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Eastern Woodrat (*Neotoma floridana*)

WILLIAM E. TOMLINSON

Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, Mississippi, 39762, USA

Abstract—*Neotoma floridana* (Ord 1818) is a cricetid commonly called the eastern woodrat or packrat. *Neotoma floridana* is a relatively large rodent with an extraordinarily large tail that is bicolored with distinctive countershading. It is 1 of 22 species in the genus *Neotoma*. It occurs throughout the southeastern United States as well as parts of South Dakota, Texas, and Colorado (Guilliams and Francl 2008). This species prefers deciduous forests, grasslands, and sometimes-abandoned buildings. *Neotoma floridana* is a secure species throughout the United States; however several subspecies are of conservation concern.

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Eastern Woodrat

Neotoma floridana (Ord, 1818)

CONTEXT AND CONTENT

Order Rodentia, suborder Myomorpha, infraorder Myodonta, superfamily Muroidea, family Cricetidae, subfamily Neotominae, tribe Neotomini. The genus *Neotoma* contains approximately 22 species. Members of this genus include *N. albigula*, *N. angustapalata*, *N. anthonyi*, *N. bryanti*, *N. bunkereri*, *N. chrysomelas*, *N. cinerea*, *N. devia*, *N. fuscipes*, *N. goldmani*, *N. lepida*, *N. leucodon*, *N. macrotis*, *N. magister*, *N. martinensis*, *N.*

mexicana, *N. micropus*, *N. nelsoni*, *N. palatina*, *N. phenax*, and *N. stephensi*. There are also numerous subspecies of *N. floridana* (Myers et al. 2008).



Fig.1. Photo of *Neotoma floridana*, Riley Co., Kansas. Photo courtesy of the regents of the University of Michigan, Animal Diversity Web.

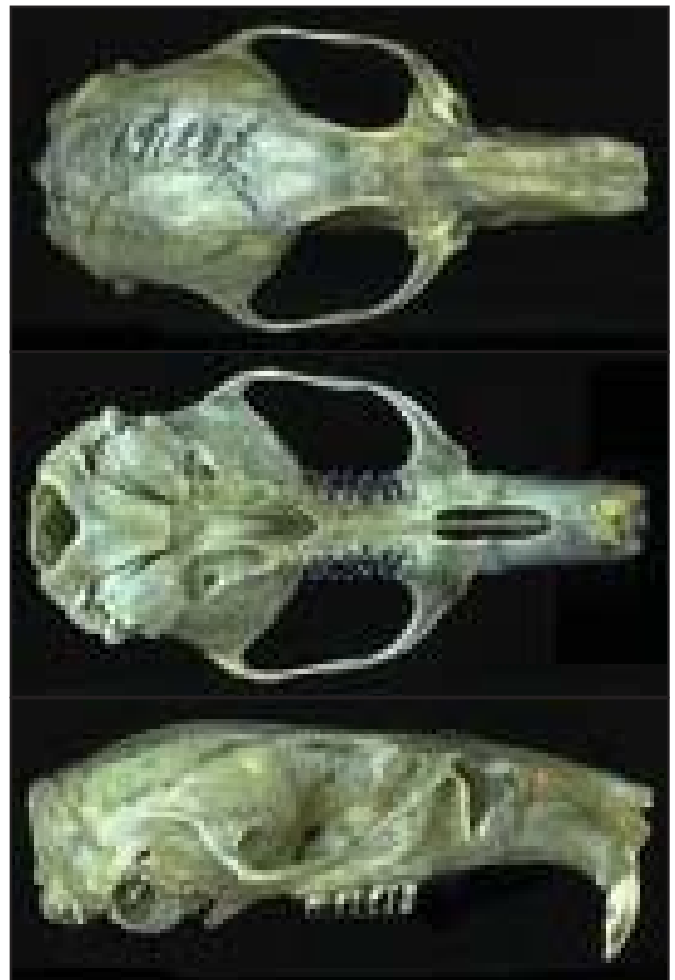


Fig. 2. Dorsal, ventral, and lateral views of the skull of *Neotoma floridana*. Photo courtesy of the regents of the University of Michigan, Animal Diversity Web.

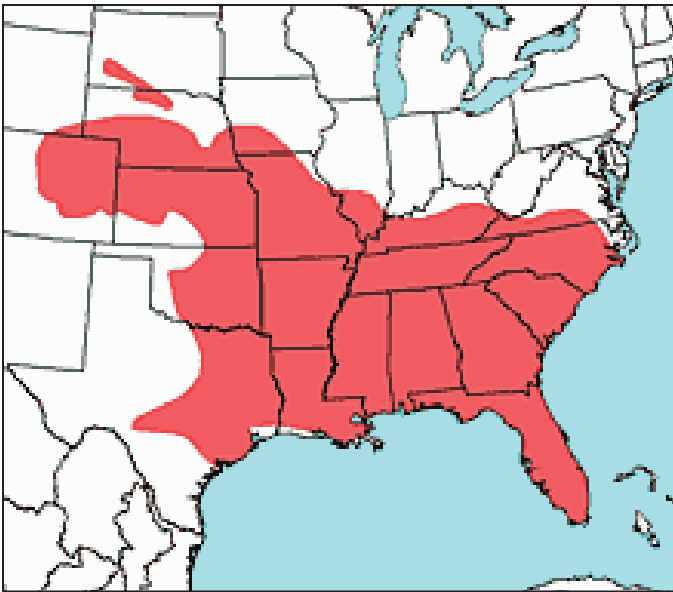


Fig. 3. Geographic distribution of *Neotoma floridana*. Image courtesy of the Smithsonian National Museum of Natural History website.

GENERAL CHARACTERS

Neotoma floridana is a relatively large species in the Cricetidae family. Adults possess a soft fur which is brownish-gray dorsally with darker hairs down the center, a countershading of white fur ventrally, and white feet (Fig. 1), while juveniles have gray dorsal fur with a white ventral side (Monty and Feldhamer 2002, Guilliams and Francl 2008). The tail is bicolored or countershaded with dark brown fur dorsally and white fur ventrally; however some southern species of *N. floridana* may have a unicolored tail (Schwartz and Odum 1957). The tail is relatively long compared to other species in this genus reaching almost the total length of the body. It has long vibrissae and large unfurred ears (Monty and Feldhamer 2002). Total length is 305–450 mm for males and 300–400 mm for females, tail length 130–180 mm, hind foot length 35–42 mm, ear length 24–29 mm, and skull length 49–50 mm (Fig.2) (Rainey 1956, Monty and Feldhamer 2002). They have 4 clawed digits and a rudimentary thumb on the forelimbs and 5 clawed digits on the hind limbs (Monty and Feldhamer 2002). Body weight of males (284–293 g) is greater than females (250–346 g; Wiley 1980, Monty 1997). Female weights vary throughout the year due to pregnancy. Males generally attain maximum weight during the February-April breeding season and then decrease again

beginning in May (Rainey 1956, Monty and Feldhamer 2002).

DISTRIBUTION

Neotoma floridana occurs throughout Mississippi and is common in most parts of the state. The geographic range includes South Dakota, eastern Texas, east through central Florida, north to the western and piedmont areas of Maryland, then west following the Appalachian Mountains (Fig. 3) (Guilliams and Francl 2008). It occurs at elevations from sea level to 1,740 m (Guilliams and Francl 2008).

FORM AND FUNCTION

Neotoma floridana possesses a unique brown stain on the mid-ventral side of the fur that results from secretions of a ventral abdominal gland present in both sexes but significantly larger in males during breeding seasons (Monty and Feldhamer 2002). This gland is likely used in scent communication and mother-litter recognition (Clark 1973, Monty and Feldhamer 2002). *Neotoma floridana* has 2–3 molts during the first year, and one molt annually thereafter (Finley 1958). The first molt occurs at 5–6 weeks of age and starts at the abdomen, chest and throat, then continues to the dorsal side of the animal (Rainey 1956, Monty and Feldhamer 2002). In females annual molts may be delayed by 1–3 months, or until after the breeding season (Feldhamer et al. 2003). Some southern populations may not exhibit well-synchronized molting patterns (Birney 1973, Feldhamer et al. 2003). The molt pattern of *N. floridana* is juvenile pelage, then a postjuvenile molt, subadult pelage, second molt, first autumn pelage, third molt, first winter pelage, and a final annual molt (Monty and Feldhamer 2002). Winter pelage is gray-brown in color.

Dental formula is $i\ 1/1, c\ 0/0, p\ 0/0, m\ 3/3$, total 16 (Monty and Feldhamer 2002). Molars are moderately high crowned and prismatic in form (Hoffmeister 1989, Monty and Feldhamer 2002). Females have a duplex uterus with 2 uteri, 2 cervixes, and a single vagina (Feldhamer et al. 2003). It also has 2 pairs of inguinal mammae (Finley 1958, Monty and

Feldhamer 2002). During sexual inactivity, female nipples are small and covered by hair on the abdomen, and the vagina is closed (Rainey 1956). Males have paired testes that descend into the scrotum during the breeding season (Howell 1926). *Neotoma floridana* also possesses a U-shaped baculum with a broad proximal end and upturned lateral projections (Monty and Feldhamer 2002).

ONTOGENY AND REPRODUCTION

Neotoma floridana breeding season varies by geographic location (Monty and Feldhamer 2002). Breeding in Oklahoma occurs from March through October (Goertz 1970, Monty and Feldhamer 2002) and from February to August in Kansas (Rainey 1956, Monty and Feldhamer 2002). In some years, eastern woodrats in Illinois, Florida, and Georgia appeared to be reproductive during throughout of the year (Wagle 1996, Monty 1997, Monty and Feldhamer 2002).

Neotoma floridana is polyestrous, with estrous cycles lasting about 4–6 days (Asdell 1964, Monty and Feldhamer 2002). During the estrous cycles, the vagina is open, the uterus and ovaries enlarge, and the clitoris swells (Rainey 1956, Monty and Feldhamer 2002). Female woodrats in the southern portion of their range reach sexual maturity when their weight is >160 g. Females born in early spring usually show signs of sexual maturity during the first autumn after birth, but seldom produce litters that year (Fitch and Rainey 1956, Feldhamer et al. 2003). During late stages of gestation, which lasts 32–38 days, the nipples enlarge and soften, and hair loss occurs in the integument (Rainey 1956, Birney 1973). If a female is nursing a previous litter when impregnated, delayed implantation may occur which lengthens gestation (Monty and Feldhamer 2002). The number of litters per year (2–4) and litter size (1–4 to 1–6) varies geographically (Worth 1950, Monty and Feldhamer 2002, Feldhamer et al. 2003). Neonates of *N. floridana* are born altricial and sparsely haired with a pink muzzle (Rainey 1956, Monty and Feldhamer 2002). The upper and lower incisors are erupted for attachment to

the mother's teat for weaning (Hamilton 1953, Monty and Feldhamer 2002). Females are solely responsible for care of young (Guilliams and Francl 2008). Females defend the nest and nurse their young for 3–4 weeks after birth. Young remain attached to the nipple until 70–90 days old (Guilliams and Francl 2008).

ECOLOGY

Population Characteristics.—Population density varies across the geographic range. Neal (1967) estimated *N. floridana* populations in Louisiana as 0.2 to 0.82 individuals/ha following a local population decline (Feldhamer et al. 2003). Average home range of *N. floridana* was 0.26 ha for males and 0.17 ha for females (Goertz 1970 in Feldhamer et al. 2003). Male home ranges are larger due to increased distances travelled to secure mates (Feldhamer et al. 2003). Neonate sex ratios are about 1:1 (Birney 1973, Goertz 1970 in Monty and Feldhamer 2002). In Illinois, 41.7% of 283 individuals were males (Monty 1997, Monty and Feldhamer 2002).

Neotoma floridana is a moderately long-lived rodent species (Monty and Feldhamer 2002). Fitch and Rainey (1956) reported an adult male previously captured was recaptured 827 days later. An adult female was captured over a 1,089 day period (Feldhamer et al. 2003). Captive woodrats generally live about 2 years, but can live up to 4 years (Schwartz and Schwartz 1959; Birney 1973). Annual survival of *N. floridana* in Illinois was 23% (Monty 1997, Monty and Feldhamer 2002). Of 27 juveniles recorded by Rainey (1956), 6 survived to adult size and 3 survived long enough to reproduce (Monty and Feldhamer 2002).

Space Use.—*Neotoma floridana* generally prefers woodland habitats but also occurs in grasslands (Guilliams and Francl 2008). They inhabit deciduous forests in mountainous areas, swamps and marshes in coastal areas, and even abandoned buildings in urban areas (Guilliams and Francl 2008). Woodrats generally stay close to their middens and limit foraging to about 20–21 m radius (Guilliams and Francl 2008).

Diet.—*Neotoma floridana* are food generalists and feed on hard and soft mast (Feldhamer et al. 2003). Analysis of fecal matter revealed a diet of 61–67% hard mast such as oak acorns (*Quercus* spp.) and hickory (*Carya* spp.; Monty and Feldhamer 2002). Individuals in agricultural fields are primarily granivores; however, they usually do not cause substantial crop damage (Rainey 1956, Monty and Feldhamer 2002). They also feed on invertebrates including grasshoppers, scorpions, beetles, and snails (Murphy 1952, Pearson 1952, Rainey 1956, Monty and Feldhamer 2002). Where free water is limited, *Neotoma floridana* obtain water from dew, rain, vegetation, and metabolic processes (Monty and Feldhamer 2002).

Diseases and Parasites.—*Neotoma floridana* is host to several parasitic species including: warble flies (*Cuterebra* species), ticks (*Ixodes* species), mites (*Eutrombicula* spp.), fleas (*Orchopeas* spp.), chiggers (*Trombicula* spp.), and nematodes (*Longistriata* spp.; Williams and Francl 2008). *N. floridana* has little impact on humans.

Interspecific interactions.—“Rainey (1956) believed that predators could keep woodrat numbers suppressed at low population levels because woodrats have relatively low reproductive potential” (Monty and Feldhamer 2002). Predators of *N. floridana* include: spotted skunk (*Spilogale putorius*), long-tailed weasel (*Mustela frenata*), black rat snake (*Elaphe obsoleta*), great horned owl (*Bubo virginianus*), timber rattlesnake (*Crotalus horridus*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), cottonmouth (*Agkistrodon piscivorus*), and copperhead (*A. contortrix*) (Crim 1961, Monty and Feldhamer 2002). *Neotoma floridana* usually avoids predator interactions through nocturnal movement, taking refuge in middens, and vigilance (Monty and Feldhamer 2002). They may also escape predation by use of escape routes from their dens (Monty and Feldhamer 2002).

BEHAVIOR

Neotoma floridana is primarily nocturnal and becomes active 30 min after sunset until 30 min before sunrise (Monty and Feldhamer 2002). According to Monty and Feldhamer (2002) “Murphy (1952) found woodrat activity decreased during extremely cold or rainy weather”, although Rainey (1956) stated woodrats are more active on dark and rainy nights.

Neotoma floridana is also known for building large dens or “middens” to store food, rear young, and sometimes for defense against predators. These dens are often built of sticks, dung, rocks, or other available material and can exceed 1 m in height (Williams and Francl 2008).

GENETICS

Neotoma floridana has a diploid number of chromosomes that equal 52 (Feldhamer et al. 2003). *N. floridana* has one large and two small pairs of autosomal banded elements that makes 22 pairs of acrocentric chromosomes (Feldhamer et al. 2003). This species is polymorphic for the number of large banded chromosomes that they possess (Feldhamer et al. 2003). The X chromosome is a large submetacentric and the Y chromosome is a medium submetacentric (Feldhamer et al. 2003). In some subspecies like *N. f. baileyi*, *N. f. attwateri*, and *N. f. campestris* a submetacentric Y chromosome was found which links these populations to the eastern woodrat (Briney 1973, Feldhamer et al. 2003).

CONSERVATION

Neotoma floridana is considered secure throughout the United States, but there are several subspecies of *Neotoma floridana* that are of. One subspecies is the Illinois Woodrat (*Neotoma floridana illinoensis*) which is monitored by the Tennessee Department of Environment and Conservation (Williams and Francl 2008). The Key Largo woodrat (*Neotoma floridana smalli*) is listed as endangered by the United States Fish and wildlife Service. This subspecies decline is due to habitat loss and fragmentation on the island of Key Largo,

Florida which has lost almost half of its suitable habitat since the early 1970's (Guilliams and Francl (2008)).

REMARKS

Some of the variations in the vernacular name include: Eastern woodrat, pack rat, trade rat, Florida wood rat, bush rat, brush rat, cave rat, and mountain rat (Monty and Feldhamer 2002).

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