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Caluromys lanatus.

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Caluromys J. A. Allen, 1900

Didelphis Linnaeus, 1758:54. Part.
Didelphys Schreber, 1778:532. Part, unjustified emendation of *Didelphis* Linnaeus, 1758.
Sarigua Muirhead, 1819:429. Part, vide Allen (1900:186).
Micoureus Lesson, 1842:186. Part.
Philander Burmeister, 1856:74. Type species *Philander cayopollin* Burmeister, 1856 (= *Didelphis philander* Linnaeus, 1758), by subsequent designation (Hershkovitz 1949:12). Preoccupied by *Philander* Brisson, 1762 and *Philander* Tiedemann, 1808.
Gamba Liais, 1872:330. Part.
Cuica Liais, 1872:330. Part.
Micoureus: Ihering, 1894:11. Part.
Caluromys J. A. Allen, 1900:189. Type species *Didelphis philander* Linnaeus, 1758 by original designation. Replacement name for *Philander* Burmeister, 1856.
Micoureus: Matschie, 1916:269. Part, not *Micoureus* Lesson, 1842.
Mallodelphys Thomas, 1920:195, footnote. Type species *Didelphis lanigera* Desmarest, 1820 by original designation. Described as a subgenus of *Philander* sensu Burmeister (1856).
Calaromys Miranda-Ribeiro, 1936:324. Incorrect subsequent spelling of *Caluromys* J. A. Allen, 1900.
Mallodelphis Miranda-Ribeiro, 1936:328. Incorrect subsequent spelling of *Mallodelphys* Thomas, 1920; considered a valid genus.
Calurosmys Ávila-Pires, 1964:11. Incorrect subsequent spelling of *Caluromys* J. A. Allen, 1900.

CONTEXT AND CONTENT. Order Didelphimorphia, family Didelphidae, subfamily Caluromyinae. A key to the 3 species of *Caluromys*, *C. derbianus* (Waterhouse, 1841), *C. lanatus* (Olfers, 1818), and *C. philander* (Linnaeus, 1758), follows:

1. Total length 587–760 mm, ears whitish to pink; forelimbs and feet creamy white; gray patch between shoulders usually present; undersides buffy white to golden tawny; proximal 30–50% of tail with dorsal hair ..... *C. derbianus*
   Total length 410–730 mm; ears pinkish tan to brownish; forelimbs and feet red-brown to grayish; gray patch between shoulders rarely present; undersides orange or yellowish white to grayish; proximal 10–70% of tail with dorsal hair 2
2. Total length 510–730 mm; proximal 50% of tail haired dorsally, up to 20% of tail haired ventrally; naked ventral surface of tail base covered with hard raised tubercles; pouch has lateral skin folds joined posteriorly and opens anteriorly ..... *C. lanatus*
   Total length 410–690 mm; pelage extending onto tail to ca. same length dorsally and ventrally, at maximum to 33% of total length of tail; naked ventral surface of tail base covered with smooth flat scales; pouch has separate and deep lateral skin folds and opens along midline ..... *C. philander*

Caluromys lanatus (Olfers, 1818)
Western Woolly Opossum

[*Didelphys*] *lanata* Illiger, 1815:107. Nomen nudum.
D[*idelphys*]. *lanata* Olfers, 1818:206. Type locality "Paraguay;" restricted to Caazapá, Paraguay, by Cabrera (1916:516); based on Azara's (1801) "*Micouré laineux*."
Didelphis lanigera Desmarest, 1820:258. Type localities "dans le Caapeza, á cinquante lieues de la cité de l'Assomption, Paraguay" and "dans les champs du village de Sainte-Marie de la Foi, Paraguay;" restricted to "Caazapá, Paraguay" by Cabrera (1916:516); based on Azara's (1801) "*Micouré second*" or *micouré laineux*."
Didelphys lanigera: Waterhouse, 1841:98. Name combination.
Micoureus lanigera: Lesson, 1842:186. Name combination.
Didelphys ochropus Wagner, 1842:359. Type locality "Barra;" (Cabrera 1958:3) Barra do Rio Negro, Amazonas, Brazil.
D[*idelphys*]. *ornata* Tschudi, 1845:146. Type locality "der mittleren und tiefen Waldregion," Peru.
Didelphys [*Philander*] *lanigera*: Thomas, 1888:339. Part; name combination.
Philander cicur Bangs, 1898:161. Type locality "Pueblo Viejo, Colombia, altitude 8000 ft."
P[*hilander*]. *ornatus*: Bangs, 1898:162. Name combination.
[*Didelphys* (*Philander*)] *cicur*: Trouessart, 1898:1238. Name combination.
[*Didelphys* (*Philander*) *laniger*] *ochropus*: Trouessart, 1898:1238. Name combination; in synonymy of *Didelphys* (*Philander*) *laniger derbiana*.
[*Didelphys* (*Philander*) *laniger*] *ornata*: Trouessart, 1898:1238. Name combination.
Caluromys cicur: Allen, 1900:189. Name combination.
Caluromys laniger: Allen, 1900:189. Name combination for *Didelphis lanigera* Desmarest, 1820.
Caluromys derbianus ornatus: Allen, 1900:189. Name combination.
[*Caluromys*] *ochropus*: Thomas, 1901:196. Name combination.
C[*aluromys*]. *l*[*aniger*]. *cicur*: Thomas, 1901:196. Name combination.
[*Caluromys*] *ornatus*: Thomas, 1901:196. Name combination.
[*Didelphys* (*Philander*) *laniger*] *ornatus*: Trouessart, 1905:855. Name combination and incorrect gender concordance.
P[*hilander*]. *l*[*aniger*]. *cicur*: Thomas, 1913:358. Name combination.
P[*hilander*]. *l*[*aniger*]. *ornatus*: Thomas, 1913:358. Name combination.
Philander laniger jivaro Thomas, 1913:360. Type locality "Sarayacu on the Pastasa River," Pastaza, Ecuador.
Philander laniger: Cabrera, 1916:514. Name combination.
Micoureus ochropus: Matschie, 1916:269. Name combination.
Micoureus ornatus: Matschie, 1916:269. Name combination.
Micoureus juninensis Matschie, 1917:283. Type locality "Chan-

FIG. 1. An adult *Caluromys lanatus* from Salto Caxias Dam, Paraná State, Brazil.

chamayo in der Nähe von La Merced, Provinz Junin, Peru, in her Höhe von 1000 m."

Micoureus meridensis Matschie, 1917:285. Type locality "von Briceno in der Montana de la Sierra bei Merida in Venezuela in der Höhe von 2500 m."

Micoureus cahyensis Matschie, 1917:288. Type locality "Am Rio Cahy in Rio Grande do Sul," Brazil.

Micoureus bartletti Matschie, 1917:288. Type locality "Chamicaros-Fluß, südlicher Nebenfluß des Marañon zwischen Huallaga and Ucayali," Loreto, Peru.

Micoureus nattereri Matschie, 1917:291. Type locality "von Caissara, Matto Grosso," Brazil.

[*Philander laniger*] *ochropus*: Cabrera, 1919:33. Name combination.

Mallodelphis lanigera ochropus: Miranda-Ribeiro, 1936:355. Name combination.

Mallodelphis lanigera hemiura Miranda-Ribeiro, 1936:355. Type locality unknown.

Mallodelphis lanigera vitalina Miranda-Ribeiro, 1936:355. Type locality "Barra do Paraopéba, Minas Geraes," Brazil.

Mallodelphis lanigera nattereri: Miranda-Ribeiro, 1936:356. Name combination.

Mallodelphis lanigera modesta Miranda-Ribeiro, 1936:356. Type locality "Mato Grosso, provavelmente Pantanal," Brazil.

Caluromys laniger ochropus: Tate, 1939:163. Name combination.

[*Caluromys laniger*] *meridensis*: Tate, 1939:163. Name combination.

[*Caluromys laniger*] *jivaro*: Tate, 1939:163. Name combination.

Caluromys laniger ornatus: Sanborn, 1949:277. Name combination.

P[*hilander*]. *lanata*: Hershkovitz, 1951:552. Name combination.

Philander calmensis Vieira, 1955:347. Incorrect subsequent spelling of *Micoureus cahyensis* Matschie, 1917.

Caluromys lanatus cicur: Cabrera, 1958:2. Name combination.

Caluromys lanatus lanatus: Cabrera, 1958:2. Name combination.

Caluromys lanatus ochropus: Cabrera, 1958:3. Name combination.

Caluromys lanatus ornatus: Cabrera, 1958:3. Name combination.

CONTEXT AND CONTENT. Content as above. *Caluromys lanatus* has 4 subspecies (Cabrera 1958):

C. l. cicur (Bangs, 1898:161); see above; *meridensis* (Matschie) is a synonym.

C. l. lanatus (Olfers, 1818:206); see above; *cahyensis* (Matschie), *hemiura* (Miranda-Ribeiro), *lanigera* (Desmarest), *modesta* (Miranda-Ribeiro), and *nattereri* (Miranda-Ribeiro) are synonyms.

C. l. ochropus (Wagner, 1842:359); see above; *vitalina* (Miranda-Ribeiro) is a synonym.

C. l. ornatus (Tschudi, 1845:146); see above; *bartletti* (Matschie), *jivaro* (Thomas), and *juninensis* (Matschie) are synonyms.

DIAGNOSIS. Fur of *C. lanatus* is long, dense, and woolly; with a reddish brown dorsum that is brightest red over shoulders, forearms, and hind legs; with an underside orange to yellowish; and with reddish brown feet. In contrast, *C. derbianus* has a pale gray patch between shoulders, creamy white forelimbs and feet, and buffy white to golden tawny venter. *C. philander* has uniform red-brown to grayish upperparts and forelimbs, and *C. philander* also differs from *C. lanatus* in having a tail furred to the 1st one-third of its length dorsally and ventrally, whereas *C. lanatus* has up to 50% of its tail length furred dorsally and 20% of it furred ventrally.

GENERAL CHARACTERS. *Caluromys lanatus* is a medium-sized opossum with long, dense, and soft guard hairs and a tail ca. 140% of length of head and body (Fig. 1). Dorsal color is reddish brown to pale brown mixed with gray and grades to orange on shoulders, forelimbs, hind limbs, and top of head; rarely, individuals have a gray patch between shoulders. Head is grayish, and face has a prominent median dark stripe from between ears to nose, brown to orange eye rings, naked ears that are pinkish tan, and whitish cheeks. Ventral surface of body is yellowish white laterally and grayish at midline. Feet are reddish brown to dark gray. All digits have well developed pads and claws, except for thumb of hind feet. Tail is furred dorsally for one-half of its length and ventrally for one-fifth of its length. Terminal portion of tail is naked (usually whitish yellow mottled with brown spots) and fully prehensile. Pouch of females is developed only when carrying young; young are more grayish than adults (Eisenberg and Redford 1999; Emmons and Feer 1997; Patton et al. 2000; Vieira 1949). External measurements (range, in mm or g) of 26 adults of both sexes: length of head and body, 201–319; length of tail, 330–446; length of hind foot, 30–51; length of ear, 30–41; and body mass, 310–520 (Emmons and Feer 1997; Patton et al. 2000; Redford and Eisenberg 1992).

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of an adult male *Caluromys lanatus* (MZUSP [Museu de Zoologia da Universidade de São Paulo mammal collection] 4532) from Igarapé Grande, Rio Juruá, Amazonas, Brazil, collected by A. M. Ollala (field number 1981) on 15 January 1937. Greatest length of skull is 61.64 mm.

Caluromys l. cicur from Magdalena Valley, Colombia, is grayish brown dorsally, with gray sides, and sometimes completely gray ventrally, whereas *C. l. lanatus* from Paraguay is pale brown, with tail lacking brown spots (Emmons and Feer 1997). *C. l. ochropus* from Amazonia has a markedly red-brown dorsal color (Patton et al. 2000), and is larger than *C. l. lanatus* from central and southern ranges (Costa and Patton 2005; Patton et al. 2000; Vieira 1949).

Skull (Fig. 2) has a short and robust rostrum, small paraoccipital process that never surpasses occipital condyle, reduced lambdoidal and sagittal crests, well developed postorbital process-

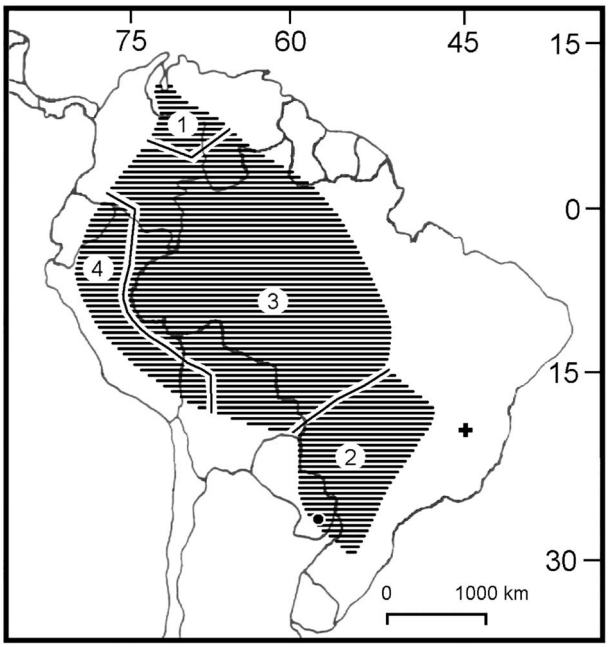

FIG. 3. Geographic distribution of *Caluromys lanatus* in South America, 1, *C. l. cicur*; 2, *C. l. lanatus*; 3, *C. l. ochropus*; 4, *C. l. ornatus*. Square is type locality in Caazapá, Paraguay. Cross is Lagoa Santa, Brazil, with Pleistocene–Holocene remains of *C. lanatus* (Cartelle 1999; Winge 1893). Map redrawn with modifications from Costa (2003), Eisenberg (1989), Eisenberg and Redford (1999), Emmons and Feer (1997), and Lambert et al. (2005).

es, small palatine foramina, dorsal projection of superior portion of zygomatic that reduces size of orbit, no foramen ethmoidale, and a small foramen rotundum (Pérez-Hernández 1985). *C. lanatus* also has a rostral process of the premaxillae, but lacks a palatal process, resulting in insertion of upper canine in maxillary bone. Nasal bones are wider posteriorly than anteriorly with tips extending anteriorly above or beyond I1, thereby obscuring nasal orifice in dorsal view. *C. lanatus* lacks maxillopalatine, palatine, and maxillary fenestrae, and a transverse canal foramen. Mandible has 2 mental foramina and an angular process that is obtuse and weakly inflected (Voss and Jansa 2003).

Means and parenthetical ranges of cranial measurements (in mm) of 8 adults of both sexes are: length of condyloincisive, 59.5 (56.5–62.8); breadth of zygomatic, 34.8 (32.7–37.1); width of braincase, 20.6 (19.4–22.3); breadth of interorbital constriction (taken posterior to postorbital processes), 8.4 (7.6–9.2); length of rostrum, 22.8 (21.7–24.0); length of nasal bones, 25.8 (22.2–27.1); width of rostrum, 13.0 (12.3–13.8); length of palate, 31.9 (30.5–33.4); width of palate, 17.7 (17.1–18.2); breadth of mastoid, 23.3 (21.4–25.6); length of basioccipital, 8.7 (8.2–9.2); depth of cranium, 18.9 (16.6–21.1); length of molar row, 9.8 (9.2–10.1); and length from C to M4, 20.6 (18.2–22.2—Patton et al. 2000).

DISTRIBUTION. *Caluromys lanatus* ranges from east of the Andes in central Colombia, western and southern Venezuela, eastern Ecuador, Peru, and Bolivia to western, central, and southern Brazil, northeastern Argentina (Missiones), and eastern and southern Paraguay (Fig. 3; Costa 2003; Costa and Patton 2005; Eisenberg 1989; Eisenberg and Redford 1999; Emmons and Feer 1997; Gardner 2005; Patton et al. 2000). Elevational range is 0–2,600 m (Alberico et al. 2000). Distributions of 4 subspecies are: *C. l. cicur*, eastern Colombia and western Venezuela; *C. l. lanatus*, Paraguay and Brazil, from Mato Grosso to São Paulo states; *C. l. ochropus*, Orinoco and Amazon basins to eastern Brazil; and *C. l. ornatus*, Peru and Ecuador, east of the Andes (Cabrera 1958; Pérez-Hernández 1989).

FOSSIL RECORD. Remains of *C. lanatus* occur in Pleistocene–Holocene cave deposits of Lagoa Santa, Minas Gerais, Brazil (Cartelle 1999; Winge 1893).

FORM AND FUNCTION. Female *C. lanatus* have abdominal and inguinal mammae confined to the pouch region (Voss and Jansa 2003). Dental formula is i 5/4, c 1/1, p 3/3, m 4/4, total 50. Crowns of I2–I5 are asymmetrical with longer anterior than posterior cutting edges. Upper canine is simple and without accessory cusps. P1 is very small, without prominent occlusal features, and situated directly behind upper canine. A gap occurs between P1 and the much larger P2. P2 is taller than P3, which has well-developed anterior and posterior cutting edges. M1 is wider than M4. Molar dentition is weakly carnassialized and weakly dilambdodont. Upper molars lack ectoflexus. A continuous shelf occurs along anterior margin of crowns of M1–M3. Mandibular teeth have distinct lingual cusps in i1–i4, a p2 taller than p3, a deciduous p3 with a complete tricuspid trigonid, a labially salient hypoconid in m3, and a large and well-developed entoconid in m1–m3 (Redford and Eisenberg 1992; Voss and Jansa 2003). Occlusal area of molars is reduced (Cáceres 2000).

Caluromys lanatus has a relatively large braincase and long tail, which are associated with its high degree of arboreal activity (Cáceres 2000; Eisenberg and Wilson 1981). The protein transthyretin occurs in plasma (Richardson et al. 1996). *C. lanatus* has a large hind gut and caecum, a small stomach, and a short small intestine (Cáceres 2005). The large hind gut and caecum are associated with a diet mainly of plant material (Chivers and Hladik 1980; Crowe and Hume 1997; Schieck and Millar 1985), and the small stomach chamber is associated with a frugivorous diet (Hildebrand 1995). Digestive tract anatomy is specialized for consumption of fruits, gums, and twigs.

Penis of *C. lanatus* is postscrotal, forming an evident sigmoid flexure, and partially located in preputial sac when in nonerected state. Two muscles, ischiocavernous and bulbospongiosus, situated outside pelvic cavity, comprise bulk of penis musculature. These muscles join in radix penis, where paired levator muscles are encased and insert by a single tendon. Paired penis retractor muscles arise in sublumbar region and insert on both sides of dorsal curvature of sigmoid flexure. Glans is same length as penis, bifid, deeply cleft, and with elliptical tips lacking a diverticulum. Urethra ends in body–glans transition, with 2 urethral grooves extending for different lengths along medial surfaces of each glans tip. When erected, penis projects through cloaca, with preputial opening ventral to anus (Nogueira et al. 1999). Urogenital and rectal openings are closely juxtaposed and share a common mucosa (Voss and Jansa 2003).

A median cylindrical structure is located between uterine cervices and the origin of lateral vaginal canals. An incomplete, thin, and perforated vaginal septum forms a short common vagina with lining markedly folded. A rudimentary pseudovaginal canal has lateral vaginal canals that form closed loops (Reig et al. 1987).

ONTOGENY AND REPRODUCTION. In Brazil, 2 females with pouch young were trapped at Rio Juruá, Amazon Basin, during June and November. Postlactating females were trapped in February, March, and October in the same region (Patton et al. 2000). In Brazil, modal estrous cycle length was 27–29 days, and females cycle throughout the year (Bucher and Fritz 1977). Litter size is 1 or 2 young in the Amazon Basin (Patton et al. 2000) and 3 or 4 in southern range of distribution (Monteiro-Filho and Cáceres 2005). Females develop a pouch only when carrying young (Emmons and Feer 1997). Body mass of young averaged 3.5 g in October 1998 at a seasonal forest in southern Brazil, and sex ratio was male-biased (1.00:0.22; $n = 3$ litters—N. C. Cáceres, in litt.).

ECOLOGY AND BEHAVIOR. *Caluromys lanatus* occurs in small, secondary forest fragments in Amazonian rain forest (Malcolm 1995) and in disturbed, fragmented forests in southern Brazil (Quadros et al. 2000). *C. lanatus* was trapped mostly in canopy and subcanopy, from 5 to 15 m high (Eisenberg and Redford 1999; Malcolm 1991b; Patton et al. 2000). *C. lanatus* occurs in dense multistratal rain forest (terra firme and várzea); in gallery, mangrove, semideciduous, transitional, and xerophitic forests; and in dense savanna (Carmignotto 2004; Gargaglioni et al. 1998; Gribel 1988; Moreno-Bejarano and Álvarez-León 2003; Patton et al. 2000; Talamoni and Dias 1999). In its southern range, *C. lanatus* occurs in more seasonal forests when compared to its northern range.

Continuous distribution of *C. lanatus* from southern Brazil to the Amazonian rain forest occurs along the southern Cerrado and Pantanal biomes (Carmignotto 2004). Phylogeography of Atlantic

and Amazon rain-forest populations shows a closer relationship between the seasonal Atlantic forest and the southwestern Amazon populations (Costa 2003). *C. lanatus* is parapatric with *C. philander* and *C. derbianus*, and is replaced by *C. philander* in eastern Brazil (Eisenberg and Redford 1999; Emmons and Feer 1997). Sympatry with *C. philander* occurs in northern and central Brazil (central Amazonia, north of Mato Grosso, Goiás and Minas Gerais states), Guyana, and eastern Bolivia (Carmignotto 2004; Eisenberg 1989; Malcolm 1991a; Patton and Costa 2003; Patton et al. 2000). No contact occurs with *C. derbianus* in northwestern South America (Eisenberg 1989; Eisenberg and Redford 1999).

In central Brazil, Peru, and Ecuador, *C. lanatus* is a nectar consumer and probable pollinator of *Pseudobombax tomentosum* and *Quararibea cordata* (Gribel 1988; Janson et al. 1981). The caecum of 1 individual contained hundreds of small seeds of *Ficus luschnatiana* in southern Brazil (Cáceres 2000, 2005). *C. lanatus* consumed fruits of *Cecropia pachystachya*, *Piper*, and Solanaceae in southern Brazil (Casella and Cáceres 2006). *C. lanatus* ingests vertebrates and invertebrates (Fonseca et al. 1996; Peres 1999). Captive *C. lanatus* subsisted on a meat–egg–fruit diet and preferred bananas (Bucher and Fritz 1977).

Population density was 13.3 individuals/km^2 and biomass was 4.6 kg/km^2 in central Amazonas State, Brazil (Peres 1999). Abundance varies seasonally (Fleck and Harder 1995), but *C. lanatus* was never trapped in high numbers (Nowak 1999). *C. lanatus* is solitary, but can be seen foraging in pairs, usually at night (Hunsaker 1977). No vocalizations are usual in the field (Emmons and Feer 1997). *Trypanosoma cruzi* occurred in *C. lanatus* from Colombia and Brazil (Montilla et al. 2002; Ribeiro and Barretto 1977) and nymphs of *Amblyomma* were found on a specimen from Peru (Walter 1990).

Captive western woolly opossums are nocturnal. Behavior is associated with individual temperament and cage size, with animals being more excited in small cages. Sexual behavior included premount and pelvic-thrust displays by males, with complete repulsion by females; no breeding occurred during 3 years in captivity (Bucher and Fritz 1977).

GENETICS. *Caluromys lanatus* has a diploid number of 14 with a fundamental number of 24. Karyotype consists of 4 pairs of large biarmed autosomes, 2 pairs of medium-sized subtelocentric autosomes, a small and biarmed X chromosome, and a very small and distinctly biarmed Y chromosome (Palma and Yates 1996; Patton et al. 2000; Reig et al. 1977; Yunis et al. 1972). A fundamental number of 20 was found in 3 individuals from northern Brazil, with the 2 pairs of medium-sized autosomes being acrocentrics, and a punctiform Y chromosome (Souza et al. 1990). An examination of location of the nucleolar organizer regions found that karyotype of *C. lanatus* had only 1 bearing pair, representing the most primitive form of nucleolar organizer region distribution.

Analysis of different cytochrome-*b* sequence haplotypes showed uniformity among Amazonian populations, with specimens differing by only 1.5% (Patton et al. 1996, 2000). When populations from southern Brazil were included, divergence between samples was 2.3% (Patton and Costa 2003).

CONSERVATION STATUS. Habitat destruction has led to a decline in natural populations. *C. lanatus* is classified as near threatened (International Union for the Conservation of Nature and Natural Resources 2004).

REMARKS. Phylogenetic analyses of didelphid marsupials using molecular and nonmolecular data indicate *C. derbianus*, *C. lanatus*, and *C. philander* are distinct species, but closely related (Cardillo et al. 2004; Costa and Patton 2005; Jansa and Voss 2000; Patton and Costa 2003; Voss and Jansa 2003).

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