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DISTRIBUCIÓN, HISTORIA NATURAL Y CONSERVACIÓN DE MAMÍFEROS NEOTROPICALES

DISTRIBUTION, NATURAL HISTORY AND CONSERVATION OF NEOTROPICAL MAMMALS

DISTRIBUTIONAL RECORDS OF BOLIVIAN MAMMALS

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ABSTRACT. We report the first records of *Akodon kofordi* and *Microsciurus flaviventer* for the Republic of Bolivia. We also present records that extend the distributional range within the country for *Gracilinanus aceramarcae, Bolomys amoenus*, and *Hippocamelus antisensis*, and call attention to an additional specimen of *Oxymycterus hiska*, one of the least known rodent species in Bolivia.

RESUMEN. Registros de distribución de mamíferos bolivianos. En este reporte presentamos los primeros registros de *Akodon kofordi* y *Microsciurus flaviventer* para la República de Bolivia, e incluimos nuevos registros que extienden el rango de distribución dentro del país para *Gracilinanus aceramarcae*, *Bolomys amoenus*, e *Hippocamelus antisensis*. Adicionalmente, puntualizamos la existencia de un espécimen adicional de *Oxymycterus hiska*, una de las especies de roedores menos conocidas de Bolivia.

Key words: distributional records, Bolivia, *Akodon kofordi*, *Bolomys amoenus*, *Gracilinanus aceramarcae*, *Hippocamelus antisensis*, *Microsciurus flaviventer*, *Oxymycterus hiska*.

Palabras clave: registros de distribución, Bolivia, *Akodon kofordi*, *Bolomys amoenus*, *Gracilinanus aceramarcae*, *Hippocamelus antisensis*, *Microsciurus flaviventer*, *Oxymycterus hiska*.

INTRODUCTION

Despite a recent monumental monograph on the mammals of Bolivia (Anderson, 1997), the country remains poorly collected and much remains to be learned about its fauna (Salazar-Bravo et al., 2002). Bolivia is a megadiversity country with over 325 species of mammals recorded to date (Yensen et al., 1994; Anderson, 1997; Emmons, 1999; Brooks et al., 2002). In this paper, we report two species new to the fauna of Bolivia as well as extensions of known ranges for three species within the country. Unless otherwise stated, specimens mentioned are deposited in the Colección Boliviana de Fauna, La Paz, Bolivia (CBF); Museum of Southwestern Biology, Albuquerque, New Mexico, USA (MSB); or the American Museum of Natural History, New York, USA (AMNH). Bolivian localities mentioned in the text are shown in **Figure 1**, and specimens examined are listed in the **Appendix**. Nomenclature follows that used in Anderson (1997). Throughout the text, references to localities in **Figure 1** are in brackets.

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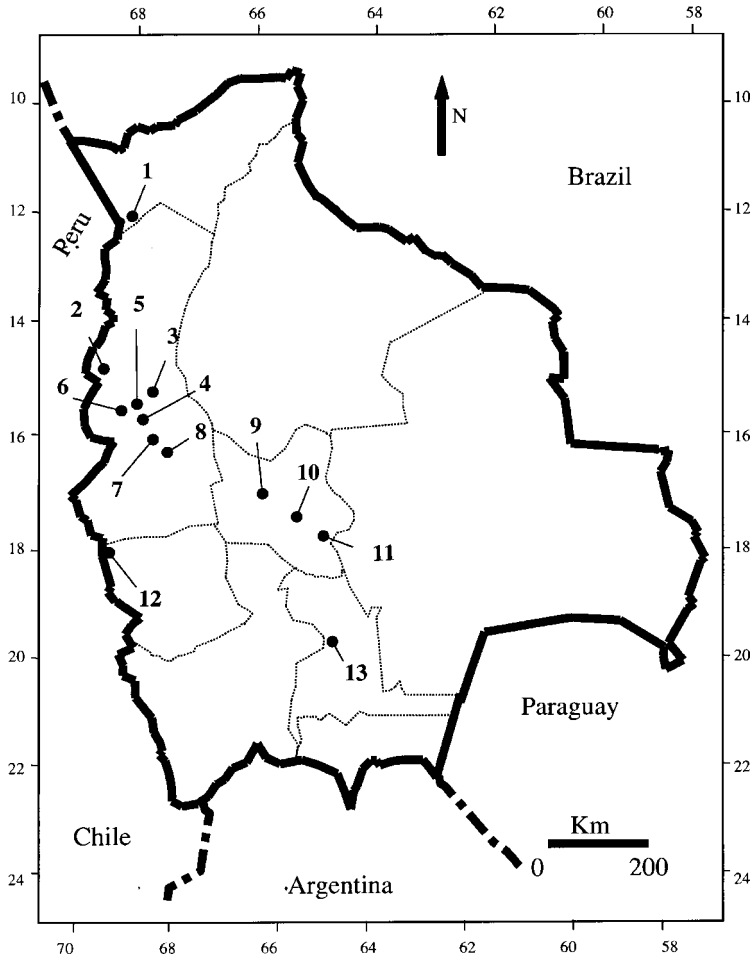

Fig 1. Map of the localities mentioned in the text. Locality 1, Santa Rosa; 2, Llamachaqui; 3, Mapiri; 4, Okara; 5, Cocapunco; 6, Tacacoma; 7, Cuticucho; 8, Unduavi; 9, Tablas Monte; 10, Mojon; 11, Pojo; 12, Patilla; 13, Potolo.

NEW RECORDS FOR BOLIVIA

Rodentia: Sciuridae

Microsciurus flaviventer (Gray, 1867)

On 2 August 1986, a joint expedition by members of the American Museum of Natural History, the Museum of Southwestern Biology, and the Colección Boliviana de Fauna were camped on the "left" bank of the Madre de Dios river near Santa Rosa, Pando Department, in the Amazon Basin of Bolivia (12° 13'S, 68° 24'W [1], 180 m elevation). At this site, two local guides shot a small squirrel approximately 4 km west of the village of Santa Rosa and brought it to the expedition campsite. The specimen was originally identified as *Sciurus ignitus boliviensis* (Anderson, 1997:379).

In the course of curatorial work in the collections of the MSB, one of us (JSB) noted that the external and the cranial morphology of this specimen did not match that of other *Sciurus ignitus*. Instead, the specimen possesses the following cranial characters (**Fig. 2**) which are diagnostic of *Microsciurus*: the postorbital process is located almost directly above the base of the posterior root of the zygomatic arch; the upper incisors are proodont, the postgle-

noid foramen pierces the squamosal bone, there is one pair of transbullar septae, and the upper third premolars are clearly present (Moore, 1959). The specimen closely resembles specimens of *Microsciurus* depicted in Allen (1915) and descriptions, coloration, and measurements of *M. flaviventer* in Patton et al. (2000). Additionally, *M. flaviventer* has the southernmost geographic range in the genus (Emmons and Feer, 1997), and is the species most apt to occur in Bolivia.

The Amazon dwarf squirrel occurs in the Amazon Basin of southeastern Colombia, Ecuador, Peru, and Brazil west of the Negro and Madeira rivers, where it ranges from < 100 to ca. 2000 m elevation (Eisenberg and Redford, 1999). In a summary of localities visited in Pando, Emmons and Smith (1992 unpublished report, cited in Anderson 1997), included observations of *Microsciurus* sp. at Ingavi (10° 57'S, 66° 50'W), 223 km northeast of Santa Rosa. In the absence of any other records, we assume that Emmons and Smith's sight record is the reason why Eisenberg and Redford (1999: map 16.10) showed the range of *M. flaviventer* extending into Bolivia. The specimen reported here represents the first voucher-verified record for the country.

Santa Rosa, a small cluster of ranches, is located in the "bosque húmedo - Subtropical" [subtropical rainforest; bh-ST] life zone in the Holdridge life zone system modified for Bolivia (Unzueta, 1975). The forest consisted of low trees (4-20 cm dbh) with spiny cactus (tacuara), and a few large trees including rubber trees (*Hevea brasiliensis*) and Brazil nuts (*Bertholletia excelsa*) (L. Ruedas, field notes).

Rodentia: Muridae

Akodon kofordi Myers and Patton, 1989

This species was previously known from four localities in the Limbani and Marcapata drainages, Puno and Cuzco Departments, southern Peru (Myers and Patton, 1989; Eisenberg and Redford, 1999). We report the first records from Bolivia based upon 20 specimens from three localities in Cochabamba Department.

From 12 to 18 July 1992, a field party from the Museum of Southwestern Biology collected

Fig 2. Skull and detail of the mesopterygoid region of *Microsciurus flaviventer* (MSB 57066). "A" indicates the upper third premolar.

11 males and five females of *A. kofordi* at a locality 4.4 km (by road) north of Tablas Monte, in Cochabamba Department, Bolivia (17º 04'S, 66º 01'W [9], 1833 m elevation). Three additional males and a female were collected nearby at 9.5 km (by road) north of Tablas Monte, and we refer them tentatively to *A. kofordi*.

On 11 July 1995, EY collected a specimen of *A. kofordi* near Mojón, 4.5 km N, 6 km E Lopez Mendoza, km 99, Old Santa Cruz highway, and about 1 km up a side canyon (17° 30'S, 65° 25'W [10], 3700 m elevation), Carrasco Province near the border with Arani Province, Cochabamba Department. Other small mammals captured at the site included *Akodon fumeus*, *A. lutescens*, *Andinomys edax*, *Oligoryzomys flavescens* group "sp. *B*.", *Oxymycterus paramensis*, and *Phyllotis osilae*.

Akodon kofordi closely resembles *A. fumeus*, and Anderson (1997:420) listed most of the above specimens as such. However, Myers and Patton (1989) used several morphological characters to distinguish the two species, among them the shape of the paraflexus of the M^1, the lyre-like shape of the mesopterigoid fossa (**Fig 3**), and the color of the pelage. Our specimens match the characteristics reported by Myers and Patton (1989).

The Mojon site was in an open *Polylepis* woodland in good condition with trees 2-3 m tall, and is in the "bosque húmedo - Montano Bajo Subtropical" [humid forest - Subtropical Lower Montane, bh-MBST] life zone. The Tablas Monte localities are in cloud forest habitats within the "bosque pluvial - Montano Subtropical" [cloud forest - Subtropical Montane, bp-MST] life zone, but are also in close proximity to three other cloud forest zones (Unzueta, 1975). The specific microhabitat at 4.4 km N Tablas Monte where some of the specimens were trapped was in the riparian zone of the Jatun Mayu river. Animals were trapped in secondary forest at the base of a steep shale rock slope. The forest canopy was dominated by *Alnus* (40% cover), and the understory was dominated by *Cecropia* shrubs (40-90% cover), with 10-80% forb cover in tree-fall clearings, and moss covering the rocks, vines, and tree-trunks (J. Dunnum, field notes).

From the analysis of the microhabitat capture-data sheets, all *A. kofordi* from Cochabamba were caught on the ground. Most (70%) were captured near the river in dense cover dominated by *Chusquea*, and the rest (30%) were caught away from the river on the forest floor in leaf litter, among rocks, or near moss-covered trunks. Other species found at this site were *Akodon* spp., *Neacomys spinosus*, *Monodelphis osgoodi*, *Marmosops noctivagus keaysi*, and *Micoureus constantiae*.

These records extend the distribution of *Akodon kofordi* 600 km to the southeast of its known range in Peru. They also indicate the species has a broader ecological amplitude than previously known. All records are on, or adjacent to, the eastern slopes of the Andes Mountains. In Peru, it occurs in moist bunchgrass, disturbed shrub, and upper elfin forest habitats (Myers and Patton, 1989). *Polylepis* woodlands were formerly widespread in the Andean highlands, and the collecting localities in southern Peru would have been either close to, or occupied by, *Polylepis* woodlands prior to anthropogenic changes (Fjeldså and Kessler, 1996). Although the majority of the specimens from Cochabamba are from yungas forests, a record of *A. kofordi* in a *Polylepis* woodland is not surprising. This is a common pattern; twelve other Bolivian rodent species occur in both yungas cloud forests and adjacent *Polylepis* woodlands (Tarifa and Yensen, 2001).

OTHER NOTEWORTHY RECORDS

Didelphimorphia: Didelphidae

Gracilinanus aceramarcae (Tate, 1931)

This species was previously known from three specimens and two localities in the Unduavi Valley on the eastern slopes of the Andes Mountains, La Paz Department, Bolivia (Anderson, 1997), and one specimen from Peru that was included in a checklist without published details (Pacheco et al., 1995; J.L. Patton, personal communication).

Unduavi (the type locality, 16° 18'S, 67° 53'W [8]) and nearby Yerbani (the other previously known Bolivian locality, 16° 18'S, 67° 54'W) are close geographically in the precipitous Aceramarca River Valley, but at 3290 m

and 2600 m elevation, respectively.

The single Peruvian record was a female specimen (Museum of Vertebrate Zoology #171411) collected on 2 August 1985 by James L. Patton at Agualani, 9 km N Limbani, 2840 m elevation, Puno Department. The specimen was captured in a Museum Special trap baited with rolled oats and sardines that had been in place for several nights in a small runway in litter under shrubs along a rock wall. It was prepared as a study skin and skull (total length, 242; tail length, 145; hind foot, 18; ear, 19; weight, 18.5 g) with the carcass in fluid. The area was formerly cloud forest, but only fragments remained by 1985 (J.L. Patton, personal communication).

On 13 May 1995, Michael Kessler and Stephen Hohnwald trapped a small marsupial near Cuticucho in the Zongo Valley, La Paz Department (16° 08' S, 68° 07' W [7], 2800 m elevation). The animal was captured in a Sherman live trap baited with rolled oats, vanilla, and tuna, and placed on a lichen and fern-covered tree branch ca. 2 m above ground. Cuticucho, located ca. 50 km NW of Unduavi, is characterized by high humidity, annual mean temperature of 10°C, and shallow, rocky, acidic soils with high organic matter content. At this site, the trees are <10 m tall, twisted, and epiphyte-laden (Moraes R. et al., 1996, in litt.).

A second specimen was collected on 3 June 1995, by Nuria Bernal H. and José Cortéz at Llamachaqui, 5 km NE of the village of Pelechuco on the road to Apolo (14° 48' S, 69° 02' W [2], 3160 m elevation), Franz Tamayo Province, La Paz Department. Interestingly, the first Bolivian record of *Lestoros inca* (Caenolestidae) was also collected at Llamachaqui on the same day by N. Bernal (Tarifa and Bernal, 1999). Llamachaqui is located in the deep, narrow valley of the Pelechuco River. The "ceja de monte de

Fig 3. Detail of the mesopterygoid region of *Akodon kofordi* (NK 30300). Notice the lyra-shaped mesopterygoid fossa and the well developed median spine. "A" indicates the enamel island in M^1.

yungas" [upper yungas cloud forest] vegetation is characterized by small, twisted 5-10 m tall trees with small, thick leaves. The trees were covered by epiphytes, including mosses, lichens, and ferns (Tarifa and Bernal, 1999).

R. Voss graciously compared the Cuticucho specimen with the type specimen of *G. aceramarcae* in the American Museum of Natural History (AMNH 72568). TT and EY then compared the Llamachaqui and Cuticucho specimens. All three agree in detail, and fit descriptions of *G. aceramarcae* (Tate, 1933; Hershkovitz, 1992).

G. aceramarcae has been found thus far in three adjacent life zones in Bolivia. Llamachaqui is in "bosque húmedo - Montano Subtropical" [humid forest - Subtropical Montane; bh-MST] life zone, Cuticucho is at slightly lower elevation in the "bosque muy húmedo - Montano Subtropical" [very humid forest - Subtropical Montane; bmh-MST] life zone, and the two Unduavi localities are in the "bosque muy húmedo - Montano Bajo Subtropical" [very humid forest - Lower Subtropical Montane; bmh-MBST] life zone (Unzueta, 1975).

The five known localities are in a line running from northwest to southeast along the eastern slope of the Andes Mountains. Llamachaqui is 110 km southeast of Limbani. Cuticucho is 190 km southeast of Llamachaqui, and Unduavi is 50 km further southeast of Cuticucho. The two new localities fill the 350 km gap between Unduavi and Limbani, and give a better concept of the species distribution. All localities are between 2600 and 3290 m elevation in yungas cloud forest vegetation types.

Rodentia: Muridae

Bolomys amoenus (Thomas, 1900)

This species occurs in Peru and Bolivia (Anderson and Olds, 1989). In Bolivia, it was previously known from 13 specimens collected at three localities in Cochabamba Department and one locality in Tarija Department (Anderson, 1997).

While trapping in anthropogenic puna (treeless grassland created by repeated human-caused fires) 2.5 km S Tacacoma, Larecaja Province, La Paz Department (15° 36' S, 68° 39' W [6], 3600 m elevation), EY collected two specimens of *Bolomys amoenus* in Sherman live traps, one on 30 June 1995, using raw peanuts and oatmeal as bait and a second specimen on 2 July 1995, with peanut butter and oatmeal bait.

Both specimens were captured at the base of rock outcrops, in both cases on rocky soils among ferns and mosses. Rodent burrows were observed under rocks in the area of the traps. Tacacoma is in the "bosque húmedo - Montano Subtropical" [humid forest - Subtropical Montane, bh-MST] life zone (Unzueta, 1975). Other species of small mammals collected with *B. amoenus* at Tacacoma included *Oxymycterus hiska*, *Phyllotis osilae phaeus*, *Akodon fumeus*, *Akodon subfuscus*, *Cavia tschudii*, and *Oligoryzomys* sp. B.

EY collected a third specimen on 15 August 1995, at Potolo (also known as Estancia Pupayoj, 19° 34' S, 64° 40' W [13], 3700 m elevation), 22 km S, 13 km E Icla, Sudañez Province, Chuquisaca Department. The specimen was captured by hand in a barley field surrounded by *Polylepis* woodland in the "bosque húmedo - Montano Templado" [humid forest - Temperate Montane; bh-MTE] life zone (Unzueta, 1975). Other species of small mammals collected at Potolo included *Phyllotis* cf. *osilae*, *Calomys lepidus*, *Galea musteloides*, and *Akodon boliviensis*.

These three new records fill major gaps in the distribution of *B. amoenus* in Bolivia. All Bolivian records to date for this species are between 3200 and 4000 m elevation in puna or *Polylepis* woodland habitats.

Oxymycterus hiska Hinojosa, Anderson, and Patton, 1987

This small species of *Oxymycterus* was known from six specimens from the type locality in Peru (14 km W Yanahuaya, Puno Department, 14º 19'S, 69º 21'W; 2210 m elevation; Hinojosa et al., 1987). Oliveira (1998) reidentified as *O. hiska* seven specimens reported earlier as *Oxymycterus paramensis nigrifrons* by Anderson (1997) and added one additional specimen from Cochabamba Department.

The specimens identified as *O. p. nigrifrons* by Anderson (1997) and considered *O. hiska*

by Oliveira (1998) are as follows: La Paz Department: "Coc**o**punco" [=Coc**a**punco] (15º 30'S, 68º 29'W [5]; 3048 m elevation; AMNH 72748, 72749), Mapiri (15º 15'S, 68º 10'W [3]; 610 m; AMNH 72889), Okara (15º 39'S, 68º 24'W [4]; 2286 m; AMNH 72750), Tacacoma (15º 35'S, 68º 43'W [6]; 3170 m elevation; AMNH 91601, 91602, 91603), and Cochabamba Department: Yungas von Pojo, Carrasco Province (17º 45'S, 64º 49'W [11]; 1800 m elevation; Zoologisches Forschungsinstitut und Museum Alexander Konig (ZFMK 92403), Bonn, Germany. We call attention to these records here because dissertations are not widely available, and we add an additional specimen from our own collecting.

On 21 July 1995, EY and TT collected a female from 2.5 km S Tacacoma, La Paz Department (15° 36' S, 68° 39' W [6], ca. 3500 m elevation) in mixed *Polylepis* woodland. The Museum Special trap was baited with rolled oats, vanilla, and peanut butter. The woodland was composed of dense, epiphyte-covered trees of short stature (5-6 m) on a 30-40° slope. Tacacoma is in the "bosque húmedo - Montano Subtropical life zone" [humid forest - Subtropical Montane, bh-MST] (Unzueta, 1975).

This new specimen was collected several kilometers from the AMNH Tacacoma specimens. These records suggest that *O. hiska* probably occurs at a variety of elevations from 610 m (Mapiri) to 3500 m (Tacacoma) on the eastern slopes of the Andes in northern Bolivia.

Artiodactyla: Cervidae

Hippocamelus antisensis (D'Orbigny, 1834)

Andean deer occur in the high Andes (2500 m to 5000 m elevation) from Ecuador to northwestern Argentina (Eisenberg and Redford, 1999). *H. antisensis* is listed in CITES Appendix I, and as DD (data deficient) by IUCN (Wemmer, 1998). In Bolivia, only eight specimens with data are known from six localities in La Paz, Cochabamba, and Potosi Departments (Yensen et al., 1994; Anderson, 1997). Yensen and Tarifa (1993) listed the species as hypothetical for Sajama National Park based upon reports from local people.

In 1996, local people told TT that *H. antisensis* was regularly seen individually or in small groups of 2 or 3 individuals at three localities in Sajama National Park: Rinconada [box canyon] de Anallajchi, Quebrada Patilla, and Rinconada del río Junthuma Khuchu. They also told TT that individuals of this species periodically come into Sajama National Park from Lauca National Park in adjacent Chile.

An adult male of this species was killed by a puma (*Puma concolor*) on 5 May 1996, in "la Rinconada de la Quebrada Patilla" (3.8 km W, 7.6 km N Sajama village; 18º 04' S, 69º 01' W [12]; 4500 m elevation) in Sajama National Park, Oruro Department. A resident of the Estancia Kasilla community salvaged the pelt and feet and later led TT to the kill site. TT recovered the upper cranium and skeleton. The skeleton and pelt are deposited in de CBF (4497); this is the first specimen record for the Department of Oruro.

DISCUSSION

Much work remains to be done before the mammals of Bolivia be adequately known, and new distributional records are coming from museum collections as well as from fieldwork. The specimen of *Microsciurus flaviventer*, a readily recognizable species, remained misidentified in a museum collection for several years. This is symptomatic of the amount of curatorial work that even our major collections require. Recent museum efforts have resulted in the description of a new genus (Anderson and Yates, 2000), and we know of seven species new to science in various stages of description. Further work in the field as well as in curation of collections is bound to uncover more heretofore unknown Neotropical species and fill gaps in the distributions of many Bolivian mammals.

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Table 1

External measurements (in mm, mass in g) for the taxa mentioned in text. In the case of *Akodon kofordi*, means (± standard deviation) and range are given; some young animals are included. We included measurements for both female *Bolomys amoenus* reported in text.

Species	Sex	n	Total	Tail length	Right Hind Feet	Ear length	Mass
Gracilinanus acermarcae	F	1	230	134	16	21	16
	M	1	224	131	17	21	18
Microsciurus flaviventer	F	1	286	139	40	18	110
Akodon kofordi	F	6	173.17 (±10.2) 165 – 188	77.5 (±5.0) 72 – 85	22.67 (±0.82) 22 – 24	15.5 (±0.84) 15 – 17	21.3 (±4.84) 16 – 27
	M	14	169.71 (±10.2) 145 – 185	73.5 (±7.7) 53 – 84	22 (±1.10) 20 – 24	15.1 (±1.49) 12 – 18	20.9 (±4.92) 15 – 31
Bolomys amoenus	F	2	160 168	67 66	20 20	13 14	18 28.5
	M	1	173	65	21	11	25
Oxymycterus hiska	F	1	205	78	23	16	39
Hippocamelus antisensis	M	1	NA	NA	NA	NA	NA

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APPENDIX I

Specimens examined: *Microsciurus flaviventer* — female: MSB 57066. *Akodon kofordi* — males: NK 30262, NK 30277, NK 30280, NK 30287, NK 30291, NK 30297, NK 30300, NK 30302, NK 30305, NK 30309, NK 30316, NK 30338, NK 30371, and CBF 5195. Females: NK 30244, NK 30256, NK 30314, NK 30318, NK 30319, and NK 30374. *Gracilinanus aceramarcae* — female: CBF 4434; male: CBF 4001. *Bolomys amoenus* — female: CBF 5152, CBF 5171;. Male: CBF 5392. *Oxymycterus hiska* —female: CBF 5232. *Hippocamelus antisensis* — male: CBF 4497.