AMERICAN MUSEUM
Novitates

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, N.Y. 10024
Number 3202, 15 pp., 5 figures, 1 table August 29, 1997

A New Species of *Cryptotis* (Insectivora: Soricidae) from Northern Peru

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ABSTRACT

The South American small-eared shrews of the genus *Cryptotis* constitute a poorly known group in need of much systematic revision. These shrews occur in the Andes of Venezuela, Colombia, Ecuador, and northern Peru. They are informally recognized as the *thomasi* complex group (sensu Choate, 1970), which includes five species: *C. avia*, *C. meridensis*, *C. montivagus*, *C. squamipes*, and *C. thomasi* (sensu Hutterer, 1993). This paper reports a new species of the genus *Cryptotis* from Peru and provides an introduction to the systematic status of related taxa. Also, we recognize *C. equatoris* (including *osgoodi*) and *C. medellinius* as valid species distinct from *C. thomasi*.

RESUMEN

Las musarañas sudamericanas del género *Cryptotis* conforman un grupo taxonómico pobremente conocido en necesidad de una exhaustiva revisión sistemática. Estas musarañas ocurren en los Andes de Venezuela, Colombia, Ecuador y norte del Perú, y son informalmente reconocidas como miembros del grupo complejo *thomasi* (sensu Choate, 1970). Este grupo incluye las siguientes especies: *C. avia*, *C. meridensis*, *C. montivagus*, *C. squamipes* y *C. thomasi* (sensu Hutterer, 1993). Este artículo reporta una nueva especie del género *Cryptotis* del Perú y provee una introducción a la revisión sistemática de taxa relacionados. Basado en nuestros resultados, reconocemos también a *C. equatoris* (que incluye *osgoodi*) y *C. medellinius* como especies válidas y distintas de *C. thomasi*.

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 ISSN 0003-0082 / Price $2.10

INTRODUCTION

The small-eared shrews of the genus *Cryptotis* are among the poorest known taxa in the family Soricidae. They are widely distributed in the Americas, ranging from parts of North America, Middle America to northwestern South America. *Cryptotis* is the only insectivore with a distribution reaching South America. These shrews occur in cloud forests and paramo habitats in the Andes of Venezuela, Colombia, Ecuador, and northern Peru, frequently above 1200 m elevation (Nowak, 1991; Hutterer, 1993). The taxonomy and phylogenetic relationships within the genus are obscure, and although some progress has been made, their systematics is still far from resolved. Choate (1970), in a partial revision of the genus, recognized four lineage groups: the *Cryptotis mexicanus* group including the species *C. mexicanus*, *C. goldmani*, and *C. goodwini*; the *Cryptotis parvus* group including *C. parvus* and *C. nigrescens*; the *Cryptotis thomasi* group including all the South American taxa known at that time; and a relict species group that included Middle American taxa of uncertain allocation. A more formal characterization of Choate's *thomasi* species group has been elusive, impeded largely by the lack of alpha-systematic studies.

A more comprehensive systematic review has been presented for Middle American forms. Woodman and Timm (1992) described a new species, *Cryptotis hondurensis*, from Honduras. They later recognized the *Cryptotis nigrescens* complex group to include all taxa previously known as *nigrescens*, resurrecting the species *mayensis*, *merriami*, and *merus*. They also stated that *Cryptotis hondurensis* might be embedded in the *C. nigrescens* group (Woodman and Timm, 1993).

Our knowledge of the systematics of South American shrews is incipient. Hutterer's (1993) tentative arrangement provided for *Cryptotis* recognized the following South American species: *C. avia* G. M. Allen, 1923; *C. meridensis* Thomas, 1898; *C. montivagus* (Anthony, 1921); *C. squamipes* (J. A. Allen, 1912); and *C. thomasi* (Merriam 1897). In addition, Woodman and Timm (1993) described *C. colombianus* from the Central Cordillera of Colombia, relating it to the *C. nigrescens* species complex, which would indicate that South American shrew species do not make a monophyletic group (our interpretation). And recently, Woodman (1996) considered *avia* a junior synonym of *thomasi*.

Cabrera (1958) and Hutterer (1993) both considered *Cryptotis medellinius* Thomas, 1921, *C. equatoris* (Thomas, 1912), and *C. osgoodi* (Stone, 1914) synonyms of *Cryptotis thomasi*. It appears that only Anthony (1921) and Tate (1932) suggested that *equatoris* and *osgoodi* might be conspecific, and distinct from *thomasi*. Moreover, Tate (1932) considered *medellinius* a distinct species, different from *thomasi*; but no morphological comparisons to support his arrangement were provided.

Until recently, the genus *Cryptotis* was unknown from Peru (Honacki et al., 1982; Corbet and Hill, 1991). However, its occurrence in northern Peru was reported in a general geographic overview of the country (Brack-Egg, 1986), a record that is undoubtedly based on the single specimen collected by Linda Barkley in Piura, Peru. To the best of our knowledge, this specimen was never studied and reported, except by Hutterer (1993) who included it as *Cryptotis thomasi* for northern Peru. In 1992, the Centro de Datos para la Conservacion de la Universidad Agraria La Molina conducted an inventory of the paramo and montane forest of San Ignacio and Jaén, Cajamarca, northern Peru. This inventory produced an interesting set of small mammals including a small-eared shrew found dead along a peasant trail. This shrew resembles Barkley's specimen; both exhibit peculiar characters that differentiate them from other known taxa. We describe these two specimens as evidence of a new species and discuss the status and content of related taxa. We also hope this paper encourages a thorough revision of the South American small-eared shrews.

ACKNOWLEDGMENTS

We acknowledge the following curators for allowing use of specimens for comparisons and illustrations: M. Haffner (LSUMZ),

M. Moreno (MECN), and B. D. Patterson (FMNH). We thank R. Hutterer who kindly guided Vivar during the first steps of this work. Robin Foster's hospitality to Vivar in Chicago is also greatly appreciated. The work of Pacheco in New York was partially financed by the Office of Grants and Fellowships of the AMNH. We acknowledge the Centro de Datos para la Conservación de la Universidad Nacional Agraria La Molina (CDC) for supporting the expedition that resulted in the collection of the holotype. B. D. Patterson and R. Hutterer kindly provided comments on the manuscript. We also thank Ms. Paula Jenkins of the British Museum of Natural History for information on the holotype of *C. thomasi*. Finally, we express our gratitude to Maritza Ocrospoma for skillfully drawing the cranial figures.

Materials and Methods

Skin measurements were taken from labels. The head and body length (HBL) was estimated by subtracting the tail length (TL) from the total length. All cranial and mandibular variables were measured to the nearest 0.1 mm using dial calipers. Most of the variables used here follow and are illustrated in Woodman and Timm (1993) and Woodman (1995). The nomenclature for dental topography follows Choate (1970). The following craniomandibular measurements were used: condylobasal length, not including the upper incisors (CBL); cranial breadth (CB); breadth of zygomatic plate (ZP); interorbital breadth (IO); breadth of palate across first unicuspid (U1B); breadth of palate across third unicuspid (U3B); breadth of palate across second molars (M2B); palatal length (PL); upper tooth row length, U1 to M3, parallel to the long axis of the skull (TRL); unicuspid tooth row length (UNL); posterior width of M1 across hypocone and metastyle (WM1); mandibular length from inferior sigmoid notch to posterior edge of mental foramen (ML); height of coronoid process (HCP); height of coronoid valley (HCV); lower tooth row length, p3 to m3 (LTL); height of articular condyle (HAC); and width of articular condyle (WAC). The last two variables follow Woodman (1995).

Specimens are housed at the Field Museum of Natural History, Chicago (FMNH); the American Museum of Natural History, New York (AMNH); Louisiana State University Museum of Zoology, Baton Rouge (LSUMZ); Museo Ecuatoriano de Ciencias Naturales, Quito (MECN); and Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima (MUSM).

Cryptotis thomasi (Merriam, 1897)

Figure 1

Blarina thomasi Merriam, 1897: 227.

Holotype: Female. BM(NH) 97.5.21.2. "Plains of Bogota, Colombia (on G. D. Child's Estate, near city of Bogota, alt. about 9000 ft)." The original description states that it was collected on 14 November 1895, but apparently it was collected on 14 September 1895 (P. Jenkins, personal comun.).

Distribution: Paramos of Bogota, Colombia.

Description: A large-size *Cryptotis*, HBL averaging 86 (table 1); tail very short, averaging 30% of HBL; dorsal and lateral pelage light brown; ventral pelage slightly paler.

Rostrum long and narrow; nasal opening narrow; interorbital area narrow; braincase not notably inflated; two small dorsal foramina positioned anteriorly to the dorsal articular facet; anterior process of the petromastoid high and moderately wide; large foramen on posterior edge of tympanic process of petromastoid; paroccipital process low; zygomatic plate narrow; anterior border of zygomatic plate above or slightly in front of metastyle of M1, and posterior border above or slightly behind M2 and M3 border; palate narrow; U4 medium size, reduced to about half the size of U3; U4 in line with other unicuspids, preventing contact between U3 and P4; U4 partially obscured by P4 but still visible from lateral view; posterior borders of P4, M1, and M2 slightly recessed; M3 complex: protocone, paracone, parastyle, and mesostyle conspicuous; metacone reduced and hypocone absent or part of posterior cingulum; upper dentition semibulbous.

Mandible long and narrow; coronoid process low and narrow, joining mandible at oblique angle; coronoid process flared to labial side of mandible; articular process distinctive, high and broad with a lingual notch

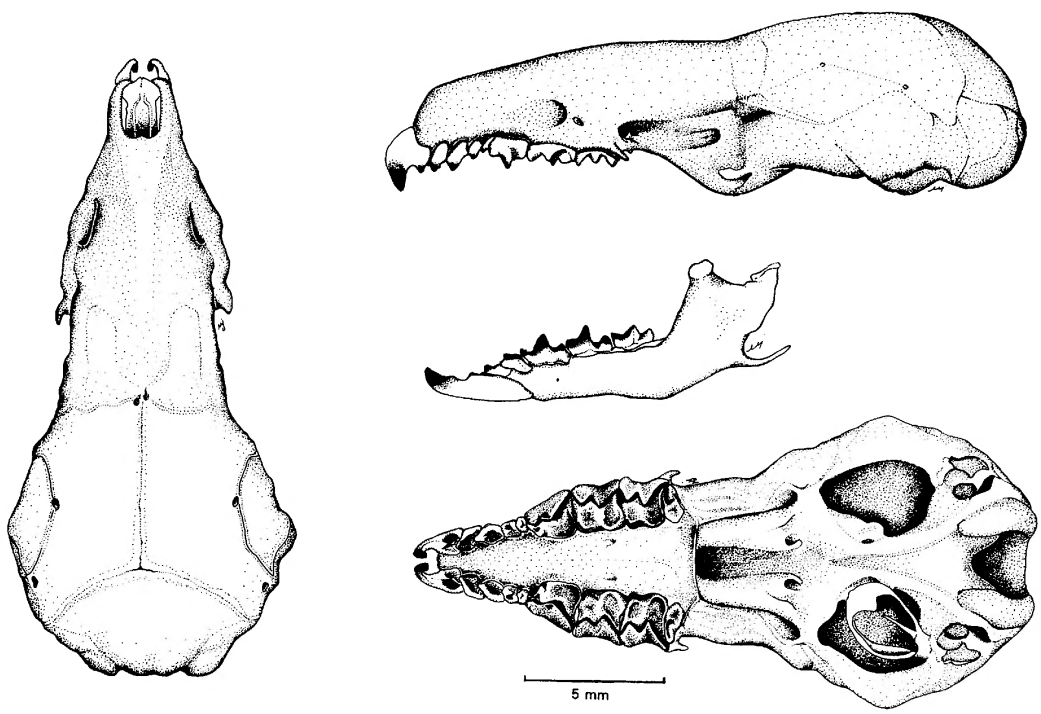

Fig. 1. Dorsal, ventral, and lateral views of skull, and lateral view of lower jaw, *Cryptotis thomasi* (FMNH 71037).

between the two articular facets; lower sigmoid notch slightly deep, below ventral articular facet; angular process long and slender; posterior border of lower incisor slightly anterior to posterior cingulum of pm4; hypoconid and entoconid in talonid of m3. Entoconid is sometimes obscured because of wear.

Cryptotis medellinius Thomas, 1921

Figure 2

Cryptotis medellinius Thomas, 1921: 354.

HOLOTYPE: "Adult male. B. M. 21.7.1.9. Original number 10. Collected December 1919 by Frère Nicéforo Maria," from San Pedro, 30 km north of Medellín, Colombia.

DISTRIBUTION: Medellín region, Colombia.

DESCRIPTION: A large-size *Cryptotis*, HBL averaging 84 (table 1); tail medium-size, averaging 47% of HBL; dorsal and lateral pelage light brown; ventral pelage slightly paler.

Rostrum long and relatively broad; nasal opening moderately broad; interorbital area broad; braincase inflated; two small dorsal foramina positioned anterior to dorsal articular facet; anterior process of petromastoid moderately high and wide; foramen on posterior edge of tympanic process of petromastoid; paroccipital process low; zygomatic plate narrow; anterior border of zygomatic plate at metacrista of M1 and posterior border above metacrista or metastyle of M2; palate broad; unicuspid U4 usually small and slightly lingually placed preventing contact between U3 and P4; U4 barely visible from lateral view; posterior borders of P4, M1, and M2 slightly recessed; M3 complex: protocone, paracone, parastyle, and mesostyle conspicuous; metacone reduced and hypocone absent or part of posterior cingulum; dentition bulbous.

Mandible long and narrow; coronoid process moderately high and narrow joining mandible at oblique angle; articular process high and broad; lingual notch present between two articular facets of articular process; lower sigmoid notch slightly deep; angular process long and slender; posterior border of lower incisor notably anterior to posterior cingulum of pm4; hypoconid in talonid of m3 reduced.

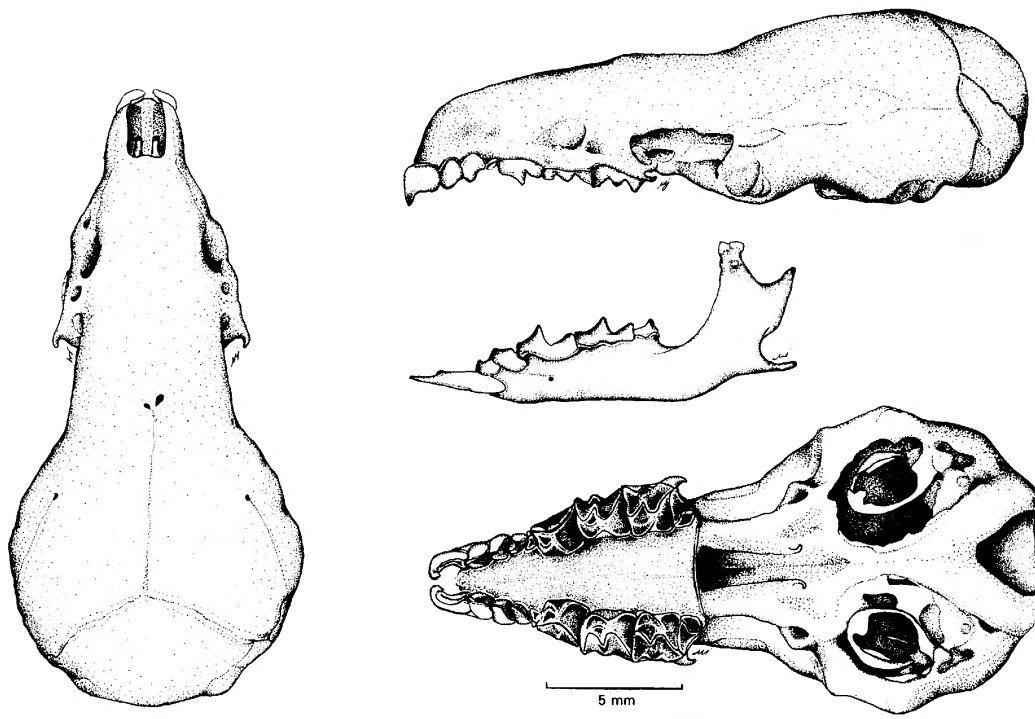

Fig. 2. Dorsal, ventral, and lateral views of skull, and lateral view of lower jaw, *Cryptotis medellinius* (AMNH 149151).

COMPARISONS: Compared to *Cryptotis thomasi*, *C. medellinius* is about the same size but has a longer tail (47% of HBL vs. 30%); rostrum slightly broader; braincase more inflated; palate broader; upper dentition more bulbous; coronoid process higher and entoconid in talonid of m3 is absent.

REMARKS: The proper gender of mammalian generic names ending in *-otis*, the case of *Cryptotis*, has been subject of recent debate. Woodman (1993) has recently argued that all generic names ending in *-otis* are feminine, therefore recommending that species names of all mammalian genera ending in *-otis* must be properly corrected to agree in gender with the generic names (Art. 31b—Ride et al., 1985). Thus among other species, two South American shrews were corrected: *medellinia*, and *montivaga* (Woodman, 1993). The specific name *avia* is a noun in apposition and therefore retains its original spelling (Woodman, 1993). However, Pritchard (1994) contested that the ending *-otis* is a Latin derivation of the Greek term *otos* and that Latin nouns ending in *-is* are of the 3rd declension, and may be masculine, feminine, or neuter, depending on priority of usage. As Woodman (1993) and Pritchard (1994) pointed out, the first specific name combination requiring gender agreement with *Cryptotis* appears to be *C. merus* by Goldman (1912; assuming masculine gender). Steppan (1995) retained the historical usage of masculine specific names for the muroid *Phyllotis*, but suggested that this issue needs further investigation on the etymology of the Greek terms. Following Pritchard (1994) we maintain the usage of *medellinius*, and *montivagus*, and spell out *colombianus* (for *colombiana*). As Pritchard (1994) pointed out, no other mammalian generic names listed by Woodman (1993) that end in *-otis* have been combined with specific feminine epithets.

Cryptotis equatoris (Thomas, 1912)
Figure 3

Blarina equatoris Thomas, 1912: 409.

HOLOTYPE: "Old male. B.M. 99.9.9.3. Original number 136. Collected 17th December 1898 by Perry O. Simons." Type from

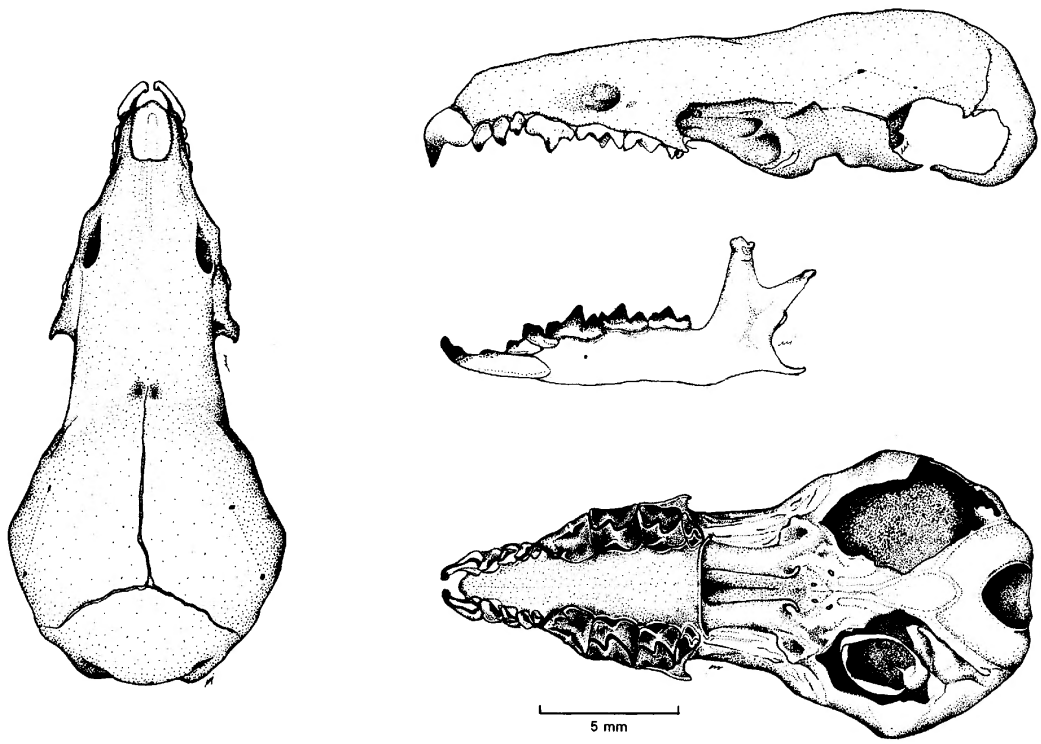

Fig. 3. Dorsal, ventral, and lateral views of skull, and lateral view of lower jaw, *Cryptotis equatoris* (AMNH 66845).

Sinche, Guabanda [Guaranda], 4000 m, Ecuador.

DISTRIBUTION: Central Andes of Ecuador.

DESCRIPTION: A medium-size *Cryptotis*, HBL averaging 79 (table 1); tail medium, averaging 45% of HBL; dorsal and lateral pelage dark brown; ventral pelage slightly paler.

Rostrum narrow and moderately long; nasal openings narrow; interorbital area narrow; braincase moderately inflated; two medium size to small dorsal foramina anterior to dorsal articular facet; anterior process of petromastoid low and narrow; posterior edge of tympanic process lacks a foramen; paroccipital process low; zygomatic plate narrow; anterior border of zygomatic plate at metacrista slightly anterior to metastyle of M1 and posterior border behind the M2 and M3 border; palate narrow and moderately short; U4 usually small, reduced to less than half the size of U3; U4 in line with other unicuspids which, although small, still prevent contact between U3 and P4; U4 obscured by P4 but still visible from lateral view; posterior borders of P4, M1, and M2 slightly recessed; M3 complex and well developed: protocone, paracone, parastyle, and mesostyle conspicuous; metacone reduced but fairly visible and hypocone absent or part of posterior cingulum; dentition semibulbous.

Mandible long and narrow; coronoid process low and narrow joining mandible at oblique angle; coronoid process flared to labial side; articular condyle distinctive, low, and narrow; lingual notch between two articular facets faint in some specimens; lower sigmoid notch slightly deep; posterior border of lower incisor anterior to posterior cingulum of pm4; only hypoconid in talonid of m3.

COMPARISONS: Compared to *Cryptotis thomasi*, *C. e. equatoris* has a much darker dorsal and ventral pelage; it is smaller (HBL =79 vs. 86) and has a longer tail (45% of HBL vs. 30%); skull length dimensions smaller on average; anterior process of petromastoid lower and narrower; posterior edge of tympanic process of petromastoid lacks a foramen; U4 usually smaller; coronoid valley

lower; articular process lower and narrower; lingual notch between articular facets faint in several specimens; entoconid in talonid of m3 absent.

REMARKS: Thomas (1912) described *Cryptotis equatoris* from Sinche, Guabanda [Guaranda], Ecuador, mentioning that the habitat included "other specimens from Mt. Pichincha, Quito." Later, Stone (1914) described *C. osgoodi* based on specimens collected at Hacienda Garzon on Mt. Pichincha. Anthony (1921) and Tate (1932) studied both taxa, and although no character or meristic comparison was provided, each suggested that both taxa might be conspecific, therefore *osgoodi* ought to be synonymized under *equatoris* based on seniority. Cabrera (1958) synonymized *osgoodi* and *equatoris* under *Cryptotis thomasi*. The same arrangement was followed by Hutterer (1993).

In the course of this work, we have found some differences between Sinche and Pichincha populations in scored characters (table 1). The topotypic *osgoodi* compared to topotypic *equatoris* is, on average, smaller in HBL, CBL, ML; narrower in CB, IO, U1B, U3B, M2B; and lower in HCP, indicating a smaller skull and narrower rostrum; which might suggest a species recognition. However, various degrees of overlap are present. Pending studies of morphological characters that include intermediate populations and direct examination of holotypes, we conclude that *osgoodi* and *equatoris* are conspecific, concurring with Anthony (1921) and Tate (1932). However, based on the meristic differences, we believe it is reasonable to consider *Cryptotis equatoris osgoodi* a subspecies.

Cryptotis montivagus (Anthony, 1921)

Blarina montivaga Anthony, 1921: 5.

HOLOTYPE: Adult female, American Museum of Natural History (AMNH 47200) collected on 15 January 1921 by H. E. Anthony at Bestión, Prov. del Azuay, Ecuador, altitude 10,000 ft. Original number 2534.

DISTRIBUTION: Andes of Ecuador.

DESCRIPTION: A large-size *Cryptotis*, HBL averaging 85 (table 1); tail short, averaging 37% of HBL; dorsal and lateral pelage light grayish brown; ventral pelage slightly paler.

Rostrum narrow and moderately long; nasal openings narrow; interorbital area narrow; braincase slightly inflated; dorsal foramina fused or tightly placed anterior to the dorsal articular facet; anterior process of the petromastoid low and narrow; posterior edge of the tympanic process of the petromastoid lacks a foramen; paroccipital process low; zygomatic plate narrow; anterior border of zygomatic plate vertically oriented and above metacrista of M1; posterior border above the M2/M3 contact; palate narrow; U4 of medium size, reduced to about half the size of U3; U4 in line with other unicuspids, preventing contact between U3 and P4; U4 visible from lateral view; posterior borders of P4, M1, and M2 recessed; M3 complex: protocone, paracone, parastyle, and mesostyle conspicuous; metacone reduced and hypocone absent or part of posterior cingulum; dentition semibulbous.

Mandible long and narrow; coronoid process low and narrow, joining mandible at oblique angle; articular condyle distinctive, high and broad; lower sigmoid notch slightly deep; posterior border of lower incisor anterior to posterior cingulum of pm4; only hypoconid in talonid of m3.

Cryptotis peruviensis, new species

Figure 4

Cr[i]ptotis sp.: Brack-Egg, 1986: 301.
Cryptotis thomasi: Hutterer, 1993: 109 [part].
Cryptotis sp.: Pacheco et al. (1995: 7, 33).

HOLOTYPE: Subadult female, Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos (MUSM 8373), collected by Antonio Tovar, and Michael and Thomas Valqui on 19 February 1992, field number LATN 46. The holotype is a flat skin mounted on cardboard in good condition and a complete skull, mandibles, and partial skeleton.

TYPE LOCALITY: Peru, Department Cajamarca, Las Ashitas, 3150 m, about 42 km W of Jaén (05°42′S, 79°08′W).

PARATYPE: Adult male, LSUMZ 26887. The paratype is a skin, skull, and skeleton in good condition; collected by Linda J. Barkley in "Machete" on Zapalache-Carmen trail at 2050 m, Department Piura on 19 June 1980.

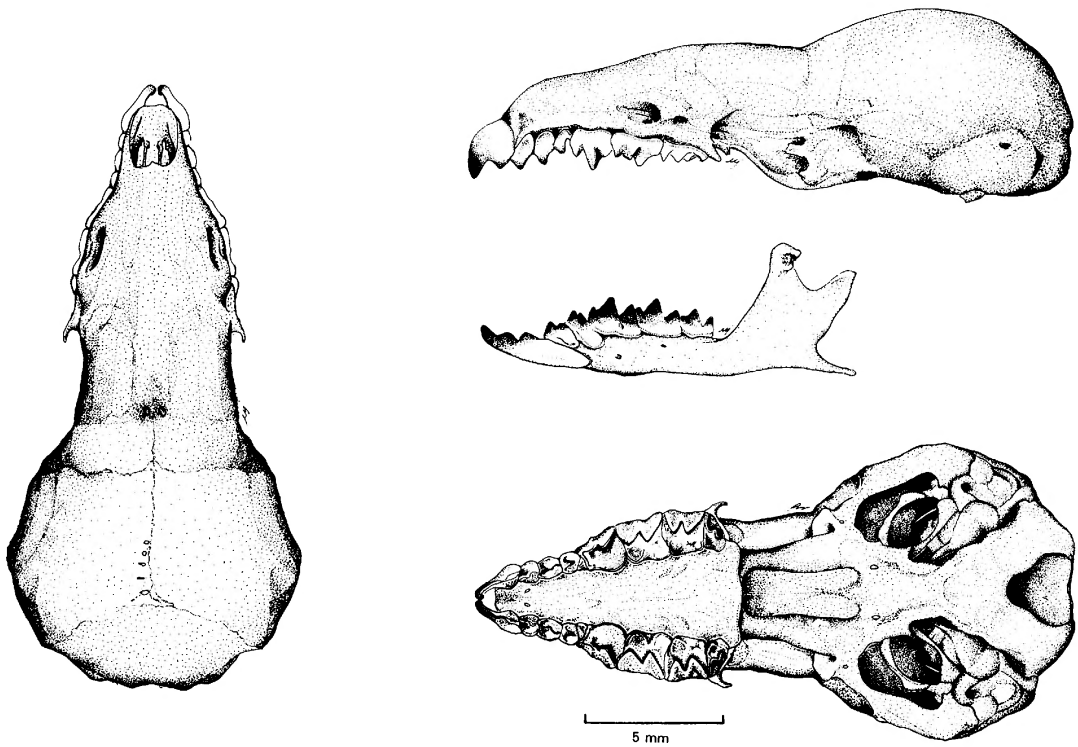

Fig. 4. Dorsal, ventral, and lateral views of skull, and lateral view of lower jaw, *Cryptotis peruviensis*, new species (MUSM 8373).

DISTRIBUTION: Known only by two specimens; one from the eastern versant of the Andes of northern Peru, Department Cajamarca, the other from the western side of the Andes, Department Piura (fig. 5). These records represent the southernmost distributional limits for the genus. The species range most likely includes the southern edge of the Andes north of the Huancabamba Depression.

DIAGNOSIS: A small-size species of *Cryptotis* characterized by its dark grayish brown coloration; tail medium size (48% of head and body length); nasal openings broad; rostrum long and narrow; braincase inflated; anterior process of petromastoid low and moderately wide to narrow; upper incisors with broad basal cusp and short slender hook; dentition bulbous; unicuspid cups with shallow borders; unicuspid U4 small, largely preventing contact between U3 and PM4, inconspicuous from lateral view; articular condyle distinctive, high, and broad.

MEASUREMENTS OF HOLOTYPE: Measurements are in millimeters and weight in grams; external measurements are those recorded on the specimen label: head and body length 63; tail length 30.5; hind foot including claws 14; ear length (not measured); weight 9 g. See table 1 for additional measurements.

DESCRIPTION: *Cryptotis peruviensis* is small compared to other South American species (HBL = 68 ± 5); tail of medium length averaging 48% of HBL; fore and hind foot medium size, not specialized, covered with short hairs and small scales; dorsal and lateral pelage coloration dark grayish brown (color 20 of Smithe, 1975); ventral pelage slightly paler, without a clear demarcation between dorsum and venter; dorsal fur of holotype is densely woolly, slightly less so in paratype; dorsal hairs approximately 5-6 mm long.

The rostrum is long (PL/CBL = 43, 45%) and narrow (M2B/CB = 56, 58%); nasal openings broad; interorbital area narrow; braincase inflated; two small dorsal foramina

positioned anteriorly to dorsal articular facet; anterior process of petromastoid low, moderately wide in holotype and narrow in paratype; foramen on posterior edge of tympanic process absent; paroccipital process low; zygomatic plate narrow; anterior border of zygomatic plate above metastyle of M1, posterior border above M3; palate narrow; upper incisor with broad basal cusp and slender hook, both nearly at same level; unicuspid cusps with shallow borders; U4 small and triangular in occlusal view, in paratype U4 even smaller, probably because of wear; U4 in line with other unicuspids, does not prevent contact between U3 and P4, or nearly so, in paratype; U4 not visible from lateral view; posterior borders of P4, M1, and M2 slightly recessed; M3 complex, protocone, paracone, parastyle, and mesostyle conspicuous, metacone reduced and hypocone absent or part of posterior cingulum; dentition bulbous with dark pigmentation in holotype and slightly less in paratype.

Mandible long and narrow; coronoid process low and narrow joining mandible at oblique angle; coronoid process flared to labial side of mandible; articular condyle distinctively high and broad, presenting a shallow lingual notch between articular facets; lower sigmoid notch slightly deep, below ventral articular facet; angular process long and slender; lower incisor with three conspicuous cusps; posterior border of lower incisor extends anterior to posterior cingulum of pm4; hypoconid in talonid of m3; a small entoconid is visible in paratype.

COMPARISONS: *Cryptotis peruviensis* can be readily distinguished from the following South American taxa based on a combination of size and other external characters: *Cryptotis meridensis*, *Cryptotis squamipes*, and *Cryptotis colombianus*. For descriptions of those taxa, readers are referred to Choate and Fleharty (1974), Hutterer (1986, 1993), and Woodman and Timm (1992, 1993). *Cryptotis peruviensis* needs comparisons only with *C. thomasi*, other taxa previously included under that name, and with *Cryptotis montivagus*, which has a range close to that of *C. peruviensis*.

Compared to *Cryptotis medellinius*, *C. peruviensis* is smaller in head and body average length (68 vs. 84), but has similar tail length (48% of HBL vs. 47%); dorsal pelage is darker and grayish; broader nasal opening; lacks a foramen on posterior edge of tympanic process of petromastoid; narrower palate; smaller U4, preventing contact between U3 and P4, and U4 not visible from labial view; dentition is more bulbous; lower coronoid process.

Compared to *Cryptotis thomasi*, *C. peruviensis* is smaller (HBL = 68 vs. 86) and has longer tail (48% of HBL vs. 30%); darker dorsal pelage; less hair on fore and hind feet; broader nasal opening; relatively more inflated braincase; lacks a foramen on tympanic process of petromastoid bone; dentition bulbous and borders more shallow; smaller U4, preventing contact between U3 and P4 or nearly so, and U4 not visible from labial view.

Compared to *Cryptotis e. equatoris*, *C. peruviensis* is smaller in average head and body length (68 vs. 79 mm); has longer tail length (48% of HBL vs. 45%); narrower rostrum; broader nasal openings; more inflated braincase; smaller U4 that prevents contact between U3 and P4 or nearly so, and is not visible from lateral view; dentition bulbous; higher coronoid valley; articular condyle process higher and broader.

Compared to *Cryptotis e. osgoodi*, *C. peruviensis*, although of similar size in HBL and TL, has broader nasal openings; more inflated braincase; broader rostrum; smaller U4 that prevents contact between U3 and P4 or nearly so, and U4 not visible from lateral view; bulbous dentition; mandible slightly longer and more robust; articular condyle process higher and broader.

Compared to *Cryptotis montivagus*, *C. peruviensis* is smaller in average head and body length (68 vs. 85); has longer tail length (48% of HBL vs. 37%); broader nasal openings; broader interorbital area; inflated braincase; shorter rostrum; shorter unicuspid length; smaller U4 preventing contact between U3 and P4 or nearly so, and U4 not visible from lateral view; less recessed posterior border of molariforms; bulbous dentition; longer mandible.

HABITAT DESCRIPTION: Las Ashitas camp was located in an elfin forest habitat, characterized by shrubby trees with abundant epiphytes and moss, and the holotype was col-

TABLE 1

Selected Measurements, South American Short-Eared Shrews of the Genus *Cryptotis*

	C. medellinius	*C. thomasi*	*C. e. equatoris*	*C. e. osgoodi*	*C. montivagus*	*C. peruviensis* (holotype and paratype)
HBL	83.8 ± 6.6 77.0–94.0 (4)	86.3 ± 4.3 79.0–93.0 (6)	79.0 ± 1.7 77.0–82.0 (7)	73.3 ± 5.6 64.0–79.0 (4)	84.5 ± 2.1 81.0–86.0 (4)	63, 73
TL	39.0 ± 3.7 34.0–43.0 (4)	25.5 ± 1.4 23.0–27.0 (6)	35.4 ± 2.1 33.0–40.0 (7)	30.8 ± 1.8 29.0–33.0 (4)	31.0 ± 1.9 28.0–33.0 (4)	31, 35
TLP	46.8 ± 5.3 43.0–55.8 (4)	29.6 ± 1.4 27.4–31.6 (6)	44.9 ± 3.0 41.5–51.3 (7)	42.3 ± 5.0 36.7–50.0 (4)	36.7 ± 2.4 32.6–38.4 (4)	48, 48
CBL	21.3 ± 0.5 21.0–22.0 (3)	21.6 ± 0.2 21.1–21.9 (7)	21.0 ± 0.3 20.5–21.6 (6)	20.7 ± 0.1 20.5–20.8 (5)	21.1 ± 0.3 20.8–21.4 (2)	20.6, 21.7
CB	10.8 ± 0.2 10.5–11 (3)	10.5 ± 0.1 10.3–10.6 (5)	10.3 ± 0.2 9.9–10.6 (6)	9.9 ± 0.0 9.9–9.9 (2)	10.4 ± 0.0 10.4–10.4 (1)	10.5, 10.7
ZP	2.1 ± 0.2 1.7–2.3 (4)	2.0 ± 0.1 1.8–2.2 (9)	2.2 ± 0.1 2.1–2.4 (7)	2.0 ± 0.1 1.8–2.2 (7)	2.0 ± 0.1 1.9–2.1 (4)	2.1, 2.1
IO	5.2 ± 0.1 5.0–5.3 (4)	5.0 ± 0.1 4.7–5.1 (9)	5.1 ± 0.1 4.9–5.3 (7)	4.9 ± 0.1 4.8–5.1 (7)	4.8 ± 0.1 4.6–4.9 (4)	5.1, 5.2
U1B	2.8 ± 0.1 2.7–2.9 (4)	2.7 ± 0.1 2.6–2.8 (9)	2.7 ± 0.1 2.5–2.8 (7)	2.4 ± 0.1 2.3–2.5 (6)	2.7 ± 0.0 2.7–2.8 (3)	2.7, 2.8
U3B	3.3 ± 0.1 3.2–3.4 (4)	3.1 ± 0.1 3.0–3.2 (8)	3.2 ± 0.1 3.0–3.3 (7)	2.9 ± 0.1 2.7–3.1 (6)	3.2 ± 0.1 3.1–3.4 (4)	3.1, 3.2
M2B	6.4 ± 0.2 6.2–6.7 (5)	6.1 ± 0.2 5.8–6.4 (8)	6.2 ± 0.1 5.9–6.3 (7)	5.9 ± 0.0 5.8–5.9 (6)	6.1 ± 0.1 6.0–6.2 (4)	5.9, 6.2
PL	9.6 ± 0.2 9.4–9.9 (5)	9.2 ± 0.2 9.0–9.6 (9)	9.2 ± 0.2 8.9–9.5 (7)	9.1 ± 0.1 8.9–9.3 (7)	9.2 ± 0.1 9.1–9.4 (4)	8.8, 9.7
TRL	8.4 ± 0.1 8.3–8.6 (5)	8.2 ± 0.1 7.9–8.4 (9)	8.0 ± 0.2 7.8–8.2 (7)	7.9 ± 0.2 7.7–8.2 (7)	8.1 ± 0.2 7.9–8.3 (4)	7.9, 8.3
UNL	2.8 ± 0.1 2.6–3.0 (5)	2.6 ± 0.1 2.4–2.8 (8)	2.7 ± 0.1 2.5–2.8 (7)	2.8 ± 0.1 2.7–3.0 (6)	3.0 ± 0.1 2.8–3.1 (4)	2.6, 2.7
WM1	2.0 ± 0.1 1.8–2.1 (5)	1.9 ± 0.1 1.8–2.0 (9)	1.9 ± 0.1 1.8–2.0 (7)	1.9 ± 0.1 1.8–2.0 (7)	1.9 ± 0.1 1.8–2.0 (4)	1.8, 1.9
ML	7.3 ± 0.2 7.0–7.4 (5)	7.1 ± 0.2 6.9–7.5 (9)	7.3 ± 0.1 7.0–7.4 (7)	7.0 ± 0.2 6.7–7.2 (7)	7.0 ± 0.1 6.8–7.0 (4)	7.4, 7.6
HCP	4.9 ± 0.2 4.7–5.2 (5)	4.6 ± 0.1 4.4–4.8 (8)	4.6 ± 0.2 4.3–4.8 (7)	4.2 ± 0.1 4.0–4.4 (7)	4.6 ± 0.0 4.5–4.6 (4)	4.6, 4.7
HCV	3.2 ± 0.2 2.9–3.5 (5)	3.2 ± 0.1 3.0–3.4 (9)	2.8 ± 0.1 2.7–2.9 (7)	2.8 ± 0.1 2.7–2.9 (7)	3.1 ± 0.1 2.9–3.2 (4)	3, 3

TABLE 1—(*Continued*)

	C. medellinius	*C. thomasi*	*C. e. equatoris*	*C. e. osgoodi*	*C. montivagus*	*C. peruviensis* (holotype and paratype)
HAC	3.0 ± 0.1	3.1 ± 0.1	2.7 ± 0.1	2.6 ± 0.1	3.0 ± 0.1	2.9, 2.9
	2.8–3.1	3.0–3.3	2.4–2.8	2.4–2.8	2.9–3.1	
	(5)	(9)	(7)	(7)	(4)	
WAC	2.0 ± 0.1	1.9 ± 0.1	1.7 ± 0.1	1.7 ± 0.1	1.9 ± 0.1	1.9, 1.9
	1.8–2.1	1.7–2.0	1.6–1.9	1.5–1.8	1.8–2.0	
	(5)	(9)	(7)	(7)	(4)	
LTL	6.5 ± 0.2	6.4 ± 0.1	6.4 ± 0.1	6.4 ± 0.1	6.5 ± 0.1	6.3, 6.8
	6.4–6.9	6.2–6.5	6.2–6.6	6.3–6.6	6.3–6.7	
	(5)	(8)	(7)	(7)	(4)	

lected at the upper limit of the forest, below the paramo. This locality corresponds to the Bosque Pluvial Montano Tropical according to the Holdridge Life Zone Classification (Tosi, 1960). Common shrub species includes representatives of the genera *Gynoxus* (Asteraceae), *Monnina* (Polygalaceae), *Rapanea* (Myrsinaceae), *Miconia* (Melastomataceae), and *Escallonia* (Grossulariaceae); *Syphocampilus jelskii* (Campanulaceae), tree ferns of the genus *Cyathea*; and bamboos of the genus *Chusquea* (Poaceae), intermixed with patches of grassland species of *Calamagostris* and *Festuca*. The environment is cold and extremely humid.

The Machete field locality is described as an extensive and typical cloud forest with presence of *Podocarpus* trees placed on east slope of Cerro Chinguela, in the Río Samaniego valley (Parker et al., 1985).

DISCUSSION

Woodman and Timm (1993) found that the *Cryptotis nigrescens* species complex is more diverse and speciose than was previously considered. Our recognition here of *Cryptotis equatoris* and *C. medellinius* and the report of *C. peruviensis* give us reasonable confidence to suggest that a similar picture of high diversity characterizes the South American short-eared shrews. A comprehensive revision of the group is needed to develop this probable scenario.

The inclusion of all the South American *Cryptotis* as members of a single *Cryptotis thomasi* species group (sensu Choate, 1970), based on geographic grounds but without convincing evidence of its monophyly, appears a simplistic view at this time, and not longer useful in a systematic context. A more realistic *C. thomasi* group would include only *Cryptotis thomasi*, and tentatively *C. medellinius*.

Cryptotis colombianus was described by Woodman and Timm (1993) as belonging to the Central American *nigrescens* complex group; we interpret this to mean that the South American taxa do not conform a monophyletic group. However, in the course of this study, some of the diagnostic characters of *C. colombianus* that distinguish it from Central American species were found in other South American species. For example: the foramen on the posterior edge of the tympanic process of the petromastoid was present in *C. thomasi* and *C. medellinius*; the moderately high and wide anterior process of the petromastoid was present in *C. thomasi* and *C. peruviensis*; the low articular condyles were found in *C. equatoris*; and a faint and shallow lingual notch between the facets of the articular condyle was frequently present in *C. equatoris*. These observations suggest that the allocation of *colombianus* to the Central American group *nigrescens* should await a thorough revision of the South American species.

Cryptotis peruviensis represents the southernmost distribution of the South American short-eared shrews. As early as 1940, Cabrera and Yepes suspected that the Huancabamba Depression and its arid habitats impeded distribution of the genus *Cryptotis* further south, and until now that appeared to be

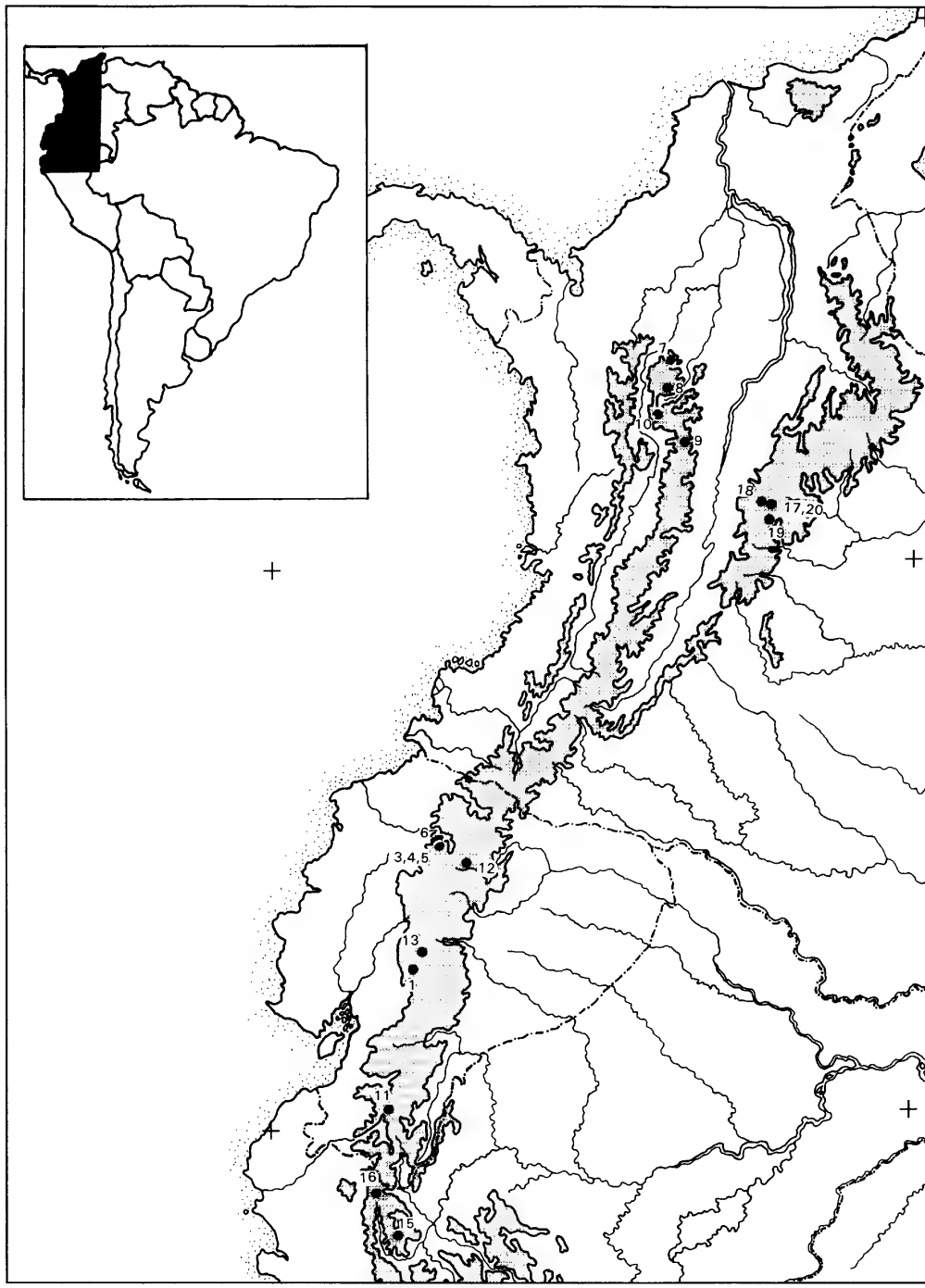

Fig. 5. Collection localities in Colombia, Ecuador, and Peru for specimens of *Cryptotis* examined.

so. Several other taxa (e.g., *Caenolestes* spp., *Tapirus pinchaque*) do not occur south of the Huancabamba Depression, indicating that this geographic feature might be an important barrier for north-south dispersion. However, patterns of mammal distribution in northern Peru, especially of nonvolant species, are still vaguely known. Tentative scenarios of the role of the Huancabamba Depression on bat distribution (Koopman, 1978; Pacheco and Patterson, 1992; Patterson et al., 1992) concur in reporting that the Huancabamba Depression has been of no major significance in impeding north-south dispersion. Interestingly, it was concluded that for high-elevation bird species, the Huancabamba Depression is not an important barrier for dispersal either (Parker et al., 1985). The importance of the Huancabamba Depression as a barrier for the distribution of *Caenolestes* was suggested by Albuja and Patterson (1996). However, all investigators agree that the distribution patterns for shrew-opossum, shrews and other non-volant cloud forests and paramo mammalian species await further study. It should be emphasized that suitable habitats north and south of the Huancabamba Depression have not been extensively sampled and what may appear to be patterns might turn out to be simply collecting biases. For example, the deer *Mazama rufina* was once considered to be limited to the northern Andes, but it has been recently reported in Lambayeque, south of the Huancabamba Depression and on the western side of the Andes (Pacheco et al., 1995).

The Cajamarca and Piura departments where *Cryptotis peruviensis* has been discovered are unfortunately among the most densely populated, which correlates with high rates of habitat deterioration. Virtually no national parks exist in this area. The only protected area is the Tabaconas-Namballe Natural Sanctuary, and the Cutervo National Park, both too small to be considered representative of the region. The Cajamarca department is the only region in Peru where northern and southern Andean elements are present in a single geopolitical region. The Cajamarca department is practically dissected by the Río Chamaya that flows eastward to join the Río Marañón, giving this area a unique importance for systematics, biogeography, and conservation. The Cajamarca department, and northern Peru on a broader scale, should have highest priority for diversion of major conservation efforts. Its unique habitats, the extensive and increasing habitat deterioration, and the meager amounts of current research and conservation efforts should be addressed.

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APPENDIX

List of collection localities and specimens studied in this report. Specimens marked with an asterisk (*) were measured. Those marked with (#) are holotypes examined.

Cryptotis equatoris equatoris
Ecuador

1. BOLIVAR, Guaranda, Sinche (AMNH: 66837, *66838, *66839, *66840, *66841, *66842, *66843, 66844, *66845).

Cryptotis equatoris osgoodi
Ecuador

2. PICHINCHA, Chinchin Cocha, 4000 m (FMNH: 53316, 53317; not located).
3. PICHINCHA, Monte Pichincha (AMNH: *62379, *62380).
4. PICHINCHA, Crater Pichincha, 4300 m (FMNH: 53318).
5. PICHINCHA, San Ignacio (AMNH: *64576, *64582, *64583, *66249).
6. PICHINCHA, Verdecocha (AMNH: *64585).

Cryptotis medellinius
Colombia

7. ANTIOQUIA, Valdivia, Las Ventanas, 2000 m (FMNH: 69812, *69813).
8. ANTIOQUIA, Antioquia, San Pedro, 2560 m (AMNH: *149151).
9. ANTIOQUIA, Sonsón, Páramo, 7 km E, 3000–3100 m (FMNH: *69815, *69817, 69818).
10. ANTIOQUIA, SE de Medellín, Las Palmas, 2650 m (FMNH: *69814).

Cryptotis montivagus
Ecuador

11. AZUAY, Bestión, 10000 ft (3048 m) (AMNH: *47197, *47199, *#47200, *47201).
12. PICHINCHA, Guamaní, Cerro Guamaní (AMNH: 63844).
13. CHIMBORAZO, Urbina (AMNH: 64623).
14. CHIMBORAZO, Lake Quinvascocha GL Cajas, Cuenca Azuay, 3850 m (MECN: 138, not located).

Cryptotis peruviensis
Peru

15. CAJAMARCA, Las Ashitas, 42 km W Jaén, 3150 m (MUSM: *#8373).
16. PIURA, Machete, Zapalache-Carmen trail, 2050 m (LSUMZ: *26887).

Cryptotis thomasi
Colombia

17. CUNDINAMARCA, Bogotá, San Cristobal, 2800 m (FMNH: *71031, *71032, 71033, *71034, *71036, *71037).
18. CUNDINAMARCA, Bogotá, San Francisco, 3000 m (AMNH: *71355, FMNH: 71023, 71024, *71025, 71026, 71028, 71029).
19. CUNDINAMARCA, Bogotá, Páramo de Choachi (AMNH: *38405).
20. CUNDINAMARCA, Bogotá, Páramo de Bogotá (AMNH: *37381).

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