MAMMALIAN SPECIES No. 15, pp. 1–4, 4 figs.

Neofiber alleni. By Dale E. Birkenholz

Published 16 June 1972 by The American Society of Mammalogists

Neofiber True, 1884

Neofiber True, 1884a:34. Type species *Neofiber alleni* True, 1884, by monotypy.

CONTEXT AND CONTENT. Order Rodentia, Family Muridae (in the broad sense including the Cricetidae), Subfamily Microtinae. The genus *Neofiber* includes one living species, *Neofiber alleni*, as treated below.

Neofiber alleni True, 1884
Round-tailed Muskrat

Neofiber alleni True 1884a:34. Type locality Georgiana, Brevard County, Florida.

CONTEXT AND CONTENT. Context given in generic summary. Five subspecies were recognized by Hall and Kelson (1959) who followed Schwartz (1953), but the utility of these slightly differentiated subspecies was questioned by Burt, 1954. They are as follows:

N. a. alleni True, 1884a:34, see above.

N. a. apalachicolae Schwartz, 1953:14. Type locality Apalachicola, east side of river, Franklin Co., Florida.

N. a. exoristus Schwartz, 1953:12. Type locality 12.1 mi. SE Waycross, Ware Co., Georgia.

N. a. nigrescens Howell, 1920:79. Type locality Ritta, south shore of Lake Okeechobee, Palm Beach Co., Florida.

N. a. struix Schwartz, 1953:1. Type locality 21 mi. W Miami, Dade Co., Florida.

DIAGNOSIS. Total length 285 to 381 mm, tail 99 to 168 mm, hind foot 40 to 50 mm, and ear from notch 15 to 22 mm; 5 plantar tubercles; skull (Figure 1) similar to that of *Ondatra* but smaller, condylobasal length 41 to 51 mm, zygomatic width 25 to 31 mm; postorbital process shelflike and nearly right-angled as in *Ondatra*, temporal ridges are more widely separated, the intertemporal portions of the parietal and interparietal being relatively broad; temporal ridges widely separated on braincase but tending to fuse in interorbital regions of large specimens; pterygoids, choanae, and auditory bullae as in *Ondatra*; molars (Figure 2) resemble those of *Ondatra* but are rootless; all triangles closed as in *Ondatra*, ml with five closed triangles between anterior and posterior loop, m3 with one outer fold, M3 with two transverse loops and two median triangles, lower incisors passing between bases of m2 and m3 and ascending behind molars to terminate within or near condylar process; fur, ears, and eyes resemble those of *Ondatra* but guard hairs produce tuft above tail, stiffened fringe hairs present on margins of hind feet but less developed than in *Ondatra*; tail long, but terete and sparsely haired (True, 1885; Bailey, 1900; Hinton, 1926; Ellerman, 1941; and Hall and Cockrum, 1953).

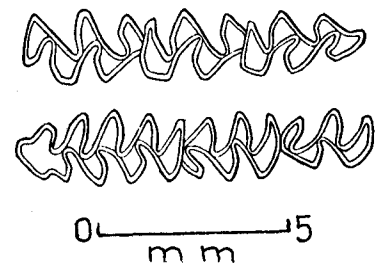

FIGURE 2. Occlusal views of molar teeth of *Neofiber alleni*, upper left tooth row at top, lower left row at bottom, anterior ends at the left of drawing (from Bailey, 1900:79).

GENERAL CHARACTERS. Conformation is typically microtine (Figure 3). The underfur is dense, gray at the base to rich brown at tip on back and pale buff on belly.

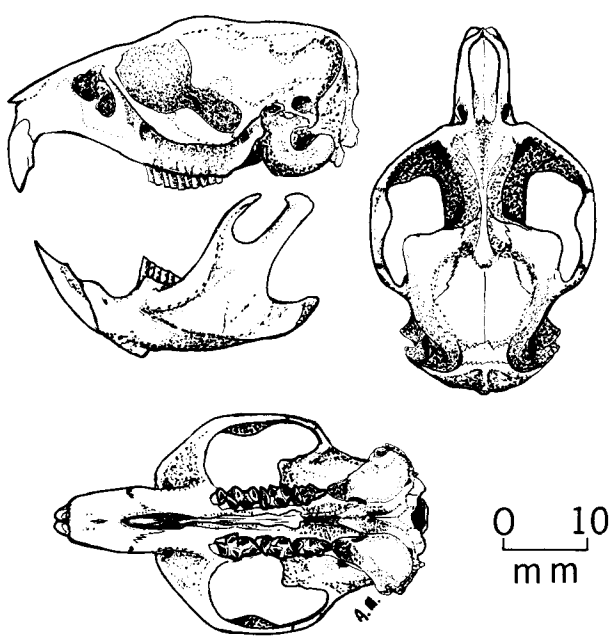

FIGURE 1. Skull of *Neofiber alleni*, male, Illinois State Univ. no. 563. Drawn by A. Moshonas.

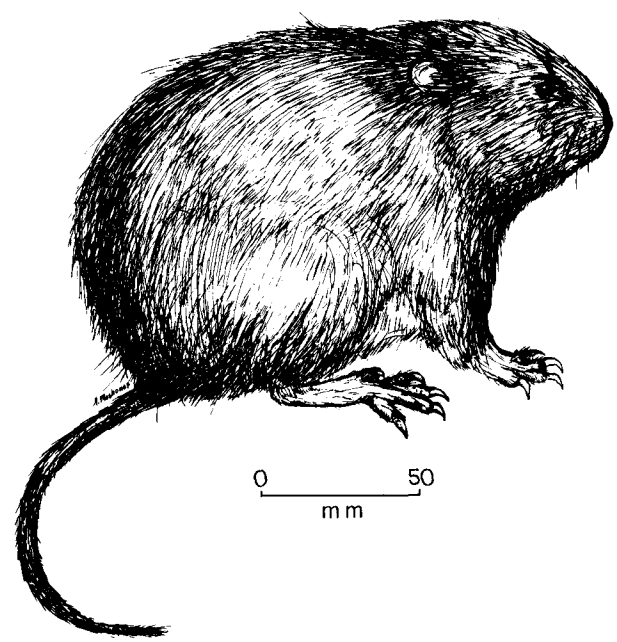

FIGURE 3. External view of *Neofiber alleni*, modified from photo by J. N. Layne. Drawn by A. Moshonas.

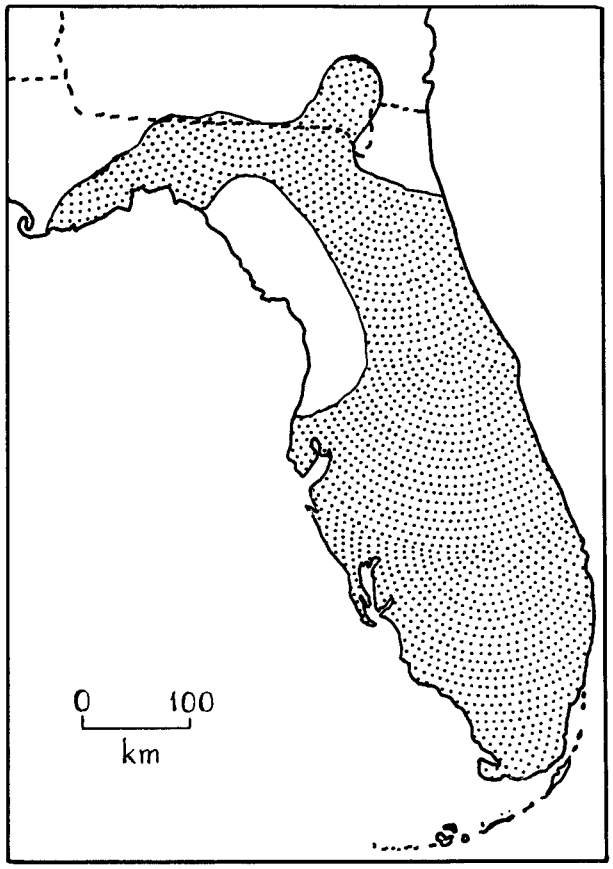

FIGURE 4. Range of *Neofiber alleni* in Florida and Georgia (modified after Hall and Kelson, 1959).

Guard hairs are dark brown and glossy. Hind feet are larger than front feet. The pelage of juveniles is lax, soft, and lead-gray in color. Adult males do not differ significantly in size from females but are slightly heavier. Range of adult weights is considerable, 108 males averaged 279.0 (187 to 350) g, coefficient of variation 12.7, 94 females averaged 262.0 g (range 192 to 357), coefficient of variation 14.6 (Birkenholz, 1963). There are 6 mammae, 4 inguinal and 2 pectoral.

DISTRIBUTION. This animal occurs locally throughout Florida and southeastern Georgia (Figure 4) except that it appears to be rare to non-existent along the upper east Gulf coast and in northeastern Florida (see Paul, 1967).

FOSSIL RECORD. Fossil *Neofiber* have been described only from the Pleistocene. Remains, all described as *N. alleni*, have been recorded from several localities in Florida (see Ray, 1957, for bibliography). *Neofiber leonardi*, somewhat larger than *N. alleni*, is recorded from north-central Kansas (Hibbard, 1943) and northwestern Texas (Meade, 1952). *Neofiber diluvianus*, same size as *N. alleni*, but with slight differences in tooth pattern, is recorded from Pennsylvania (Hibbard, 1955). The fossil species are from deposits thought to represent Sangamon or Yarmouthian interglacials. Most Florida deposits have been dated as late Pleistocene.

FORM. The glans penis is unique in external form, in size and shape of the frenum, and in the conelike arrangement of the urethral process (Hooper and Hart, 1962, which see for details about structure and systematic relationships). The baculum measures to 4.7 mm in length, which is 1¾ times the greatest breadth and four times the greatest depth. The stalk is massive with three digitate processes, but ossification of the processes is variable, with the median process infrequent and tending to be smaller than the lateral processes (Hamilton, 1946; Anderson, 1960; and Hooper and Hart, 1962). The preputial glands are large and triangular in shape, measuring 20 by 10 mm. There are three sets of prostate glands. The ventral prostates are large (18 by 11 mm) and paired, and each consists of two lobes. Only one duct drains them, thus they may be considered as one pair of glands. *Neofiber* also possesses one pair of dorsal and one pair of anterior prostate glands. The latter are drained by four ducts on each side. The ampullary glands consist of several lobes tightly bound together. The vesicular glands are large and convoluted, measuring up to 50 mm when straightened (Arata, 1964). The testes of mature males measure 10 by 8 to 13 by 10 mm and weigh .30 to .50 grams. The cremaster is thinly furred in adults and often is tumid with a pigmented area near the anus. Occasionally the tip of the glans penis is pigmented (Birkenholz, 1963).

The species has small mastoid and tympanic segments of the auditory bullae, which are solid, thick-walled, and without bony ingrowths (Hooper, 1968). With regard to the Meibomian glands, the large tarsal glands are crowded and tend to be fused at the posterior angle of the eyelids. Only small filiform glands are found over most of the length of the eyelid. The enlarged tarsal glands are compacted together (Quay, 1954a). In these respects, *Neofiber* and *Ondatra* show several interesting parallels. The diastemal palate possesses one or two large interpremaxillary foramina showing four patterns. With regard to superficial features, the palate is similar to that of other microtines that either dig with their incisors or are aquatic (Quay, 1954b). The side glands of *Neofiber* appear as oval, pale-colored, and striated patches of skin on each flank. The area is overlain by fur with a cream-colored base. No glandular tissue exists (Quay, 1952; Birkenholz, 1963). Bailey (1900) reported that its degree of development was associated with breeding activity, but I found no correlation between reproductive status or sex and its prominence.

The diploid chromosome number is 52. Chromosomes range in length from 0.8 to 4.5 μm. All are acrocentric. In meiosis the X and Y chromosomes unite only loosely and undergo an early disjunction (Matthey, 1961).

ONTOGENY AND REPRODUCTION. Round-tailed muskrats breed throughout the year with periods of increased reproduction in late autumn (Birkenholz, 1963). Reproduction usually coincides with the availability of dense emergent cover and suitable water levels. The estrous cycle appears to be 15 days, and a post-partum estrus was recorded only after one still-born litter. When young were suckled the cycles began 15 days later. The gestation period is between 26 and 29 days. No data are available on copulatory behavior. Average number of young from 104 females was 2.2 (range 1 to 4). Four to six litters are produced each year, depending upon habitat conditions. For a description of gross morphological changes of the gonads and reproductive tracts see Birkenholz (1963). Inguinal mammary tissue develops in a band 15 by 40 mm on each side of the ventral midline. In some instances only the hind pair of teats are suckled and then only the posterior portion of the mammary tissue is developed. The pectoral teats are not developed. The mammary tissue regresses within a week after weaning. Placental scars remain distinct for 2 months and are nearly invisible by 3 months post partum.

Seven newborn averaged 12.1 g (range 10.0 to 14.9). Average measurements of these were: total length 90 mm (85 to 94), tail 21.0 mm (20 to 22), hind foot 12.0 mm (12 to 13), and ear from notch 3.5 mm (3.5). Newborn *Neofiber* are blind and nearly naked. The skin is pink and wrinkled, the vibrissae about 5 mm in length. No teeth are extruded. The pinnae are sealed and folded. Instantaneous growth rates are highest during the first week, then decrease gradually to adulthood, except for a slight increase at weaning. At day 2 post partum, short, coarse, and shiny gray to blackish fur covers the body, and the incisors are extruded. The pelage becomes brown-tipped, long, dull, and lax at days 10 to 14, and the auditory meatus opens. By days 14 to 18, the eyes are open, all teeth are erupted, and the young can care for themselves if necessary. By day 21, the incisors are pigmented and only adult fare is eaten. By day 30, the ears and hind feet attain full size and the young resemble adults. They become sexually mature at 90 to 100 days of age when they weigh an average of 275 grams. Juveniles molt between 7 and 30 days of age. The resultant pelage is browner than the juvenile one and guard hairs are longer and glossier. Shortly after this molt (at 35 to 50 days) a subadult molt begins on the ventral midline and proceeds dorsally terminating on the crown. Waves of partial molt may accompany it. This molt lasts from 24 to 30 days and results in the adult pelage. Adult molts are unpatterned, spreading from centers usually located in the lumbar region, upper back, crown, and legs. Molting adults have been recorded in every month, but the highest incidence is found during autumn (Birkenholz, 1963).

Schwartz (1953) suggested that adults may molt once each year.

ECOLOGY. *Neofiber* typically inhabits shallow grassy marshes. In central Florida, they resided in greatest numbers in water 150 to 460 mm deep where the substrate was of sand and stands of *Panicum hemitomon* and *Leersia hexandra* were dense. Slightly deeper waters also containing *Pontederia lanceolata* were used. Chapman (1894), Bangs (1898), Elliot (1901), Rand and Host (1942), and Porter (1953) reported the use of similar habitats. Harper (1927) noted that this species preferred areas where the water was nearly completely filled with vegetation. *Neofiber* does burrow into banks on occasion (Porter, 1953; Birkenholz, 1963), especially when droughts lower water levels.

Houses are spherical to dome-shaped and from 180 to 610 mm in diameter. They are constructed mainly of aquatic grasses, but *Pontederia, Sagittaria, Ceratophyllum,* and *Polygonum* also are used (Harper, 1920; Schwartz, 1952; Porter, 1953, and Birkenholz, 1963). Houses are attached to emergent vegetation and often built upon a mass of sunken plant material. The interior chambers are about 100 mm in diameter and normally contain two exit holes that lead beneath the surface of the water. When used for raising young, the chambers are lined with fine, dry grasses. Houses were used for as long as three months in central Florida, but Porter (1953) stated that large houses might be used from year to year. Round-tailed muskrats also construct one to six feeding platforms near the houses. These consist of a pad of vegetation about 100 by 150 mm in size, elevated slightly above the water surface, and containing one or two plunge holes. Occasionally animals roof the feeding platforms or convert them into houses (Birkenholz, 1963).

In early morning of a typical summer day, house temperatures average 2°C above ambient temperatures, but during most of the day they are lower, as much as 5.5°C. Humidities remain higher at all times in the house (88 as opposed to 84% in early morning, 70 as opposed to 58% at mid-afternoon —Birkenholz, 1963).

The round-tailed muskrat is herbivorous, feeding primarily on aquatic grasses, but also *Nymphaea lutea, Sagittaria lancifolia, Pontederia* sp. (Porter, 1953), seeds of *Peltandra* (Schwartz, 1952), stems of *Brasenia*, seeds of *Iris*, and roots of *Anchistea* (Harper, 1927). The grasses *Panicum hemitomon, Mariscus* sp., *Sporobolus* sp., and *Echinochloa* sp. are utilized the most. In north central Florida, they eat mostly stems of *P. hemitomon* (Birkenholz, 1963), but also the roots and epidermis of the stems of *Pontederia lanceolata.* Harper (1927) suggested that the diet might be partly carnivorous on the basis of crayfish remains on feeding platforms, but Birkenholz (1963) found no such evidence from analysis of 330 stomach contents. Rice rats commonly use *Neofiber* platforms for feeding and may account for the animal remains.

I reported on population densities in 1963 and calculated approximately 100 to 120 animals per acre (250 to 300 per hectare) on small areas in central Florida. Populations fluctuated greatly and on one pond dropped from 250 per hectare in early March to 50 per hectare in early May. One large marsh of 1000 hectares contained an average density of 50 animals per hectare. In this area, males constituted 56% of 326 specimens collected. The only evidence for territoriality was that only one adult occupied each house. Animals shared feeding platforms. Of 14 animals marked and released, one adult male was retaken 36 m away 4 months later. Feeding areas were measured by injecting animals with radioactive phosphorous, then monitoring houses and feeding platforms for radioactive fecal pellets. Individuals fed in a circle about 9.1 m in diameter, but traveled over a larger area that was not measured. A central Florida population enlarged its range into unoccupied habitat no more than 400 m in one year (Birkenholz, 1962).

Reported predators of *Neofiber* are the great blue heron (Maynard, 1895), barn owl (Howell, 1932; Schantz and Jenkins, 1950; Schwartz, 1952; and Birkenholz, 1963), a domestic cat (Harper, 1927), cottonmouth, marsh hawk, red-tailed hawk, and bobcat (Birkenholz, 1963). In my study, marsh hawks and barn owls were the most important predators, most predation occurring on flood displaced animals.

Rausch (1952), Porter (1953), and Birkenholz (1963) have reported on parasites of *Neofiber*. These include the cestodes *Paranoplocephala neofibrinus* and *Cittotaenia praecoquis* in the small intestine and *Taenia lyncis* from the liver, the trematode *Quinqueserialis floridensis* in the cecum, and the nematodes *Longistriata adunca* and *Litosomoides* sp. in the pleural cavity, and an unidentified species in the stomach. Mites recorded include *Laelaps evansi, Haemolaelaps glasglowi,* (= *Androlaelaps fahrenholzi*) and an undescribed species of the Family Listrophoridae. I reported that 123 of 298 specimens (41.3%) harbored helminths. Tapeworms were most common. Prevalence in juveniles was 16.7%, in subadults 52.8%, and in adults 67.0%. No evidence of disease in *Neofiber* has been reported except that Porter (1953) recorded subcutaneous cysts on captives that later died.

BEHAVIOR. Little has been reported on the behavior of *Neofiber*. Baker (1889) and Chapman (1889, 1894) described a gyrating motion of the tail when the animal swam, but this occurs only when turning (Birkenholz, 1963). Captive animals occupying nests boxes will rush at intruders, their front feet clenched on the chest and the teeth chattering.

Young *Neofiber* attach tightly to the mother's teats and often are carried into the water when she is frightened from the nest. At 1 week of age they can drag themselves about and at 10 days crawl readily. At 2 weeks of age they are active and alert. Young *Neofiber* groom themselves as do adults. The face and top of the head are washed first. They then roll onto one side, grasp a hind leg in both front paws and clean each in turn. Lastly the groin area is cleaned. Sometimes only the face is washed.

Only one individual occupies each house, however, Hamilton (1956) reported two captives occupying one nest box.

Houses are constructed by bending surrounding vegetation over a platform and then incorporating additional vegetation into the walls from within after it is brought into the chamber through the plunge holes (Birkenholz, 1963).

The round-tailed muskrat is primarily nocturnal. Porter (1953) reported the species most active from the hour of 2000 until 2400, but Bangs (1898) recorded them building houses during the daytime. I observed captives and individuals in the field, and noted peak activity shortly after dark, and sporadic activity throughout the night. Only occasionally was diurnal activity noted.

REMARKS. In 1963, I compared the chronology of some developmental landmarks of *Neofiber* with that of other microtines. The species resembles many smaller microtines with regard to opening of the eyes, extrusion of teeth, and weaning. The relatively rapid rate of development may be an adaptation to a partially aquatic habitat and the home-site, which soon becomes too small for an adult with its growing young. *Neofiber* houses often are used by rice rats (*Oryzomys palustris*) and many other vertebrates. Hence, the species provides shelter for many marsh associates. The present compared to the former range of *Neofiber* has often been speculated upon. I suggest that this species, by utilizing shallow water grasses for house building becomes limited to areas where marshes do not freeze for a long period of time. Such houses would not be strong and durable enough to withstand predators and other abuse if they were exposed on the ice.

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