase of burrow length to allow adequate gas diffusion. Apparently, physiological requirements of thermoregulation restrict *G. pinetis* to dry sandy soils, even in local areas where lower moist soils are available (Pournelle, 1950). In Alabama, Howell (1921) found *G. pinetis mobilensis* on gravelly ridges having mixed timber stands of long leaf pine and oak.

Approximately 80 species of arthropods, mostly insects, have been found in *G. pinetis* burrows, and 14 are apparently obligate commensals (Chamberlin, 1940; Hubbell, 1940; Hubbell and Goff, 1940; Ross, 1940).

Hickman and Brown (1973*a*) reported that the rate of mound production was not correlated with mean monthly temperatures or temperature ranges but that gophers did produce more mounds in the three months with lowest mean temperatures. They attributed this activity to increased tunneling for food supplies due to partial or total plant dormancy. Moore (1949) also noted increased burrowing activity during the first cool weather of October.

Possible predators of *G. pinetis* include owls (Brown, 1971), mink (Sherman, 1929), and spotted skunk (Howell, 1920).

BEHAVIOR. Goode (1875) and Gesner (1861) generally described mound-building behavior of *G. pinetis*. Five phases of mound-building behavior of *G. pinetis* (Hickman and Brown, 1971*b*) are prospecting, groundbreaking, excavation, mound-building, and plugging. Total time for completion of these behaviors ranged from five to 53 minutes.

REPRODUCTION AND ONTOGENY. *Geomys pinetis* apparently breeds throughout the year. The greatest percentage of males are reproductively active from January through August, whereas females exhibit two peaks of breeding activity—February through March and June through August (Wing, 1960; Brown, 1971; Ewel, 1971). Brown (1971) found that 70 to 90% of the adult male *G. pinetis* contained mature spermatozoa in each month of the year. Males exhibit alternating cycles of spermatogenic activity and inactivity (individuals in population are not synchronous), with the rate of sperm production increasing with age (Ewel, 1971). Leydig cells decrease in size after puberty, but increase in diameter during times of increased reproductive activity. Correlated with this change is an increase in height of the secretory epithelium in the accessory sex gland and epididymis (Ewel, 1971). Average litter sizes reported for *G. pinetis* are 1.7 ± 0.51 (Brown, 1971) and 1.52 ± 0.11 (Wing, 1960), with a range from one to three in both studies. Females of *G. pinetis* may produce two litters per year and the two peaks in female breeding activity may be related to increases in plant growth (Brown, 1971). Reported preimplantation and postimplantation embryonic losses ranged from 25% for southern populations (Brown, 1971) to 17% for northern populations (Wing, 1960).

The birth of three *G. pinetis* was observed by Barrington (1942). Young are born tail-end first and with eyes, ears, and cheek pouches closed. They are nearly naked and teeth are not erupted. Average length and weight of three specimens observed by Barrington was 50 mm and 5.8 g. Young wean and disperse within approximately one month and females reach sexual maturity at four to six months (Wing, 1960; Brown, 1971).

GENETICS. *Geomys pinetis* has a diploid number of 42 and a fundamental number of 80 (figure 4). This karyotype is known from four males and six females representing four subspecies. No variation was found in these ten specimens. The X chromosome is a large metacentric, the Y a large subtelocentric, and all autosomes are biarmed elements (Williams and Genoways, 1975). The low diploid number of 42 is only four higher than that reported for *G. tropicalis* (Davis *et al.*, 1971). Williams and Genoways (1975) suggested that this similarity is due to convergence in centric fusions from a chromosomal compliment similar to that of *G. bursarius* or *G. personatus*.

ETYMOLOGY. The word *Geomys* is compounded from the Greek words *Geo*, meaning "earth," and *mys*, meaning "mouse." The specific name, *pinetis*, is derived from the Latin word *Pinetum*, meaning "a pine wood," and the Latin suffix *is*, meaning "pertaining or relating to." The two subspecific names, *floridanus* and *mobilensis*, are Latinized place names, whereas the subspecific name, *austrinus*, comes directly from either Greek or Latin, meaning "southern." The subspecific name, *goffi*, honors Carlos C. Goff, H. B. Sherman's personal friend and collector of part of the type series.

REMARKS. Vernacular names applied to *G. pinetis* are of uncertain origin. Goode (1875) contended that gopher is a corruption of the French "Gaufre" and apparently refers to "the manner in which the soil is honey-combed by the pouched rats." Locally, this name is usually applied to the gopher tortoise, *Gopherus polyphemus*, whereas pocket gophers are called "salamanders." The name "salamander" for these animals is either a corruption of "sandy-mounder" (Kilby, 1935), or is due to their appearance soon after the pine woods are burned (Lyell, 1845; Goode, 1875).

Only the four species of the *G. pinetis* complex share the ectoparasite, *Geomydoecus scleritus*. Female *Geomydoecus scleritus* appear to closely resemble *Geomydoecus truncatus*, which is parasitic on *G. personatus*. No male *Geomydoecus scleritus* have been found (Price and Emerson, 1971).

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