



## **On a New Species of Titi Monkey, Genus Callicebus Thomas (Primates, Pitheciidae), from Western Bolivia with Preliminary Notes on Distribution and Abundance**

Authors: Wallace, Robert B., Gómez, Humberto, Felton, Annika, and Felton, Adam M.

Source: Primate Conservation, 2006(20) : 29-39

Published By: Conservation International

URL: <https://doi.org/10.1896/0898-6207.20.1.29>

---

BioOne Complete ([complete.BioOne.org](http://complete.BioOne.org)) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at [www.bioone.org/terms-of-use](http://www.bioone.org/terms-of-use).

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

---

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

# On a New Species of Titi Monkey, Genus *Callicebus* Thomas (Primates, Pitheciidae), from Western Bolivia with Preliminary Notes on Distribution and Abundance

Robert. B. Wallace<sup>1</sup>, Humberto Gómez<sup>2</sup>, Annika Felton<sup>3</sup> and Adam M. Felton<sup>3</sup>

<sup>1</sup>Wildlife Conservation Society – Bolivia, La Paz, Bolivia

<sup>2</sup>Wildlife Conservation Society, Greater Madidi Landscape Conservation Program, La Paz, Bolivia

<sup>3</sup>Centre for Resource and Environmental Studies, Australian National University, Canberra, ACT, Australia

**Abstract:** This paper describes a new species of titi monkey, *Callicebus aureipalatii*, recently discovered in the Madidi protected area of northwestern Bolivia. Descriptions are based on observations, photographs and video material, and the subsequent collection of two specimens. Preliminary surveys and notes on habitat associations indicate that *C. aureipalatii* is limited in distribution to the western side of the Río Beni. It is found in the Andean foothills and immediately adjacent lowland forests. Line transect studies at four sites and subsequent extrapolations based on available suitable habitat suggest that population densities are sufficiently high to ensure the protection of this species within the confines of the Madidi protected area. This finding is discussed with reference to the general lack of knowledge regarding titi monkey distributions in Bolivia.

**Resumen:** Este artículo describe una nueva especie de mono tití, *Callicebus aureipalatii*, recientemente descubierto en el área protegida Madidi en el noroeste de Bolivia. Las descripciones están basada en observaciones, fotografías y video, y la colección resultante de dos especímenes. Evaluaciones preliminares y notas sobre uso de hábitat indican que *C. aureipalatii* tiene una distribución limitada al oeste del Río Beni. Se encuentra en el pie de monte andino y el bosque de tierras bajas adyacente. Estudios de transectas lineales en cuatro sitios y subsecuentes extrapolaciones basadas en cantidad de hábitat disponible, sugieren que las densidades de población son suficientemente altas para asegurar la protección de esta especie dentro de los límites del área protegida Madidi. Este descubrimiento es discutido en referencia a la falta de conocimiento general sobre la distribución de los monos tití en Bolivia.

**Key Words:** Primates, Madidi, Amazonia, neotropics, river boundaries

## Introduction

Neotropical primate taxonomy is constantly changing, with the regular discovery of new taxa (Ayres 1985; Ferrari and Lopes 1992; Mittermeier *et al.* 1992; Silva and Noronha 1998; Van Roosmalen *et al.* 1998; Ferrari *et al.* 1999; Kobayashi and Langguth 1999; Van Roosmalen *et al.* 2000, 2002). The use of morphological, genetic, and molecular data is also revealing important differences between populations previously thought homogenous; for example, *Alouatta sara* (Stanyon *et al.* 1995). The most recent review of the Platyrrhini (Rylands *et al.* 2000) argued that for conservation purposes it is preferable to adopt a “splitting” approach to formal taxonomy to ensure that all possible taxa are accounted for in associated action plans. This approach has been particularly relevant to the smaller and extremely diverse neotropical taxa such as the Amazonian marmosets (*Mico*, formally *Callicebus*), the ranges of which are often delineated by the larger Amazonian tributaries (Van Roosmalen *et al.* 1998, 2000).

A recent taxonomic review of the titi monkeys (*Callicebus*) resulted in a list of 28 species (Van Roosmalen *et al.* 2002). It drew on previous efforts over the last 15 years (Hershkovitz 1988, 1990; Kobayashi and Langguth 1999; Groves 2001), introduced two new taxa, and argued that river barriers (Ayres and Clutton-Brock 1992) are a major cause of speciation for this genus. Titi monkeys are small primates (c.1 kg), are unable to swim, and apparently visit flooded forests only during high waters (Van Roosmalen *et al.* 2002).

Until recently the northern part of the La Paz Department, Bolivia, was relatively unexplored with very little biological information available for the region. Current information, nevertheless, suggests that Madidi is the most biologically diverse terrestrial protected area in the world (Remsen and Parker 1995; CARE/WCS/IE/SERNAP 2003). For example, over 900 bird species have already been registered within the park despite large areas never having been visited by biologists (CARE/WCS/IE/SERNAP 2003). Furthermore, in

recent years western Bolivia has provided a series of range extensions for rare or threatened species (Gottdenker *et al.* 2001; Tarifa *et al.* 2001; Hennessey 2002a), new Bolivian records (Hennessey and Gómez 2003; Rios *et al.* 2004), as well as vertebrate species potentially new to science (Wallace and Painter 1999; Hennessey 2002b). In this paper we describe a new species of titi monkey found in the Madidi protected area and surrounding lowlands in northwestern Bolivia, and provide preliminary information regarding its distribution and ecology.

## Methods

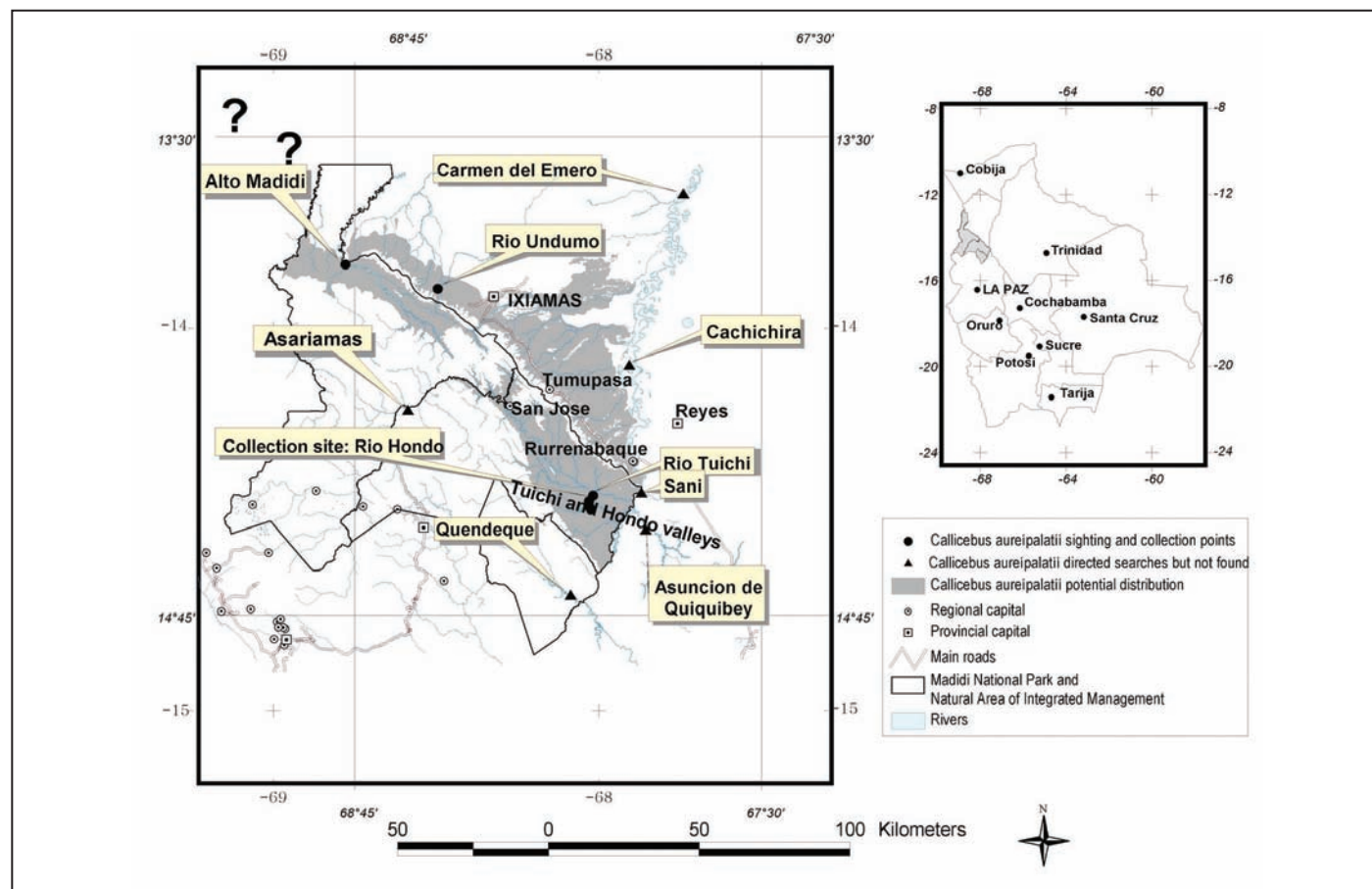
### Species description

In August and September 2002 we filmed and photographed five groups of an unidentified *Callicebus* in the Tuichi Valley. This material provided sufficient evidence to justify the collection of a type specimen in February 2003. A description was then made using two specimens collected

along the Río Hondo within the Natural Area of Integrated Management section of the Madidi protected area in northern La Paz Department, Bolivia, as well as video and photographic footage from groups in the Tuichi and Hondo valleys and the Alto Madidi site farther north (Fig. 1). The specimens were deposited in the Colección Boliviana de Fauna, part of the Museo Nacional de Historia Natural based in La Paz, Bolivia.

### Distribution

Distributional information on the titi monkey was gathered from observations collected during general mammalian biodiversity surveys conducted in the northern La Paz region between 1999 and 2004. Six sites were surveyed (Fig. 1); Río Hondo (14°37'30"S, 67°43'06"W), Río Tuichi (14°33'10"S, 67°43'19"W), Río Quendeque (14°59'14"S, 67°46'59"W) Río Undumo (13°44'22"S, 68°21'42"W), the Asariamas region (14°12'38"S, 68°30'05"W), and Alto Madidi region (13°37'18" S, 68°44'33"W).



**Figure 1.** Known and hypothetical *C. aureipalatii* distribution in northern La Paz Department, Bolivia.

**Table 1.** Sampling effort and relative abundance of *C. aureipalatii* at four sites in western Bolivia.

Study site	Trail (km)	Transect (km)	Total # sightings	Groups per 10 km	Individuals per 10 km	Average group size
Río Hondo	31.1	172.8	10	0.97	1.73	3 ±0.8
Río Tuichi	20.9	130.1	7	0.41	1.48	2.75 ±0.96
Río Undumo	20.4	102.0	6	0.60	1.35	2.3 ±1.2
Alto Madidi	16.8	144.6	7	0.48	1.25	3 ±0.2

We also conducted a literature search for the region to identify possible locations for the species, as well as directed searches for *Callicebus* at six sites (Fig. 1): the eastern and western sides of the Río Beni at Cachichira and Carmen del Emero, and Asunción del Quiquibey and Sani in the Pílon Lajas Biosphere Reserve and Indigenous Territory on the western side of the Río Beni.

#### *Density and habitat preferences*

Line transect methodologies were employed to survey the Río Undumo, Asariammas, Río Tuichi, Río Quendeque, Alto Madidi, and Río Hondo sites (Gómez *et al.* 2001, 2003; Ríos *et al.* 2001). Diurnal transects were typically run by two observers in fair weather conditions between 06:00 and 11:30 and from 15:00 to 18:00, along trails newly cut by the survey team. Transect speed ranged from 1–2 km per hour and depended on trail conditions and associated noise levels. Periods of walking were regularly interspersed with brief “listening stops” to increase the probability of detecting more cryptic species. The following information was recorded for all primates encountered: species, group size (and where possible age/sex composition), date and time detected, observation duration, transect position, habitat type, and the perpendicular distance from the transect trail to the estimated geometric center of the group. Trail and transect effort are detailed in Table 1. Results were analyzed using DISTANCE techniques and accompanying software (Thomas *et al.* 2001).

#### *Callicebus aureipalatii* sp. nov.

**Holotype:** Adult male, skin, skull and complete skeleton (CBF7511, Collectors: Robert Wallace, Rodolfo Nallar, Jesús Martínez, Fortunato Espinoza, Lucio Ocampo and Remberto Chiguapuri, 2003). Colección Boliviana de Fauna, Museo Nacional de Historial Natural, La Paz, Bolivia. Collected 27 February 2003 on the northern bank of the Río Hondo (14°37'59"W, 67°42'27"S).

**Paratype:** Adult female, skin, skull and complete skeleton (CBF7510, Collectors: Robert Wallace, Rodolfo Nallar, Jesús Martínez, Fortunato Espinoza, Lucio Ocampo and Remberto Chiguapuri, 2003). Colección Boliviana de Fauna, Museo Nacional de Historial Natural, La Paz, Bolivia. Collected 25 February 2003 on the southern bank of the Río Hondo (14°38'23"W, 67°42'27"S).

**Type locality:** Campamento Roco Roco, Río Hondo, Madidi National Park and Natural Area of Integrated Management, La Paz Department, Bolivia (14°37'30"S, 67°43'06"W).

**Diagnosis:** A species of the *C. moloch* group (*sensu* Hershkovitz 1990; Groves 2001) as defined according to broad distributional and physical characteristics. Using the Van Roosmalen *et al.* (2002) classification, this new species shows physical similarities with the *C. cupreus* group (crown and cheiridia dominated by pheomelanin hair pigments, orange



**Figure 2.** The Madidi titi monkey, *Callicebus aureipalatii* sp. nov. Illustration by Annika Felton.

ventrally sharply contrasting with agouti body coloration, cheiridia reddish), however, available information on distribution suggests it borders *C. brunneus* (a member of the *C. moloch* group according to Van Roosmalen *et al.* 2002) to the north. This species is distinguished by a golden crown due to golden tipped hairs with dark longer base, dark forehead with slightly less golden coloration; deep orange throat and ventral area; deep orange burgundy limbs from elbow and knees to hands and feet; dark tail with clear paler whitish tip (Figs. 2–6). Distinguished from *C. brunneus* by a distinct golden coloration on the crown, deep orange throat coloration; sharply contrasting sideburns and underside, and orange to burgundy cheiridia; from *C. cupreus* by a distinct golden coloration on the crown and deep orange throat coloration, and from *C. dubius* by a distinct golden coloration on the crown, deep orange throat coloration, and lack of the white forehead stripe. *C. olallae*, *C. modestus*, and *C. donacophilus*, all members of the *C. donacophilus* species group (Van Roosmalen *et al.* 2002) and found exclusively on the eastern side of the Río Beni, display clear white ear tufts and are characterized by a uniform dorsal and lateral body color. These taxa lack differential crown coloration and contrasting lateral coloration on the limbs, and are characterized by a uniformly colored tail with no obvious white tip.

**External characteristics of holotype:** Dorsal and lateral body to neck, lateral forelimbs to elbow and lateral hind-limbs to knee light brown non-uniform color due to agouti-banded hairs that are grey brown at the basal half, then changing to banded grey brown with lighter brown, and ending in a light brown tip. Laterally, forelimbs and hind limbs from elbows and knees colors gradually change to deep orange burgundy



**Figure 3.** *C. aureipalatii*, new species. Views of the male holotype (CBF7511). Photographs by R. B. Wallace.



**Figure 4.** *C. aureipalatii*, new species. Views of the male holotype (CBF7511). Photographs by R. B. Wallace.



Figure 5. Details of the adult male holotype *C. aureipalatii* (CBF7511): a. tail and hind feet, b. hind legs, c. hind foot. Photographs by R. B. Wallace.

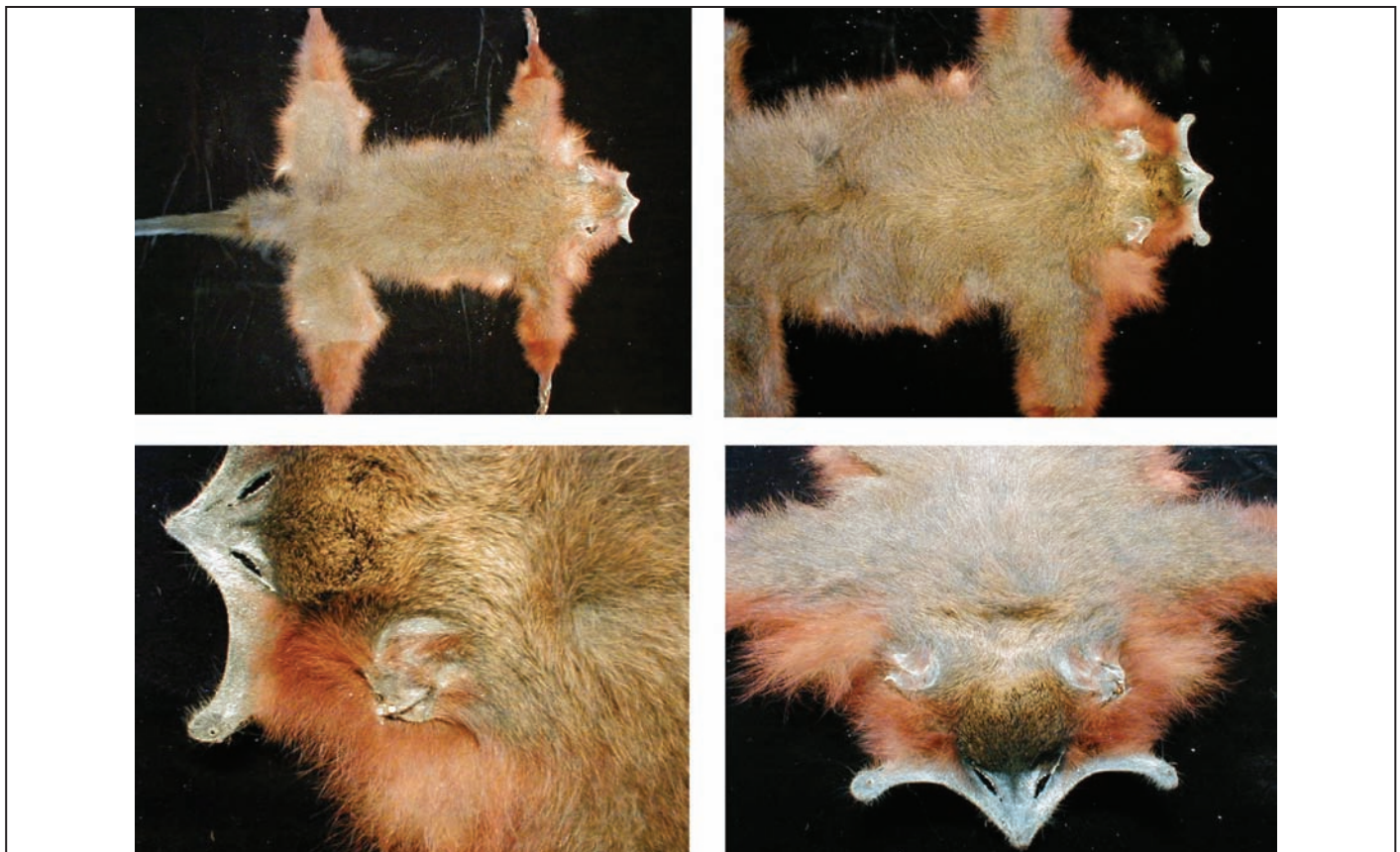


Figure 6. Dorsal views of the adult male holotype of *C. aureipalatii* (CBF7511). Photographs by H. Gómez.

through initial mixing of orange hairs. At hands color change becomes more definite to a deep burgundy and these hairs lightly cover hands dorsally. Feet very thickly covered with dark burgundy colored hair. Body ventrally pale orange largely due to low hair density. Hair density increases from groin area toward abdominal and chest regions, considerably denser at neck. Ventral hairs are a deep orange color that deepens as hair density increases and extends to cheek regions as far as the base of the ear. Forelimbs and hind limbs ventrally the same orange color as far as the feet where the color deepens slightly in the hands and more strikingly in the feet. Tail brown to black dorsally, paler black to light brown ventrally with banded hairs (pale base and dark tip). Tip of tail clearly whitish pale with white hairs at very tip (female specimen hairs *c.*52 mm long and male specimen *c.*81 mm). Crown extending to an area just above ears shows clearly defined golden tipped *c.*16 mm hairs that are banded in dark and light brown phases at the base with a *c.*4.5 mm golden tip. Forehead appears slightly darker due to shorter hairs (*c.*9.5 mm) with smaller golden portions. No clear line distinguishing crown area. Facial skin black with a few whitish hairs in the nasal region; whiskers and eyebrows black; paler ears with hairs on tops of ears golden tipped and hair around ear orange; pupils black and irises coffee colored. During transect observations, filming and collection activities in more than 15 different social groups only one animal

showed variation to the holotype description above, being slightly paler.

**Measurements:** See Tables 2 and 3.

**Etymology:** This species is named *Callicebus aureipalatii* in recognition of a major financial contribution from Golden-Palace.com to FUNDES NAP (Foundation for the Development of the National Protected Area System). This funding will go exclusively toward the long-term conservation of the Madidi National Park and Natural Integrated Management Area where the species was discovered.

**Table 2.** Measurements (in mm) of specimens of *C. aureipalatii*.

Measurement	Adult male	Adult female
Head and body (mm)	817	800
Tail (mm)	524	480
Hind foot (mm)	102	93
Ear (mm)	36	33
Weight (gm)	1,000	900
Neck circumference (mm)	90	90
Hind leg (mm)	249	247
Fore leg (mm)	207	212
Testicles (mm)	15 × 11 (both)	



**Figure 7.** Skull of the adult male holotype of *C. aureipalatii* (CBF7511), and mandibles of the male holotype and female paratype (CBF7510). Note variation in the coronoidal forms of male (right) and female (left) mandibles. Photographs by R. B. Wallace and H. Gómez.

**Table 3.** Cranial and dental measurements (mm) of two specimens of *C. aureipalatii* following Kobayashi (1995).

Cranial measurements	Adult male	Adult female
Nasion – Rhinion	8.20	10.33
Rhinion – Prosthion	13.43	11.70
Nasion – Prosthion	20.44	22.49
Left maxillofrontale – Right maxillofrontale	3.48	
Left frontomolare orbitale – Right frontomolare orbitale	29.08	
Left zygomaxillare superior – Right zygomaxillare superior	24.75	
Left frontomolare orbitale – Left zygomaxillare superior	13.10	12.52
Left zygomaxillare superior – Left zygomaxillare inferior	13.47	15.06
Greatest width across outer margins of orbit	34.28	
Left zygion – Right zygion	39.28	
Greatest width across narrowest part in postorbital portion	29.31	
Left euryon – Right euryon	33.80	33.71
Prosthion – Bregma	48.32	47.82
Nasion – Bregma	31.49	28.74
Bregma – Lambda	25.76	26.24
Prosthion – Lambda	61.94	62.66
Basion – Bregma	31.37	31.62
Left zygomaxillare inferior – Right zygomaxillare inferior	29.43	
Left kondilion laterale – Right kondilion laterale	32.74	
Left koronion – Right koronion	33.87	
Infradentale – Left kondilion laterale	40.78	41.42
Infradentale – Gnathion	11.79	
Greatest length between left koronion and base of mandibular	35.66	36.82
<b>Dental measurements</b>		
PM3–M3	16.65	-
I–M3	24.45	-
PM3–M3	16.10	16.40
M1–M3	9.25	8.95
I2–I2	9.80	-
C1–C1	13.60	-
M1–M1	18.35	-
M3–M3	18.55	-

**Vernacular Name:** This species is locally known by the generic names for titi monkeys in the region—luca luca or lucachi. The company GoldenPalace.com refers to the monkey as the GoldenPalace.com monkey, and other English names currently in use include the golden palace monkey and the Madidi titi monkey.

**Geographic Distribution:** *Callicebus aureipalatii* was present at four of the line transect survey sites: Río Tuichi, Río Hondo, Alto Madidi, and Río Undumo (see Fig. 1). The literature review revealed a further 15 sites in the immediate vicinity of the known distribution where an unidentified *Callicebus* had been registered: Chalalán, Tumupasa, Capaina, Buena Vista, Santa Fe, Carmen Pecha, Bella Altura, Napashi, Santa Rosa de Maravilla, Altamarani, San Antonio de Tequeje, Carmen del Emero, Esperanza de Enapurera,

**Figure 8.** *Callicebus* specimen from Los Amigos, southern Peru. Photograph by Jenna Lawrence.

Tres Hermanos, and Cachichira (Sarmiento *et al.* 2001; CIPTA/WCS, unpubl. data). According to our surveys, *Callicebus aureipalatii* is found exclusively on the western side of the Río Beni, a major tributary of the Amazon and one of the largest rivers in Bolivia. The known and hypothetical distribution of this species is shown in Figure 1. In addition, literature and structured informal interviews with local indigenous communities along the Río Quiquibey suggest that the genus *Callicebus* is now absent from most of the Pilon Lajas Biosphere Reserve and Indigenous Territory (Barrera *et al.* 1994; Rumiz and Townsend 1999) apparently wiped out because of its use as fishing bait (Ascensión de Quiquibey, pers. comm.). Nevertheless, a group of unidentified *Callicebus* monkeys were heard calling in the Sani vicinity (14°35'41"W, 67°29'47"S) of Pilon Lajas in March 2003 (F. Espinoza, pers. comm.).

**Habitat:** The Río Tuichi and Río Hondo valleys are adjacent tributaries of the Río Beni and are enclosed by the last foothills of the Andes in northwestern Bolivia. The region is characterized by a marked dry season between April and November with annual precipitation of approximately 2,230 mm. Vegetation appears similar to that of the Beni alluvial plain forests found at the base of the Andes in this region. The forest is characterized by relatively open canopies with a large proportion of palms such as *Iriartea deltoidea*, *Scheelea princeps*, *Astrocaryum* sp., *Socratea exorrhiza*, and *Jessenia*, as well as large emergent and canopy tree species such as *Ceiba pentandra*, *Sterculia* sp., *Cabrlea canjerana*, *Rinorea viridifolia*, *Pseudolmedia* sp., and *Pentaplaris davidsmithii* (Flores *et al.* 2002; pers. obs.). *Callicebus aureipalatii* has been observed in the lowland plain forests of the Río Tuichi and Río Hondo valleys and the Alto Madidi lowlands, as well as the piedmont or foothill forests of the region in the



Río Tuichi, Río Hondo, Alto Madidi, and Río Undumo study sites. Sightings to date are altitudinally distributed between 200 and 500 m a.s.l., although surveys are lacking in the humid tropical forests between 500 and 1,000 m a.s.l. that might be suitable habitat for *Callicebus*. Based on distributional and habitat use data we used a simple GIS model using habitat type, potential river boundaries, and elevation to provide a preliminary estimation of potential habitat for *C. aureipalatii* (Fig. 1). A total of 4,256 km<sup>2</sup> were estimated to be suitable using this model.

**Relative abundance and density:** Relative abundance data for the four sample sites are presented in Table 1. In general, there is a little variation across the transect survey sites where titi monkeys were recorded. It is worth mentioning that an examination of the data suggests a fairly localized distribution across wide areas at these survey sites. Overall mean and modal group size was three (mean: SE 0.19). Distance sampling analysis of 902 km of line transect data from the Río Hondo, Río Tuichi, Alto Madidi, and Río Undumo study sites revealed an overall density of 6.2 animals/km<sup>2</sup> (Hazard Rate Model;  $n = 33$  transect sightings; 95% Confidence Limits: 2.7–14.2 animals/km<sup>2</sup>). These results combined with the habitat availability model provide a crude population estimate of around 26,400 animals (95% Confidence Limits: 11,491–60,435 animals).

## Discussion

The recent and comprehensive taxonomic review of the genus (Van Roosmalen *et al.* 2002) recognized 28 species. Hershkovitz (1988, 1990) emphasized that “primary differentiation among species and subspecies of *Callicebus* is in coat color,” and we suggest that the differences detailed herein for *C. aureipalatii* are sufficiently distinct from neighboring congeners (*C. brunneus*, *C. dubius*, *C. cupreus*, *C. donacophilus*, *C. modestus* and *C. ollalae*) that species status should be afforded.

This species represents the first new primate discovery for Bolivia in the last 60 years (Anderson, 1997). The populations described in this study were assumed to be of *C. brunneus* (Hershkovitz 1988; Emmons and Feer 1999) or *C. olallae* (Van Roosmalen *et al.* 2002). Van Roosmalen *et al.* (2002) made an error in the maps for the hypothesized populations of *C. olallae* and *C. modestus* that were depicted as occurring exclusively on the western side of the Río Beni. Both these species were actually collected on the eastern side of the Río Beni within 52 km of each other (Anderson 1997; see Figure 633, pp. 316; Hershkovitz 1990, see Figure 23, pp. 47; Felton *et al.* 2006) in the vicinity of the town of Santa Rosa in the Ballivian province.

Indeed, surveys conducted in 2002 by the research team confirmed the presence of titi monkeys fitting the description of both of these taxa in the Santa Rosa region (Felton *et al.* 2006) and, although the precise distributional situation of these taxa has yet to be resolved, available informa-

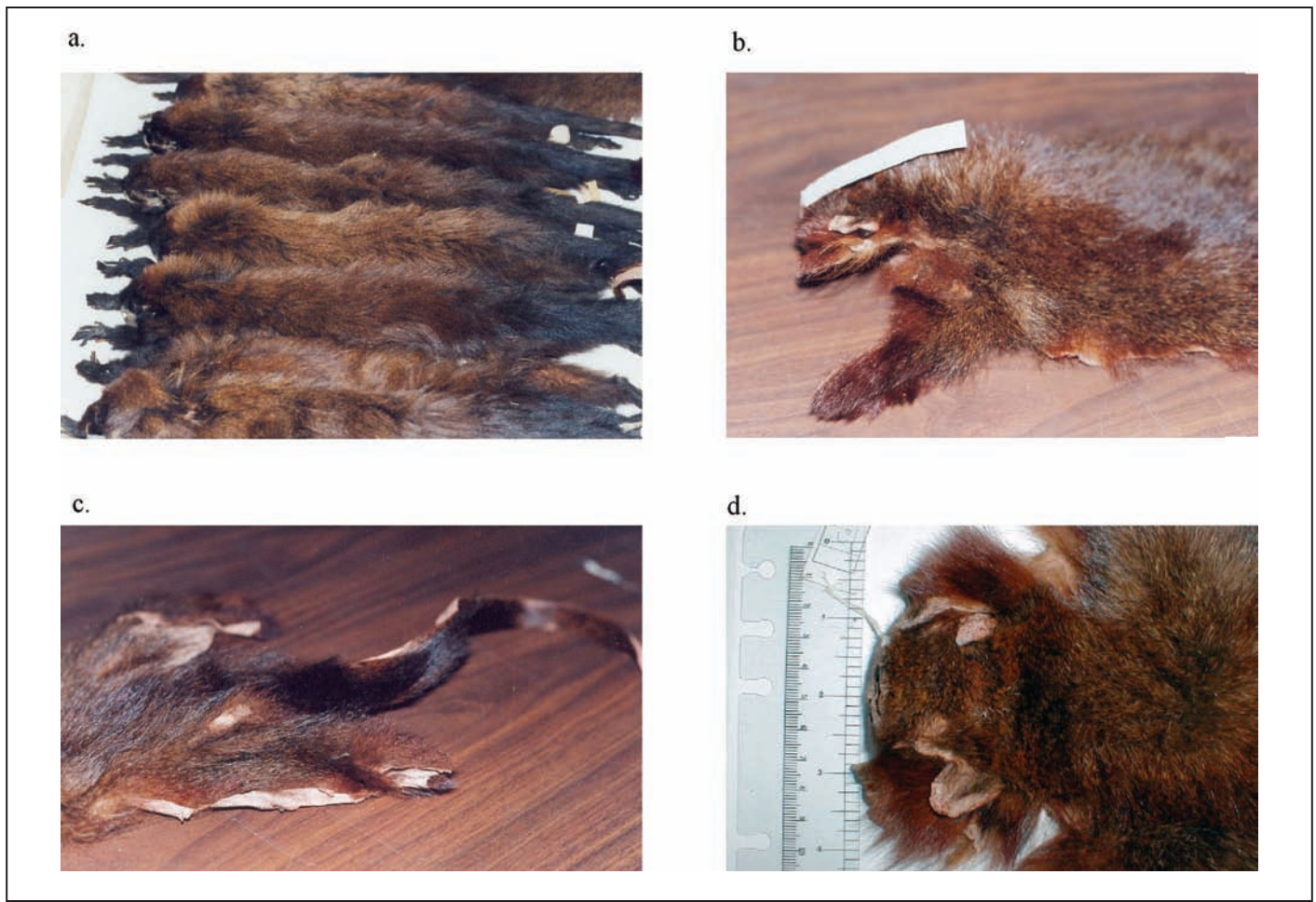
tion strongly suggests that they are confined to the eastern bank of the Río Beni (Martinez and Wallace unpubl. data). This study, therefore, further suggests the importance of rivers as distributional boundaries for the genus *Callicebus* and highlights the need for future surveys to focus on both sides of a given river. In this light, further investigation as to the identity of the Sani population, as well as structured informal interviews along the Palos Blancos–Yucumo–Rurrenabaque road would be critical in confirming the apparent absence of *Callicebus aureipalatii* on the eastern side of the Río Beni.

Data from southern Peru are scarce and surveys on both sides of the Río Heath are a priority in order to determine the western limit of this species’ range. The northern range limits for *C. aureipalatii* are currently unknown and we predict that they may reach as far as the southern bank of the Río Madre de Dios. Current knowledge indicates that *Callicebus aureipalatii* is distinct from populations north of the Madre de Dios, where animals do not display a golden crown or deep orange throat coloration. These populations have previously been considered to be *C. brunneus* (Hershkovitz 1988), although Van Roosmalen *et al.* (2002, see Figure 1, pp.5) classified them as *C. dubius*. Recent primate surveys in the Cobija region of Pando have photographed *Callicebus* displaying a white-tipped tail but with no golden crown, and Pando monkeys also lack the characteristic *C. dubius* white stripe across the forehead (Sandra Suarez, pers. comm., Noel Rowe, pers. comm.).

Film footage of titi monkeys from Los Amigos (12°34'15"W, 70°06'02"S), a northern tributary of the Madre de Dios in southern Peru (Nissen and Trolle, 2003), and photographic evidence from an uncollected specimen at the same site (J. Lawrence, unpubl. data; Fig. 8) lend further support to the hypothesis that *C. brunneus* extends into northern Bolivia and southern Peru (Hershkovitz 1988, 1990) and provides additional evidence that the new species described here is not found north of the Río Madre de Dios.

It is unclear whether *C. aureipalatii* belongs to the *cupreus* or *moloch* species groups as defined by Van Roosmalen *et al.* (2002), and genetic studies may be required to determine the correct lineage, particularly as *C. cupreus* has 46 diploid chromosomes and *C. brunneus* has 48 diploid chromosomes. Given the information that we have been able to gather regarding *Callicebus* populations immediately north of the Río Madre de Dios, it seems that the distribution maps detailed by Van Roosmalen *et al.* (2002) for *C. brunneus*, *C. dubius*, and *C. cupreus* may need to be broadly revised. Indeed the true status and distribution of *C. dubius* remains doubtful (Groves 1992, 2001).

Examination of relevant *Callicebus* specimens at the American Museum of Natural History in New York included one specimen (AMNH262650) purchased from a hunter in Chive (12°23'S, 68°35'W), a small town on the Río Madre de Dios at the border of the departments of La Paz and Pando and very close to neighboring Peru. It is unclear on which side of the Río Madre de Dios the specimen was collected and at the



**Figure 9.** Specimens examined at the American Museum of Natural History; a. *Callicebus brunneus* series from Brazil; b., c., d., dorsal views of specimen (AMNH262650) collected in Chive, Madre de Dios, Bolivia. Photographs R. B. Wallace and H. Gómez.

AMNH it is classified as *C. brunneus* despite being markedly different from the main *C. brunneus* series collected in Brazil. Although the specimen displays some broad similarities with *C. aureipalatii*, for example, the rufous coloration on the limbs and general body coloration, neither the orange throat coloration nor golden crown are evident (Fig. 9). In short, further research is required to determine the taxonomic status of *Callicebus* populations in Pando Department, Bolivia.

This finding, along with other recently published information (Wallace *et al.* 1996; Wallace and Painter 1999), underlines the poorly known status of Bolivian primate distributions. We suggest that a thorough review of *Callicebus* distribution in Bolivia is urgently required in order to assess the need for additional conservation measures. A GIS-based analysis of forest cover in the Beni and Pando departments of Bolivia, in conjunction with surveys on both sides of major rivers, might enable targeting of major blocks of forest for future investigation. The need for an examination of genetic material, particularly of the *C. modestus* and *C. olallae* populations (Felton *et al.* 2006), would also be a critical aspect of a thorough review.

The density estimate for *C. aureipalatii* is similar to the majority of estimates available in the literature for congeners (density ranges, 2.7–400 individuals per km<sup>2</sup>; Rob-

inson *et al.* 1987; Pinto *et al.* 1993; Peres 2000; Chiarello and de Melo 2001; Price *et al.* 2002). Although the density extrapolation across the known distribution is simplistic, the results strongly suggest that the conservation of a significant population of this primate is ensured within the confines of the Madidi protected area and its official five-kilometer-wide buffer zone. However, potential threats to the lowland portion of Madidi, including such as petroleum exploration and subsequent exploitation, hydroelectric programs, and planned road construction, will need to be monitored in the future with special attention given to this species.

#### Acknowledgments

The authors are grateful for the continued support of the Wildlife Conservation Society and the Gordon and Betty Moore Foundation. The Bolivian Protected Area Service (SERNAP) and the Madidi protected area administration kindly provided the due permits for the research. Specimen collection was facilitated through permission from the Dirección General de Biodiversidad. Fortunato Espinoza, Billy Cáceres, Charles Veitch, Lucio Ocampo, Jairo Cáceres, and Jasmani Cáceres assisted in the filming and photography of *Callicebus* across the region. Jesus Martinez and Rodolfo Nallar assisted in the

collection of the specimens. Line transect fieldwork was also assisted by Victor-Hugo Caceres, Hugo Aranibar, Boris Rios, Guido Ayala, Nisha Owen and Thomas Barbry. The manuscript was improved following comments from Colin Groves, Anthony Rylands, and an anonymous reviewer.

## Literature Cited

- Anderson, S. 1997. Mammals of Bolivia, taxonomy and distribution. *Bull. Am. Mus. Nat. Hist.* 231: 1–652.
- Ayres, J. M. 1985. On a new species of squirrel monkey, genus *Saimiri*, from Brazilian Amazonia (Primates, Cebidae). *Pap. Avuls. Zool., São Paulo* (36): 147–164.
- Ayres, J. M. and T. H. Clutton Brock. 1992. River boundaries and species range sizes in Amazonian primates. *Am. Nat.* 140(3): 531–537.
- Barrera, S., J. F. Guerra, F. Osorio, J. Sarmiento and L. Vilalba. 1994. Territorio Indígena Reserva de la Biosfera Pilon Lajas: Reconocimiento Preliminar de la Fauna. Unpublished report, Colección Boliviana de Fauna, Instituto de Ecología (Limnología) and Veterinarios Sin Fronteras, La Paz, Bolivia.
- CARE/WCS/IE/SERNAP. 2003. Madidi de Bolivia, Magico, Unico y Nuestro. CD-ROM. Digifilms, La Paz, Bolivia.
- Chiarello, A. G. and F. R. de Melo. 2001. Primate population densities and sizes in Atlantic forest remnants of northern Espírito Santo, Brazil. *Int. J. Primatol.* 22(3): 379–396.
- Emmons, L. H. and F. Feer. 1999. *Neotropical Rainforest mammals: A Field Guide*. The University of Chicago Press, Chicago.
- Felton, A., A. M. Felton, R. B. Wallace and H. Gómez. 2006. Identification, distribution and behavioral observations of the titi monkeys *Callicebus modestus* Lönnberg, 1939 and *Callicebus olallae* Lönnberg, 1939. *Primate Conserv.* (20): 41–46.
- Ferrari, S. F. and M. A. Lopes. 1992. A new species of marmoset, genus *Callithrix* Erxleben 1777 (Callitrichidae, Primates) from western Brazilian Amazon. *Goeldiana Zoologia* (12): 1–3.
- Ferrari, S. F., L. Sena and M. P. C. Schneider. 1999. Definition of a new species of marmoset (Primates: Callitrichinae) from southwestern Amazonia based on molecular, ecological, and zoogeographic evidence. In: *Livro de Resumos, IX Congresso Brasileiro de Primatologia*, pp.80–81. Sociedade Brasileira de Primatologia, Santa Teresa, Espírito Santo, Brazil, 25–30 July 1999.
- Flores B., J. G., C. Batte B. and J. Dapara. 2002. Caracterización de la vegetación del Río Undumo y su importancia para la conservación de la fauna silvestre. *Ecología en Bolivia* 37(1): 23–45.
- Gómez, H., R. B. Wallace and C. Veitch. 2001. Diversidad y abundancia de mamíferos medianos y grandes en el nordeste del área de influencia del Parque Nacional Madidi durante la época húmeda. *Ecología en Bolivia* 36: 17–29.
- Gómez, H., R. B. Wallace, G. Ayala and F. Espinoza. 2003. Densidad de la ardilla roja amazónica (Familia Sciuridae, *Sciurus spadiceus*) en el valle del río Tuichi (Parque Nacional y Área Natural de Manejo Integrado Madidi, La Paz, Bolivia). *Ecología en Bolivia* 38: 79–88.
- Gottdenker, N., R. B. Wallace and H. Gómez. 2001. La importancia de los atropellos para la ecología y conservación: *Dinomys branickii*, un ejemplo de Bolivia. *Ecología en Bolivia*, 35: 61–67.
- Groves, C. P. 1992. Book Review: Titis, New World monkeys of the genus *Callicebus* (Cebidae, Platyrrhini): A preliminary taxonomic review. *Fieldiana Zool., New Series* (55): 1–109. *Int. J. Primatol.* 13(1): 111–112.
- Groves, C. P. 2001. *Primate Taxonomy*. Smithsonian Institution Press, Washington, DC.
- Hennessey, A. B. 2002a. Red Data Bird – Wattled Curassow. *World Bird Watch* 24(2): 30–31.
- Hennessey, A. B. 2002b. First Bolivian observation of Swallow-tailed Cotinga *Phibalura flavirostris boliviana* in 98 years. *Cotinga* (17): 54–55.
- Hennessey, A. B. and M. I. Gómez. 2003. Four bird species new to Bolivia: An ornithological survey of the yungas site Tokoaque, Madidi National Park. *Cotinga* (19): 25–33.
- Hershkovitz, P. 1988. Origin, speciation dispersal of South American titi monkeys, genus *Callicebus* (family Cebidae, Platyrrhini). *Proc. Acad. Nat. Sci. Philadelphia* 140(1): 240–272.
- Hershkovitz, P. 1990. Titis, New World monkeys of the genus *Callicebus* (Cebidae, Platyrrhini): A preliminary taxonomic review. *Fieldiana, Zoology, New Series* (55): 1–109.
- Kobayashi, S. 1995. A phylogenetic study of titi monkeys, genus *Callicebus*, based on cranial measurements: I. Phyletic groups of *Callicebus*. *Primates* 36(1): 101–120.
- Kobayashi, S., and A. Langguth. 1999. A new species of titi monkey, *Callicebus* Thomas, from north-eastern Brazil (Primates, Cebidae). *Rev. Bras. Zool.* 16(2): 531–551.
- Mittermeier, R. A., M. Schwarz and J. M. Ayres. 1992. A new species of marmoset, genus *Callithrix* Erxleben 1777 (Callitrichidae, Primates), from the Rio Maués region, state of Amazonas, Central Brazilian Amazon. *Goeldiana Zoologia* (14): 1–17.
- Nissen, T. and M. Trolle. 2003. Amazon Conservation Association Video Images of 2003. Amazon Conservation Association, Washington, DC.
- Peres, C. A. 2000. Evaluating the impact and sustainability of subsistence hunting at multiple Amazonian forest sites. In: *Hunting for Sustainability in Tropical Forests*, J. G. Robinson and E. L. Bennett (eds.), pp.31–56. Columbia University Press, New York.
- Pinto, L. P. S., C. M. R. Costa, K. B. Strier and G. A. B. da Fonseca. 1993. Habitat, density and group size of primates in a Brazilian tropical forest. *Folia Primatol.* 61: 135–143.

- Price, E. C., H. M. Piedade and D. Wormell. 2002. Population densities of primates in a Brazilian Atlantic forest. *Folia Primatol.* 73: 54–56.
- Remsen, J. V. and T. A. Parker. 1995. Bolivia has the opportunity to create the planet's richest park for terrestrial biota. *Bird Cons. Int.* 5: 181–199.
- Ríos, B., R. B. Wallace, H. Aranibar and C. Veitch. 2001. Evaluación de mamíferos medianos y grandes en el bosque semidecíduo del alto Tuichi (PN y ANMI Madidi, Dpto. La Paz). *Ecología en Bolivia* 36: 31–38.
- Ríos Uzeda, B., J. Vargas and R. B. Wallace. 2004. Un nuevo registro de mamífero para Bolivia: La jayupa de la altura (*Cuniculus taczanowskii*, Rodentia, Cuniculidae). *Mastozool. Neotropical* 11: 5–10.
- Robinson, J. G., P. C. Wright and W. G. Kinzey. 1987. Monogamous cebids and their relatives: Intergroup calls and spacing. In: *Primate societies*, B. B. Smuts, D. L. Cheney, R. M. Seyfarth, R. W. Wrangham, and T. T. Struhsaker (eds.), pp.44–53. University of Chicago Press. Chicago, London.
- Rumiz, D. I. and W. R. Townsend (eds). 1999. Programa de Fauna Silvestre para la Tierra Comunitaria de Origen y Reserva de Biosfera Pilon Lajas: Informe Final Presentado a Veterinarios Sin Fronteras. Unpublished report, Museo de Historia Natural Noel Kempff Mercado, U.A.G.R.M., Santa Cruz de la Sierra, Bolivia.
- Rylands, A. B., H. Schneider, A. Langguth, R. A. Mittermeier, C. P. Groves and E. Rodríguez-Luna. 2000. An assessment of the diversity of New World primates. *Neotrop. Primates* 8(2): 61–93.
- Sarmiento, J., S. Barrera, J. Vargas, C. Quiroga and C. Cortez. 2001. Evaluación de la fauna de vertebrados de la formación de bosque alto en la región de Alto Madidi (PNANMI Madidi). Unpublished report, Colección Boliviana de Fauna and Conservation Internacional, Programa Bolivia, La Paz, Bolivia.
- Silva Jr., J. S. and M. de A. Noronha. 1998. On a new species of bare-eared marmoset, genus *Callithrix* Erxleben, 1777, from central Amazonia, Brazil (Primates: Callitrichidae). *Goeldiana Zoologia* (21): 1–28.
- Stanyon, R., S. Tofanelli, M. A. Morescalchi, G. Agoramoorthy, O. A. Ryder and J. Winberg. 1995. Cytogenetic analysis shows extensive genomic rearrangements between red howler (*Alouatta seniculus* Linnaeus) subspecies. *Am. J. Primatol.* 35: 171–183.
- Tarifa T, J. Rechberger, R. B. Wallace and A. Nuñez. 2001. Confirmación de la presencia de *Odocoileus virginianus* (Artiodactyla, Cervidae) en Bolivia, y datos preliminares sobre su ecología y su simpatria con *Hippocamelus antisensis*. *Ecología en Bolivia* 35: 41–49.
- Thomas, L., J. L. Laake, S. Strindberg, F. Marques, D. L. Borchers, S. T. Buckland, D. R. Anderson, K. P. Burnham, S. L. Hedley and J. H. Pollard. 2001. Distance 4.0. Beta 1. Research Unit for Wildlife Population Assessment, University of St. Andrews, St. Andrews, UK.
- Van Roosmalen, M. G. M., T. van Roosmalen, R. A. Mittermeier and G. A. B. da Fonseca. 1998. A new and distinctive species of marmoset (Callitrichidae, Primates) from the lower Río Aripuanã, state of Amazonas, central Brazilian Amazon. *Goeldiana Zoologia* 22: 1–27.
- Van Roosmalen, M. G. M., T. van Roosmalen, R. A. Mittermeier and A. B. Rylands. 2000. Two new species of marmoset, genus *Callithrix* Erxleben 1777 (Callitrichidae, Primates), from the Tapajós/Madeira interfluve, south Central Amazonia, Brazil. *Neotrop. Primates* 8(1): 2–19.
- Van Roosmalen, M. G. M., T. van Roosmalen and R. A. Mittermeier. 2002. A taxonomic review of the titi monkeys, genus *Callicebus* Thomas, 1903, with the description of two new species, *Callicebus bernhardi* and *Callicebus stephennashi*, from Brazilian Amazonia. *Neotrop. Primates* 10(suppl): 1–52.
- Wallace, R. B. and R. L. E. Painter. 1999. A new primate record for Bolivia: An apparently isolated population of common woolly monkeys representing a southern range extension for the genus *Lagothrix*. *Neotrop. Primates* 7(4): 111–113.
- Wallace, R. B., R. L. E. Painter, A. B. Taber and J. M. Ayres. 1996. Notes on a distributional river boundary and southern range extension for two species of Amazonian primates. *Neotrop. Primates* 4(4): 149–151.

*Authors' addresses:*

**Robert B. Wallace**, Greater Madidi Landscape Conservation Program, Casilla 3-35181, San Miguel, La Paz, Bolivia, and Wildlife Conservation Society, 185th Street and Southern Boulevard, Bronx, New York 10460, USA. E-mail: <rwallace@wcs.org>.

**Humberto Gómez**, Fundación Amigos de la Naturaleza (FAN), Santa Cruz, Bolivia.

**Annika M. Felton** and **Adam Felton**, Centre for Resource and Environmental Studies, Australian National University, W. K. Hancock Building #43, Canberra, ACT 0200, Australia.

*Received for publication: November 2003*

*Revised: January 2005*

*Final version received (with name): 20 April 2005*

*Published: 1 May 2006*