

Rediscovery of *Marmosops juninensis* Tate, 1931 (Didelphimorphia: Didelphidae) in the Yungas of Peru

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ABSTRACT: *Marmosops juninensis* is an endemic marsupial of the forests of Junín Department, central Peru. It is known by four specimens but has not been recorded in almost 50 years. We report two new specimens collected in 2011 that extend the range distribution of the species by 83 km eastward of the type locality. In addition, we describe some morphological characteristics of the species and provide description of its microhabitats: primary growth forest and cultivated fields of coffee and banana. Finally, we propose that *M. juninensis* qualifies for Endangered status according to IUCN criteria.

Marmosops Matschie 1916 comprises a total of 17 species of small marsupials which are distributed in tropical and subtropical forests of South America and one species in Panama (Gardner and Creighton 2008; Díaz *et al.* 2011; Voss *et al.* 2013). These slender mouse opossums are reported to inhabit lowland rainforest, lowland dry forest (Emmons 1999; Voss *et al.* 2004), montane forests, humid montane forests (Emmons 1999) and inundated habitats such as *Heliconia* thickets (Patton *et al.* 2000) up to 3000 meters above sea level (Voss *et al.* 2004). In addition, *Marmosops* is reported in the understory, usually caught on the ground or a few meters above the ground (Voss *et al.* 2004). Five species of *Marmosops* occur in Peru (Pacheco *et al.* 2009): *M. bishopi*, *M. impavidus*, *M. juninensis*, *M. neblina*, and *M. noctivagus*; and most of them inhabit montane and lowland forests (*sensu* Brack-Egg 1986). Among them *Marmosops juninensis* Tate, 1931, that belongs to the "parvidens" complex (Voss *et al.* 2001), is an endemic species restricted to Department of Junín and is known by four specimens to date.

Tate (1931) described *M. juninensis* based on one female specimen collected in 1929 in Utcuyacu, between Tarma and Chanchamayo provinces, Junín department, housed in the American Museum of Natural History, New York, (AMNH 63864). In 1964, three additional specimens were collected near Tarma province, Junín department (AMNH 230014–230016, Voss *et al.* 2001). The species has not been collected since then, and has not been documented in the literature since the review by Pine (1981) except Voss *et al.* (2001).

We report two new specimens of *Marmosops juninensis*, from San Antonio, a locality 63 km east of the type locality; these were collected during a field survey in Pampa Hermosa district, Satipo province, Junín department (Figure 1). A total of seven localities were sampled along Pampa Hermosa River using ground and arboreal Sherman traps (230 x 77 x 90 mm) depending on the accessibility of the shrubs and trees, baited with a mixture of peanut butter and rolled oats. *M. juninensis* was collected in

only one locality but in different microhabitats. One young adult specimen was collected at 1406 m (4612 ft) (11°24'55.95" S, 74°46'8.21" W) on 5 July 2011 (MUSM 40616, female) and one adult was collected at 1387 m (4551 ft) (11°25'0.27" S, 74°46'8.69" W) on 8 July 2011 (MUSM 40617, female). Specimens were euthanized using standard methods, and later positively identified using available descriptions on the literature (Tate 1931, Pine 1981) and comparisons with photographs of the holotype. The external measurements (in mm) and weight of the specimens are: Total length 224, 242; Length of tail 130, 137; Length of foot 17, 16; Length of ear 20, 20 and Weight 17, 27 g, respectively (Table 1). Tissue sample (ear) associated with MUSM 40617 was preserved in 90% alcohol. Whole specimens were prepared as dry specimens with skull removed with carcasses fixed in 10% formalin, and later preserved in 70% alcohol, and deposited in the Museo de Historia Natural of the Universidad Nacional Mayor de San Marcos, Peru (MUSM 40616 and 40617).

Morphological description of *Marmosops juninensis*: The morphology of the two female specimens (MUSM 40616; MUSM 40617) corresponds to that described for the holotype by Tate (1931) and Pine (1981), to the characteristics mentioned by Voss *et al.* (2001) and to the additional observations in AMNH 63864 (Type), and AMNH 230014 - 230016. The specimens present a dark circumocular mask, pale supraocular absent. The dorsal pelage is Color 34 Russet, darker in the midline of the dorsum, sides coloration is Color 33 Cinnamon-Brown. The ventral pelage has a midventral strip self-colored white hairs with base of Color 83 Dark Neutral Gray only on the sides (Voss *et al.* 2001; Gardner and Creighton 2008) (The color codes follow Smithe, 1975). The inguinal region has Tawny hairs in, as described by Tate (1931). The carpal and tarsal are dorsally covered by self-colored white hairs that do not contrast with the color of digits' hairs (Figure 2). The forearm has two cubital antebrachial vibrissae, one distal and one proximal medial antebrachial vibrissae (Figure 2C). The lateral carpal tubercle is present

and not spoon-shaped in observed male specimens (AMNH 230014, 230016) (Voss *et al.* 2001; Gardner and Creighton 2008).

The skull is short (Tate 1931), the nasals are abruptly expanded at the maxillo-frontal suture and the muzzle is narrow (Figure 3), as described by Gardner and Creighton (2008). The lacrimal bone does not form large part of the anteroventral margin of the orbit so the lacrimal foramen does not perforate the orbital margin when they are exposed in lateral view (Figure 4A). This character was described by Voss *et al.* (2001: fig. 25A) for *Marmosops parvidens*. The subsquamosal foramen is anteroposteriorly elongated, exposing a large area of petrosal bone (Figure 4D), as described by Díaz *et al.* (2011: fig. 6.B) for *Marmosops handleyi*. Teeth are small (Tate 1931). The upper canine crowns are subequal in height to second premolar (Figure 4B) but larger in young specimens. A posterior accessory cusp of the upper canine is present, as described by Voss *et al.* (2001) and Voss and Jansa (2009) for *M. bishopi*. The palatine fenestrae are also present (Voss and Jansa, 2003; Gardner and Creighton 2008), long, with regular borders in the posterior palate and relatively posterior to M4 (Figure 5).

Distribution and natural history: According to Tate (1931) the holotype was registered in Utcuyacu locality; but since the elevation reported at 4800 ft (1463 m) does not coincide with the range elevation known for Utcuyacu nowadays, we accepted the type locality at 11°12'S, 75°28' W, following Vaurie (1972) and Pine (1981), although they did not mention the elevation. The other specimens (AMNH 230014–230016) of *Marmosops juninensis* reported by Voss *et al.* (2001) were captured at 21 km south from the type locality, and 35.41 km east of Tarma, at 7000 ft to 7600 ft (2133 to 2316 m) without additional data about the coordinates (American Museum of Natural History, 2013). Finally, our specimens reported from San Antonio locality in Pampa Hermosa district (Figure 1) extend the

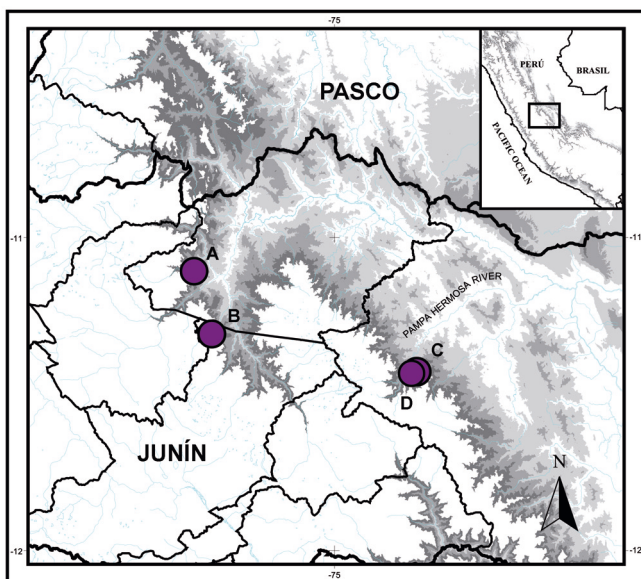


FIGURE 1. Collecting localities of *Marmosops juninensis* in Peru, Junín department. (A) Utcuyacu between Tarma and Chanchamayo; 11°12' S, 75°28' W (Type Locality); (B) 35.41 km east of Tarma; (C) San Antonio, near to the Pampa Hermosa River; 11°24'55.95" S, 74°46'8.21" W and (D) San Antonio, near to Pampa Hermosa River; 11°25'0.27" S, 74°46'8.69" W. Light-gray shaded regions are localities between 1000-1500 m, gray shaded regions are localities between 1500-2000 m and dark-gray shaded regions are localities between 2000-2500 m.

range distribution to 83 km east of the type locality and provide a lower locality (1387 m), more than 700 m lower of the last report.

Habitat: The specific habitats correspond to tropical premontane rain forest (TP-rf) life zone (Holdridge 1967), which is characterized by an average temperature of 24 to 25°C, and annual rainfall of over 6,000-7,000 mm (Onern, 1976). Specimens were collected in dry season, with a daily range of temperatures of 18 to 28°C on the collection days. Both specimens of *M. juninensis* were caught in traps on the ground in both collection sites. The microhabitat of the first specimen (MUSM 40616) was primary growth forest with dense understory, ferns, woody shrubs, and litter depth of less than 4 cm (Figure 6). The trees had an



FIGURE 2. External appearance of *Marmosops juninensis* (MUSM 40617): (A) dorsal view and (B) ventral view. Scale bar: 20 mm. Photo by M. Peralta. (C) Ventral view of right forelimb vibrissae of *Marmosops juninensis* (MUSM 40617). Note the absence of a lateral carpal tubercle that is sexually dimorphic in *Marmosops* spp. Distal medial antebrachial vibrissa (dav) and proximal medial antebrachial vibrissa (pav).

approximate canopy height of 10 m, and the dominant families were Melastomataceae, Rubiaceae, Araceae, Piperaceae, and Fabaceae. The microhabitat of the second specimen (MUSM 40617) included cultivated fields of coffee and banana with patches of maize plants dispersed within the coffee crop and surrounded by primary growth forest (Figure 6). The understory was open, with small herbaceous plants about 10 cm height, woody shrubs, and litter depth less than 3 cm; and the dominant families were Melastomataceae, Rubiaceae, Araceae, Piperaceae, Fabaceae, and Asteraceae

M. juninensis was collected in sympatry with *Marmosops* cf. *bishopi*, and the following Cricetid rodents: *Hylaeamys* cf. *yunganus*, *Neacomys* cf. *spinus*, *Akodon* cf. *aerosus*, *Oecomys* cf. *phaeotis*, *Oecomys* cf. *bicolor* and *Oligoryzomys andinus*, in traps mounted on the ground near burrows.

Conservation and Status: Because this species was captured at only one site from the total of seven sites



FIGURE 3. Dorsal, ventral and lateral views of cranium, and lateral view of the mandible of *Marmosops juninensis* (MUSM 40617). Scale is 10 mm.

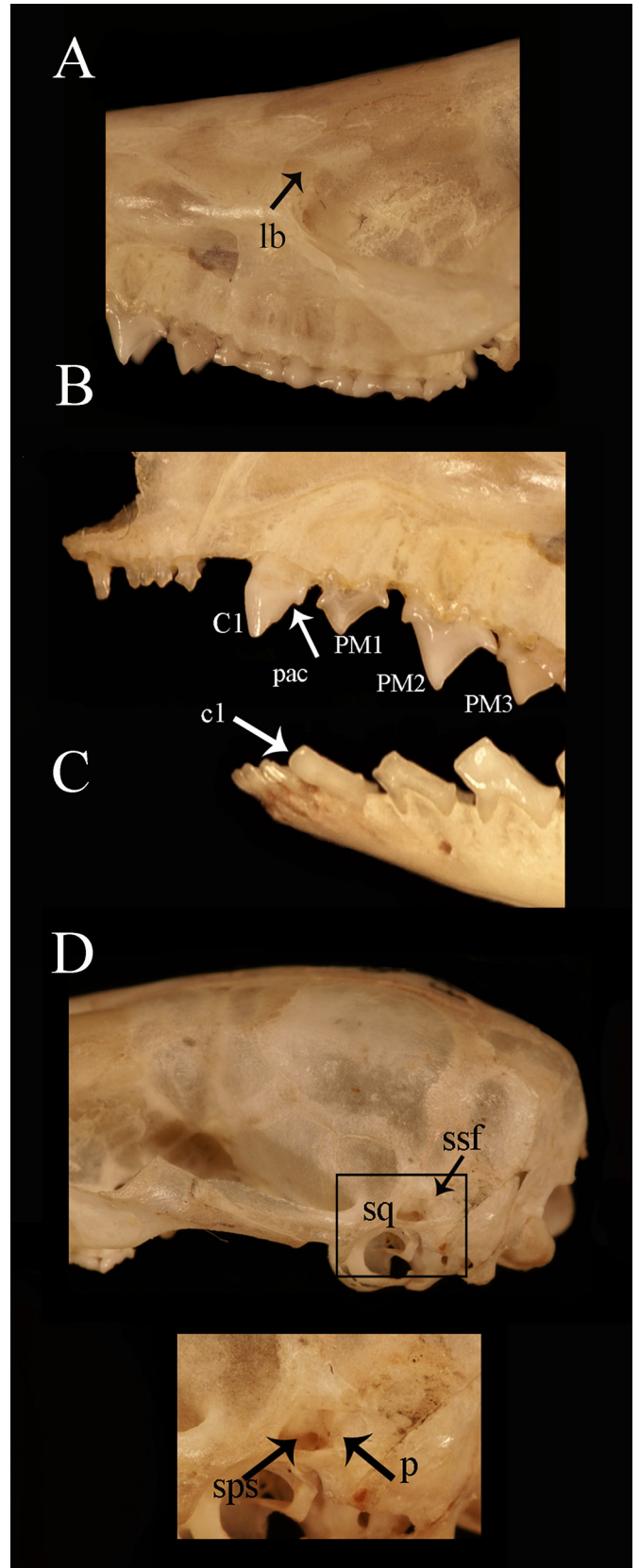


FIGURE 4. (A) Detail of the anterior orbital region (MUSM 40617) character described by Voss *et al.* (2001: fig. 25). Lacrimal bone (lb) does not form large part of the anteroventral margin of the orbit. (B) Left lateral view of maxilla, and (C) mandible of *Marmosops juninensis* (MUSM 40617). Left upper canine (C1) with posterior accessory cuspid (pac) and left inferior canine (c1) without an accessory cuspid. Note that the crown upper canines (C1) and the upper premolar 2 (PM2) have the same height. (D) Left lateral view of braincase and detail of subquamosal of *Marmosops juninensis* (MUSM 40617). The subquamosal foramen (ssf) is antero-posteriorly elongated that exposes a large area of the petrosal bone (p), character described by Díaz *et al.* (2011:fig. 6.B). Other abbreviations: squamosal (sq) and sulcus of prootic sinus (sps).

evaluated, and a yield of 2 specimens off 259 non-volant small mammals this species would be considered rare. Also, the specimens of *M. juninensis* registered during the fieldwork were only found in primary conserved forest (Figure 6) and in a small patch of cultivated field, both microhabitats crossing the Pampa Hermosa River from the road and far from the town of San Antonio. In contrast, the forest near the road was very fragmented with evident anthropogenic activities such as forestry and

human settlement that have reduced the montane forest dramatically in that area. Therefore, we consider this species is strongly related to primary forests. Currently, *M. juninensis* is considered as Vulnerable B1 ab (i, iii) following IUCN criteria (Pacheco *et al.* 2008); we propose that this species should be assigned to “Endangered” status under the criteria B2 ab (i, ii, iii), considering that the actual distribution area of *M. juninensis* appears to be less than 500 km².

TABLE 1. External and cranial measurements (in millimeters) of *Marmosops juninensis*.

CHARACTERS	AMNH 63864*	AMNH 230014 ^c	AMNH 230015 ^c	AMNH 230016 ^c	MUSM 40616	MUSM 40617
Total length	246.0 ^b	(140.0)	218.0	233.0	224.0	241.5
Length of head and body	(110.0) ^a	-	96.0	98.0	94.0	104.5
Length of tail	129.0 ^b	(51.0)	122.0	135.0	130.0	137.0
Length of hind foot	17.5 ^a	16.0	14.0	18.0	16.5	16.0
Length of ear	-	21.0	17.0	20.0	19.5	20.0
Palatal length	14.9 ^b	-	-	-	14.2	14.7
Greatest nasal length	13.2 ^b	-	-	-	12.7	12.4
Zygomatic breadth	14.4 ^a , 14.2 ^b	-	-	-	13.4	14.5
Interorbital constriction	5.4 ^b	-	-	-	5.9	5.8
Postorbital constriction	7.0 ^b	-	-	-	6.1	6.1
Length of M1-3	5.2 ^a	-	-	-	5.3	5.3
Mandibular depth	2.1 ^b	-	-	-	2.3	2.6
Mandibular tooththrow	13.3 ^b	-	-	-	12.1	12.3
Maxillary tooththrow	11.4 ^b	-	-	-	10.9	11.2
M1-M3	5.0 ^b	-	-	-	5.3	5.2
M1-M4	5.8 ^b	-	-	-	6.0	5.7
M3-M3	8.2 ^b	-	-	-	8.0	8.5
Weight	-	-	-	-	16.5	26.8

^a Measurement taken by Tate (1931), ^b measurements taken by Pine (1981), and ^c measurements taken of http://entheros.amnh.org/db/emuwebamnh/ResultsList.php?value1=Marmosops&column1=IdeCurrentGenusLocal&value2=juninensis&column2=IdeCurrentSpeciesLocal&value3=&column3=BioSiteBioSiteCountryLocal&value4=&column4=CatPreps_tab&pagelength=25&page=1&sortedcolumn=CatNumCatNumber&submit=Submit. (Captured on 12 October 2012). * Type specimen.

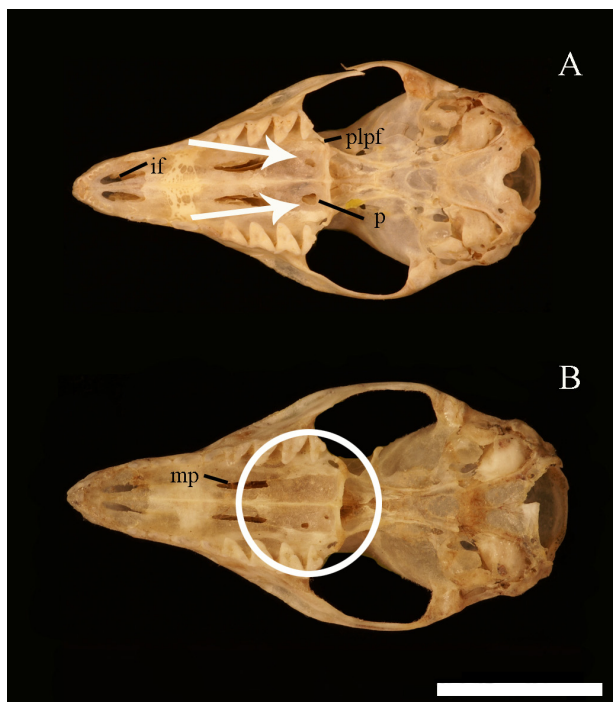


FIGURE 5. Palatal morphology in *Marmosops juninensis* (MUSM 40617) (A) and *Marmosops bishopi* (MUSM 30073) (B) showing species differences in patterns of fenestration. Both, *M. juninensis* and *M. bishopi* have incisive foramina (if), posterolateral palatal foramina (plpf) and maxillopalatine fenestrae (mp). Palatine fenestrae (p), however is present only in *M. juninensis*. Scale equal 5 mm.



FIGURE 6. Habitat in San Antonio locality, Junín Department, Peru, where *Marmosops juninensis* was collected in our study: (a) Coffee and banana plantations and (b) Mountain forest. Photograph by M. Peralta.

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