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Dactylomys boliviensis.

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Dactylomys Geoffroy Saint-Hilaire, 1838

Echimys Desmarest, 1817:57. Type species *Echimys dactylinus* Desmarest, 1817.

Dactylomys I. Geoffroy Saint-Hilaire, 1838:888. Type species *Dactylomys typus* Geoffroy Saint-Hilaire, 1838 (= *Echimys dactylinus* Desmarest, 1817) by monotypy.

Lachnomys Thomas, 1916:299. Type species *Dactylomys peruanus* Allen, 1900, by original designation. Proposed as a subgenus of *Dactylomys*.

Dactylinus Anthony, 1920:83. Unjustified emendation of *Dactylomys*.

CONTEXT AND CONTENT. Order Rodentia, suborder Hystricognathi, family Echimyidae, subfamily Dactylomyinae, genus *Dactylomys*. The original generic description by I. Geoffroy Saint-Hilaire was published in 4 different French journals in 1838 (Emmons et al. 2002). We have included the citation with date priority. Three species are commonly recognized: *D. boliviensis*, *D. dactylinus*, and *D. peruanus* (Eisenberg and Redford 1999; Nowak 1999; Woods 1993), although Emmons and Feer (1997) recognized only 2: *D. dactylinus* for the Amazonian form and *D. peruanus* for a poorly known highland form currently known only from cloud forests of SE Peru above 1,000 m and 1 locality in La Paz department, Bolivia (Salazar-Bravo et al. 2003). Chromosomal and mtDNA data (Aniskin 1993; Dunnum et al. 2001; Patton et al. 2000; Silva and Patton 1993) suggest 2 species in the lowland Amazon basin, *D. boliviensis* and *D. dactylinus*. Cabrera (1961) followed Tate (1935) in including *Lachnomys* as a synonym for *Dactylomys*. A key to the 3 currently recognized species follows.

1. Entire tail well haired; total length ≤600 mm; color yellowish-brown with black tipped hairs. ..... *D. peruanus*
   Tail naked except for well-haired basal 20%; total length >600 mm; color grizzled yellow-olivaceous streaked with black 2
2. Distinct dark mid-dorsal stripe from head to rump present; mystacial vibrissae short; extending no further than one-half length of superciliary vibrissae; 2n = 118 ..... *D. boliviensis*
   Distinct dark middorsal stripe from head to rump absent, mystacial vibrissae long; extending greater than one-half length of superciliary vibrissae; 2n = 94. ..... *D. dactylinus*

Dactylomys boliviensis Anthony, 1920

Bolivian Bamboo Rat

Dactylomys boliviensis Anthony, 1920:82. Type Locality "Mission San Antonio, Río Chmo re [sic. = Chimore], Prov. [= department of] Cochabamba, Bolivia; altitude 1,300 feet."

Dactylinus boliviensis: Anthony, 1920:83. Name combination.

CONTEXT AND CONTENT. Content as for genus. *D. boliviensis* is monotypic. Anderson (1997) suggested that all Bolivian specimens in the literature for which the name *D. dactylinus* had been used (Biknevicius 1993; Brennan 1970; Emmons and Feer 1990; Silva and Patton 1993) were synonyms of *D. boliviensis*. However, these papers referred to specimens from the Beni and Pando departments (northern Bolivia), which are actually referable to *D. dactylinus* (Patton et al. 2000; Silva and Patton 1993).

DIAGNOSIS. *Dactylomys boliviensis* can be distinguished from most other echimyids by its large size (length of head and body, ca. 300 mm); soft, nonspinose, long (ca. 400 mm) fur; naked tail; and presence of only 4 externally visible digits on forefeet. *D. peruanus* is distinctly smaller (total length, 240 mm) and has a haired tail. *Olallamys albicauda* and *O. edax* are also smaller (total length, 180–240 mm), have reddish-brown pelage, and more northerly distributions in Colombia, Venezuela, and perhaps Ecuador (Eisenberg and Redford 1999).

D. dactylinus and *Kannebateomys amblyonyx* are the only echyimids of similar size and characteristics as *D. boliviensis*. *D. boliviensis* can be distinguished from *K. amblyonyx* by the latter's reddish or agouti color and haired tail. Moreover *K. amblyonyx* occurs only outside of the Amazon forest proper. *D. dactylinus* may overlap geographically with *D. boliviensis* (Eisenberg and Redford 1999; Emmons and Feer 1997). *D. boliviensis* has more muted dorsal tones and a proportionately longer tail than *D. dactylinus*. Middorsal stripe of *D. dactylinus* is never blackish-brown as in *D. boliviensis* but does contrast with the grizzled yellow dorsum. Mystacial vibrissae are short, extending only to one-half length of superciliary vibrissae, in contrast to much longer mystacial vibrissae of *D. dactylinus* (Patton et al. 2000). Call structure also differs; calls from Brazilian localities consist of 15–45 pulses per vocalization for *D. boliviensis* and no more than 5–10 pulses for *D. dactylinus* (Silva and Patton 1993). Vocalizations from *D. dactylinus* at 2 Ecuadorian localities and *D. boliviensis* from Peru differ (Emmons 1981).

GENERAL CHARACTERS. *Dactylomys boliviensis* (Fig. 1) is among the largest echimyid rodent (type specimen measurements in mm: total length, 700; length of tail, 410; length of hind foot, 60; length of ear, 20). Its distinctive blunt-nosed head is gray-brown with black vibrissae ca. 80 mm long. Fur is soft and lacks spines. Overall dorsal color is grizzled grayish-olivaceous streaked with black, becoming paler on sides. A dark middorsal stripe of tricolored (black-brown-black) hairs runs from head to rump; ventrally, *D. boliviensis* is sparsely haired with white fur. Sides of rump and hind legs are orange-brown. Tail is naked except for the basal 20%, which is densely covered in tricolored (black-white-black) fur. Tail is heavily scaled and bicolored from furred base to tip, with 6 annuli/cm at base and 7.5/cm at tip. Scales are less pentagonal than in *D. dactylinus*. Median hair extends 1.5–2 scale rows (Patton et al. 2000).

Forefeet have 4 externally visible digits, with 3rd and 4th digits elongated and separated by a large gap giving them primate-like grasping capabilities. Fifth toe on the forefoot is extremely small, consisting mainly of a vestigial claw set in the plantar tubercle that formerly lay at the base of that toe (Anthony 1920). The broad palmar and plantar surfaces have no distinct pads but are covered with hundreds of 0.5–0.7-mm, oval to hexagonal tubercles over their entire surface, except small spots on tips of digits (Emmons 1981). Front feet have nails rather than claws. Eyes have horizontally slit pupils, pale brown irises, and weak eye shine (Emmons 1981).

Skull is large, with a short rostrum and broad, well-developed

FIG. 1. Adult *Dactylomys boliviensis* from Cocha Cashu Biological Station, Manu National Park, Madre de Dios, Peru. Photograph by Louise H. Emmons.

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of the holotype of *Dactylomys boliviensis* (AMNH 38709), an adult male. Occipitonasal length = 72.31 mm. Photograph by J. L. Dunnum.

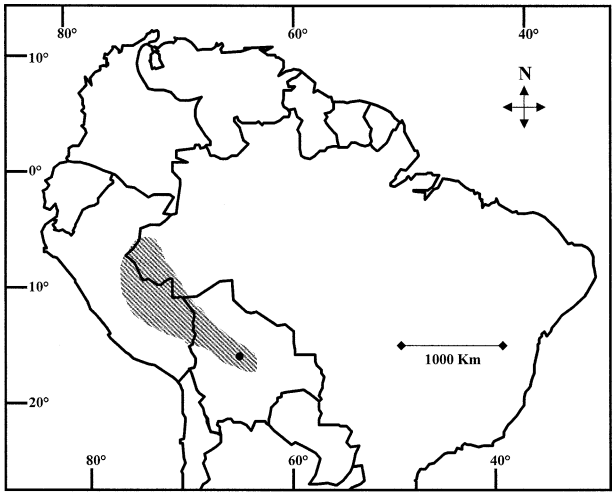

FIG. 3. Distribution of *Dactylomys boliviensis* based on specimens in Anderson (1997), Emmons (1981), Patton et al. (2000), and Salazar et al. (1994). ● Type locality = Bolivia: Cochabamba; Mission San Antonio, Rio Chimore.

supraorbital ledges that form subtriangular supraorbital processes (Fig. 2). Paroccipital processes are directed anteriorly and follow curvature of auditory bulla. Postorbital process of zygomatic arch is comprised primarily of jugal (Patton et al. 2000). Bullae are moderately large, and infraorbital foramen has no canal for nerve transmission. Palate is constricted anteriorly so that premolars almost touch each other (Ellerman 1940). Nasals widen rapidly anteriorly, terminating almost in the same plane with the premaxillae. Superior outline of the skull is very flat. Posterior portion of palate is built out by a thin shelf-like extension of postpalatal region. Pterygoid process is very long and slender and meets auditory bullae (Anthony 1920).

DISTRIBUTION. The Bolivian bamboo rat ranges throughout central Bolivia and southeastern Peru and extends at least into extreme northwestern Brazil (Cabrera 1961; Eisenberg and Redford 1999; Patton et al. 2000; Woods 1993; Fig. 3). All published localities are in tropical or subtropical lowlands and are at or below 1,000 m (Anderson 1997; Emmons 1981; Patton et al. 2000; Salazar et al. 1994; Silva and Patton 1993). However, within this range it is restricted to a patchwork of suitable habitat associated with bamboo growth and riparian areas. No fossils of *D. boliviensis* are known (McKenna and Bell 1997).

FORM AND FUNCTION. Dental formula is i 1/1, c 0/0, p 1/1, m 3/3, total 20. Teeth are brachyodont, broad and heavy, with a pattern consisting of a deep reentrant fold in middle of each upper molar more or less completely dividing each tooth into 2 lobes, each of which is subdivided by a broad external fold. Lower molars have 2 inner folds, the posterior one completely dividing the tooth. The lower premolar has a small extra lobe positioned anteriorly (Ellerman 1940). Upper toothrows diverge posteriorly, with left and right P4 nearly meeting at midline. Individual teeth exhibit coronal hypsodonty, have well-developed roots, and have a planar occlusal surface. Each tooth consists of 4 transverse lophs, with both an anterior and a posterior pair separated by a deep median flexus but joined lingually and thus form a distinctive Y shape; the 2 pairs of lophs are separated by a transverse flexus that extends completely across the tooth (Patton et al. 2000). An odiferous gland over the sternum produces a strong smell (Salazar et al. 1994).

ONTOGENY AND REPRODUCTION. One pregnant female *D. boliviensis* with 2 well-developed embryos (74 and 82 g) was collected in late July (Salazar et al. 1994). None of the 5 specimens collected in February at 2 localities in Brazil showed signs of reproductive activity, although the vagina of a single female was perforated (Patton et al. 2000).

ECOLOGY. *Dactylomys boliviensis* is closely associated with bamboo habitat and riparian areas. All individuals observed, collected, or detected by their odor at Igarapé Porongaba or in the community of Flora in the headwaters of the Rio Juruá, Acre, Brazil, were found in dense and extensive bamboo thickets (Patton et al. 2000). Other specimens from Cusco department, Peru, were collected along the Rio Pangoreni at 1,000 m (Patton et al. 2000). Along the Rio La Reserva in La Paz department, Bolivia, 4 specimens were collected on different nights within 5 m of each other in a dense stand of bamboo (*Bambusa*) and small trees (Salazar et al. 1994). Nineteen animals were seen at Cocha Cashu Biological Station, Manu National Park, Madre de Dios Department, Peru; 18 were in clumps of bamboo, and the other was in a tree along a stream bank. The mean height at which these animals were seen was 4.7 m (range, 1.5–15 m—Emmons 1981). In pooled data for both *D. boliviensis* and *D. dactylinus*, 44% of the bamboo rats seen were within a few meters of each other in pairs, often in the same mass of vegetation (Emmons 1981). The 2 species may overlap geographically in northern Bolivia and northwestern Brazil. Patton et al. (2000) reported they likely encounter one another in Brazil somewhere along the upper Rio Juruá.

Stomach contents from animals from La Reserva, Bolivia, included bamboo sprouts and epidermis. Gnawing and tooth marks were found on bamboo trunks near where animals had been col-

lected (Salazar et al. 1994). In Peru, on 8 occasions bamboo rats were stripping bark from green bamboo stems (*Bambusa*), scraping and eating the inner surface, then discarding the rest, forming large piles mixed with droppings. Many stands occupied by Bolivian bamboo rats had partly stripped bark or large, jagged holes gnawed into the stem near the internodes (Emmons 1981).

Home range information is based on 1 individual (Emmons 1981). At Cocha Cashu, Madre de Dios, Peru, an adult male *D. boliviensis* was fitted with a 25-g radiocollar and followed for 6 complete nights. He was located 157 times in a home area covering 0.23 ha within a 0.43-ha bamboo stand. During 6 complete activity periods, he moved a mean, maximum diameter of 61.9 m/night (range, 45–68 m; *SD* = 8). Mean total path length based on 2 locations per hour was 227 m (range, 169–284 m; *SD* = 48). Movement began up to 1 h before dark and was equivalent on full- and new-moon nights. He moved slowly and steadily throughout the night (mean displacement, 18.9 m/h) and returned to his daytime rest site at dawn (0500–0530 h). He used 3 diurnal rest sites on the extreme perimeter of his range that were located 16 times: 1 was a dense mass of vegetation tangled in the crown of *Scheela* palm at the waters edge; the 2 others were at heights of 10 and 25 m in dense vines around the trunks of trees. Neither Bolivian bamboo rat nest was visible from the ground. In comparison to the movements of Bolivian bamboo rats, the mean daily path length (mean of 8 days) traveled by a group of smaller (400 g), arboreal frugivorous–insectivorous primates in the same forest, *Saguinus fuscicollis*, was 1,219 m, or 6 times greater (Emmons 1981).

Collection of Bolivian bamboo rats is difficult. They are folivores that do not readily enter traps, and their weak eye shine and methodical movements make them difficult to see at night (Patton et al. 2000). All specimens taken by Salazar et al. (1994) were collected with a 16-gauge shotgun. Voss and Emmons (1996) reported that collecting *Dactylomys* requires substantial time and effort and is best done through night hunting. An adult male and a subadult male were darted using a "Telinject" blowgun and the anesthetic Ketamine HCl at Cocha Cashu (Emmons 1981).

BEHAVIOR. Bolivian bamboo rats are most easily detected by their distinctive vocalizations, which have been described as resembling those of a toad (Salazar et al. 1994). Individuals from the headwaters of the Rio Juruá exhibited a staccato series of 15–25 short pulses at most localities, with 45 being the maximum counted (Patton et al. 2000:175; Silva and Patton 1993). Both males and females called at La Reserva between the hours of 1900 and 0400, most frequently between 2200 and 0245 h (Salazar et al. 1994). High-amplitude calls that carried over long distances ("L" calls) and grunt-like pulses of low amplitude and lower and narrower frequency range carried only a few meters ("A" calls) were from Ecuador and Peru (Emmons 1981). The A calls were emitted singly or in a long series lasting 20 min or more. The actual recordings are available in Emmons et al. (1997).

During 114 h of night censuses in Cocha Cashu, individuals were heard calling only from bamboo stands. Along the Rio Tambopata, Madre de Dios Department, Peru, animals called from the extensive bamboo stands as well as from stands several kilometers away from permanent watercourses (Emmons 1981). A radiotagged male from Cocha Cashu was monitored for 6 nights. During 4 of the nights he called twice, on 1 night he called only once, and during 1 night he did not call at all. Over the course of those nights, the 1st call was made between 1947 and 2218 h, and the 2nd was between 0045 and 0200 h. No other Bolivian bamboo rats were emitting L calls from within this male's home range. On 5 of the 10 times the radio-tagged male was heard giving L calls, another Bolivian bamboo rat within his home range instantly answered with a series of A calls. Twice the answering animal was a female. On another occasion, 2 animals answered. Response calls usually came from within 20–50 m of the male (Emmons 1981). The L calls heard at Limoncocha, Tzapino (*D. dactylinus*), and those from Cocha Cashu (*D. boliviensis*) were distinctly different. At Tzapino the initial burst of pulses sounded identical to those at Limoncocha, but the final pulses were grouped into pairs or trios. At Cocha Cashu, *D. boliviensis* calls lacked the initial burst and had a mean of 29 pulses (n = 6; *SD* = 6.0). The initial pulses were ca. 3 times as long as those from Ecuador and had no harmonics below 500 Hz. At Tambopata, the call was like that at Cocha Cashu but included a mean of 44 pulses (n = 7; *SD* = 12.5—Emmons 1981).

In Peru, calling Bolivian bamboo rats sat crosswise on branches ca. 2 cm in diameter, often at a branch fork or where a vine crossed the support. They sat back on their tarsi and either placed their forefeet on the vine or side branch or tucked them up near their chest. The tail hung free below the body, and dorsal hair at the tail base was slightly erected. At the emission of each pulse, the mouth was open and the head jerked forward so that the muzzle was horizontal (Emmons 1981).

In Cocha Cashu, Madre de Dios Department, Peru, 2 animals were observed lowering their chests to branches and rubbing their sternal glands along it for a few centimeters immediately following a vocalization (Emmons 1981).

Locomotion in *D. boliviensis* is smooth and cautious with only 1 foot moving at a time. This results in almost soundless movement through the vegetation. Branches are usually grasped between the 2nd and 3rd digits of the forefeet. The tight grip allows an easy climb along thin vines and up vertical stems that could not be negotiated by a squirrel of similar body mass. When disturbed, a Bolivian bamboo rat would either sit motionless for many minutes, creep away in slow motion, or run swiftly up out of sight (Emmons 1981).

GENETICS. Diploid chromosome number is 118, and FN = 168 (Dunnum et al. 2001). The standard karyotype for *D. boliviensis* is highly asymmetric, with 26 pairs of meta or submetacentrics autosomes and 32 pairs of acrocentric autosomes. The X and Y chromosomes are a large submetacentric and a medium submetacentric, respectively.

The 798 base pairs of cytochrome *b* sequence from 1 *D. boliviensis* taken from the headwaters of the Rio Juruá (Acre State, Brazil) differed by an average of 9.5% from individuals from populations assigned to *Dactylinus* and taken from a wide geographic area stretching from northeastern Bolivia to eastern Brazil (Silva and Patton 1993). Analysis of sequence of the cytochrome-*b* gene (1,140 base pairs) found *D. boliviensis* was in a clade sister to the 3 Echimyinae genera (*Makalata*, *Echimys*, and *Nelomys*—Lara et al. 1996). *D. boliviensis* is not currently listed as threatened or endangered.

REMARKS. Specimens from Cocha Cashu were referred to as *D. dactylinus* (Emmons 1981); however, these specimens were subsequently verified as *D. boliviensis* (Patton et al. 2000; Silva and Patton 1993), and thus their information was included in this report. The generic name *Dactylomys* is from the greek *daktyl*, meaning finger or toe, and *mys*, meaning mouse. This refers to the nailed, primate-like front digits. The specific name *boliviensis* refers to the Bolivian type locality. We would like to thank Louise Emmons and Al Gardner for providing critical information regarding the genus as well as valuable comments on an earlier version of this manuscript. Editorial comments provided by Duke Rogers were also incorporated in the manuscript. Yuri Leite provided a review and critical comments on the submitted version. The live *D. boliviensis* photograph was provided by Louise Emmons.

LITERATURE CITED

ALLEN, J. A. 1900. On mammals collected in southeastern Peru, by H. H. Keys, with descriptions of new species. Bulletin of the American Museum of Natural History 13:219–227.

ANDERSON, S. A. 1997. Mammals of Bolivia. Bulletin of the American Museum of Natural History 231:1–639.

ANISKIN, V. M. 1993. 3 new karyotypes of prickly chinchillas of the family Echimyidae (Rodentia). Genetika 29:1500–1507.

ANTHONY, H. E. 1920. New rodents and new bats from Neotropical regions. Journal of Mammalogy 1:81–86.

BIKNEVICIUS, A. R. 1993. Biomedical scaling of limb bones and differential limb use in caviomorph rodents. Journal of Mammalogy 74:95–107.

BRENNAN, J. M. 1970. Chiggers from the Bolivian-Brazilian border (Acarina: Trombiculidae). Journal of Parasitology 56:807–812.

CABRERA, A. 1961. Catálago de los mamíferos de América del Sur. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia". Ciencias Zoológicas 4(2):xxii + 732.

DESMAREST, A. G. 1817. Nouveau dictionnaire dhistoire naturelle, appliquèe aux art, principalement à l'agriculture et à l'economie rurale et domestique; par une société de naturalists. Nouvelle edition, presqu' entierement refondue et considerablement augmentee. Deterville, Paris, France 10:54–60.

DUNNUM, J. L., J. SALAZAR-BRAVO, AND T. L. YATES. 2001. The Bolivian bamboo rat, *Dactylomys boliviensis* (Rodentia: Echimyidae), a new record for chromosome number in a mammal. Mammalian Biology 66:121–126.

EISENBERG, J. F., AND K. H. REDFORD. 1999. Mammals of the Neotropics, the central Neotropics. University of Chicago Press, Illinois 3:1–609.

ELLERMAN, J. R. 1940. The families and genera of living rodents. Rodents other than murids. Order of the Trustees of the British Museum, London, United Kingdom 1:1–689.

EMMONS, L. H. 1981. Morphological, ecological, and behavioral adaptations for arboreal browsing in *Dactylomys dactylinus* (Rodentia, Echimyidae). Journal of Mammalogy 62:183–189.

EMMONS, L. H., AND F. FEER. 1990. Neotropical rainforest mammals: a field guide. University of Chicago Press, Illinois.

EMMONS, L. H., AND F. FEER. 1997. Neotropical rainforest mammals: a field guide. Second edition. University of Chicago Press, Illinois.

EMMONS, L. H., Y. L. R. LEITE, D. KOCK, AND L. P. COSTA. 2002. A review of the named forms of Phyllomys (Rodentia, Echimyidae) with the description of a new species from coastal Brazil. American Museum of Natural History Novitates 3380: 1–20.

EMMONS, L. H., B. M. WHITNEY, AND D. L. ROSS. 1997. Sounds of Neotropical rainforest mammals: an audio field guide. CD. Distributed for Cornell Laboratory of Ornithology, University of Chicago Press, Illinois.

GEOFFROY SAINT-HILAIRE, I. 1838. Notice sur les Rongeurs épineux désignés par les auteurs sous les noms d Echimys, Loncheres, Heteromys, et Nelomys. Comptes Rendus Hebdomadaires de l'Académie des Sciences 6(26):884–888.

LARA, M. C., J. L. PATTON, AND M. N. F. DA SILVA. 1996. The simultaneous diversification of South American echimyid rodents (Hystricognathi) based on complete cytochrome b sequences. Molecular Phylogenetics and Evolution 5:403–413.

MCKENNA, M. C., AND S. K. BELL. 1997. Classification of mammals above the species level. Columbia University Press, New York.

NOWAK, R. M. 1999. Walker's mammals of the world. Sixth edition. Johns Hopkins University Press, Baltimore, Maryland 2: 1–1629.

PATTON, J. L., M. N. F. DA SILVA, AND J. R. MALCOLM. 2000. Mammals of the Rio Juruá and the evolutionary and ecological diversification of Amazonia. Bulletin of the American Museum of Natural History 244:1–306.

SALAZAR, J. A., M. L. CAMPBELL, S. ANDERSON, S. L. GARDNER, AND J. L. DUNNUM. 1994. New records of Bolivian mammals. Mammalia 58:125–130.

SALAZAR-BRAVO, J., T. TARIFA, L. F. AGUIRRE, E. YENSEN, AND T. L. YATES. 2003. Revised checklist of Bolivian mammals. Occasional Papers Museum of Texas Tech University 220:1–27.

SILVA, M. N. F., DA, AND J. L. PATTON. 1993. Amazonian phylogeography: mtDNA sequence variation in arboreal echimyid rodents (Caviomorpha). Molecular Phylogenetics and Evolution 2:243–255.

TATE, G. H. H. 1935. The taxonomy of the genera of Neotropical hystricoid rodents. Bulletin of the American Museum of Natural History 68:295–447.

THOMAS, O. 1916. Some notes on the Echimyinae. Annals and Magazine of Natural History; including Zoology, Botany, and Geology, London 8,18:294–301.

VOSS, R. S., AND L. H. EMMONS. 1996. Mammalian diversity in Neotropical lowland rainforests: a preliminary assessment. Bulletin of the American Museum of Natural History 230:1–115.

WOODS, C. A. 1993. Suborder Hystricognathi. Pp. 771–806 in Mammal species of the world, a taxonomic and geographic reference (D. E. Wilson and D. M. Reeder, eds.). Smithsonian Institution Press, Washington, D.C.

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