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Identification, Behavioral Observations, and Notes on the Distribution of the Titi Monkeys *Callicebus modestus* Lönnberg, 1939 and *Callicebus olallae,* Lönnberg 1939

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Abstract: We conducted field surveys for titi monkeys (*Callicebus* spp.) in the vicinity of the original collection sites of two poorly known species, *Callicebus olallae* and *Callicebus modestus*. Two distinct *Callicebus* forms were photographed and filmed, and according to an examination of existing literature as well as the original specimens, these represent *C. olallae* and *C. modestus*. They occur in patchy and fragmented grassy woodlands and appear to be at least locally threatened by hunting. Both were known from single locality collections and the taxonomic distinctiveness of these forms urgently needs to be further investigated, as does their true conservation status.

Resumen: Llevamos a cabo evaluaciones de campo para monos titi (*Callicebus* spp.) en la proximidad de los lugares originales de colecta de dos especies poco conocidas, *Callicebus olallae* y *Callicebus modestus*. Fueron fotografiados y filmados dos tipos distintos de *Callicebus* que de acuerdo a una revisión de la literatura existente, así como los especimenes originales, representan a *C. olallae* y *C. modestus*. Ellos viven en islas de bosque en sabanas y parecen estar amenazados localmente por la cacería. Ambas especies eran conocidas a partir de una sola localidad y colecta. Su singularidad taxonómica, así como el verdadero estado de conservación de estos primates, necesitan ser investigados urgentemente.

Key Words: *Callicebus*, Bolivia, titi monkey, taxonomy

Introduction

Titi monkeys (genus *Callicebus*) are small Neotropical monkeys that range in body mass from 0.8 to 1.4 kg (Smith and Jungers 1997), possess non-prehensile tails, and are primarily frugivorous (Hershkovitz 1990). They are found in the Atlantic forest of Brazil and throughout the tropical forests of the Amazon, Orinoco, and upper Paraguay basins (Hershkovitz 1988). In Bolivia, titi monkeys inhabit the departments of Pando, Beni, and Santa Cruz, northern La Paz, and eastern Cochabamba (Hershkovitz 1988; Anderson 1997).

In 1937 and 1938, A. M. Olalla collected individuals of this genus near Santa Rosa, Department of Beni. One adult and one subadult male were taken from the vicinity of El Consuelo, 12 km east of Reyes (Patterson 1992); and an adult male was collected near La Laguna, 5 km from Santa Rosa (Anderson 1997). In 1939, Einmar Lönnberg determined that the two El Consuelo specimens represented a new species — *Callicebus modestus* — with the single La Laguna specimen representing another new species — *Callicebus olallae*. It was Lönnberg's opinion that despite the proximity of the two collection sites (about 65 km), the specimens "appear to be so different that they certainly must be considered as representing two different species" (Lönnberg 1939).

Based on these specimens *C. modestus* is characterized as having light-brownish or reddish-agouti upper and outer body parts (agouti refers to hairs that possess alternating bands of color); a reddish-brown-agouti crown, forehead, sideburns, and beard; well developed white ear tufts, short white hairs on the face, and a blackish-agouti tail (Lönnberg 1939; Van Roosmalen *et al.* 2002). In contrast, *C. olallae* has a thin fringe of black hair on the sides of the head and across the forehead; non-agouti rufous back and limbs with lighter rufous on the flanks and hind quarters; hairs with black tips on the head and neck; weakly developed whitish ear tufts; short white hairs on the face and a dark-agouti tail (Lönnberg 1939). The

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features that best separate these two species are the relative conspicuousness of the ear tufts and the agouti coloration of *C. modestus* (Anderson 1997).

Morphological measurements of the two holotype skins (Anderson 1997) revealed that *C. modestus* is smaller than *C. olallae* in total length (715 cm vs. 750 cm), and in the length of the hindfoot (90 cm vs. 100 cm), but has a longer tail (400 cm vs. 340 cm). Cranial measurements were originally used by Lönnberg (1939) to further differentiate these species. The *C. modestus* skull is unusually elongated (Hershkovitz 1988, 1990) and possesses the smallest braincase volume among the Cebidae (Kobayashi 1995; note that *Callicebus* is now in the family Pitheciidae [Groves 2001]). However, as no subsequent collections have been made of either species, the continued taxonomic distinctiveness of *C. modestus* and *C. olallae* relies solely on the repeated measurements and descriptions of the same 65-year-old adult skulls and skins.

In this report we provide the first documentation of *C. modestus* and *C. olallae* in the wild since their discovery. We photographed and filmed titi monkeys in the vicinity of the original collection sites of A. M. Olalla, as well as other nearby locations. Furthermore, we discuss differences in group size, as well as current conservation status, habitat use, and the vulnerability of these populations to hunting.

Methods

Surveys were conducted between 26 September and 4 October 2002, with our efforts concentrated in four locations (Fig. 1): Puerto Santa Cruz on the Río Yacuma (14º00′S, 66º58′W), La Laguna (14º03′S, 66º51′W), Petaca (14º07′S, 66º49′W), and Naranjal (14º05′S, 66º56′W). We interviewed local people regarding where titi monkeys could be found and, with the exception of La Laguna, all survey locations were chosen on the basis of local knowledge.

Surveys involved visiting the sites from 06:00 to 10:00, and waiting for or inducing calls using playback recordings of titi monkey duets. The first group encountered was induced to call using recordings of *C. aureipalatii*. The first group's response calls were recorded for playback to all subsequently encountered groups. *Callicebus* groups were approached, or alternatively approached us, at which time slide photos (Canon EOS 35mm) and digital video (Digital HandyCam 700X) were taken. The location of each group was recorded using a Geographic Positioning System (GPS) (Garmin 12XL).

Individuals were classified as adult, juvenile, or infant, and sex was noted when possible. Infants were defined as individuals carried by an adult, whereas juveniles were noticeably smaller than other unaccompanied individuals. Adults were full-sized individuals that either carried young, or participated in duets or both. Sexes are grossly indistinguishable (Hershkovitz 1988), although adults carrying offspring on their backs can safely be classified as males (Wright 1984; Tirado Herrera and Heymann 2004).

To help us determine the identity of *Callicebus* monkeys encountered we visited the Royal Museum of Natural History in Stockholm, Sweden, and examined and photographed two of the original specimens from 1937–38 (*C. modestus* #A612105; *C. olallae* #A632187).

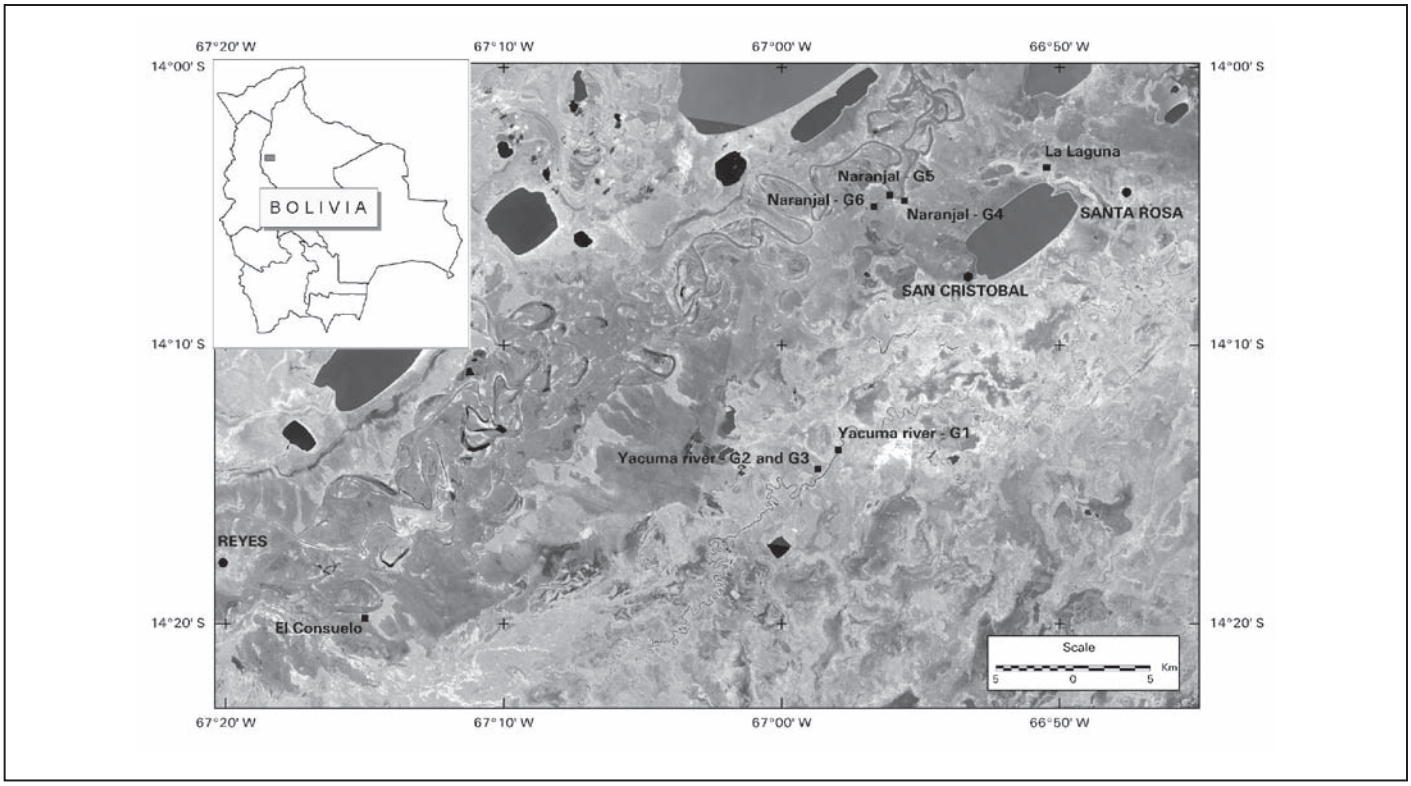

Figure 1. Localities for *C. modestus* and *C. olallae* in southwestern Beni Department, Bolivia.

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Results

Occurrence and group composition

Six groups of closely associating individuals of the genus *Callicebus* were encountered. They were photographed and filmed, and given a number depending on their order of sighting. Groups began calling at approximately 07:00 and continued calling for about 30 minutes. Calling was often sporadic and sometimes recommenced at approximately 08:30. One group was heard calling at 11:30. Groups 1–3, each consisting of two individuals, were located at Puerto Santa Cruz on the north side of the Río Yacuma (Fig. 1, Table 1). No calls were heard from the south side of the river and local farmers had no recollection of them ever occurring there. Groups 4–6 were located near Naranjal (Fig. 1), and consisted of more individuals per group than Groups 1–3 (Table 1).

No titi monkeys were heard or encountered at La Laguna or Petaca. Local residents in Santa Rosa and San Cristobal indicated that titi monkeys used to be present around La Laguna until 1998, but had apparently been exterminated by hunting. The owners of Petaca did, however, say that titi monkeys could still be heard calling irregularly from within the different forest islands in the area. In general, local distributions appear to be patchy, although at certain locations, for example Naranjal, titi monkeys appeared relatively abundant with five groups heard calling within a radius of approximately 1.5 km.

Pelage color

Individuals from Groups 1–3 were characterized by rufous on their back, limbs, and chest, with lighter rufous on the outside of limbs; dark brown-red forehead, sideburns, and beard; small white ear tufts; pale throat; blackish hands; creamy underparts; and a sharply contrasting blackish, uniformly colored, tapering tail (Figs. 2 and 3). The anterior base of the tail was pale orange. The fur appeared short and spiky. The face had white hairs on the muzzle.

Monkeys of Groups 4–5 had a grey-brown-red agouti back and upper limbs; light red-brown forehead, sideburns and beard; well-developed white ear tufts; dark hands with sparse whitish fur; reddish underparts and chest; a greyish, uniformly colored non-tapering tail, darker than dorsum (Figs. 4 and 5). The fur appeared dense and frizzy. There were whitish hairs above the nose and eyebrows and on the muzzle.

Table 1. Composition and location of the six encountered groups of *Callicebus*. See Figure 1 for locations.

Group	Location	Adults	Juveniles	Infants	Total
1	Yacuma	2			2
2	Yacuma	2			2
3	Yacuma	1	1		2
4	Naranjal	3	1	1	5
5	Naranjal	6		1	7
6	Naranjal	4			4

Figure 2. Photographs of wild titi monkeys matching the original descriptions for *C. olallae.* Photograph by Mileniusz Spanowicz.

Figure 3. Revised illustration for *C. olallae*. Illustration by Stephen D. Nash.

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Figure 4. Photograph of wild titi monkeys matching the original description for *C. modestus*. Photograph by Mileniusz Spanowicz.

Figure 5. Revised illustration for *C. modestus*. Illustration by Stephen D. Nash.

The pelage color of most of the individuals of Group 6 was similar to that of Groups 1–3 in that they had a rufous non-agouti back and chest, creamy under-parts, and a pale throat, although they resembled Groups 4–5 by having conspicuous white ear tufts and pale hands. One distinctly colored individual in this group appeared lighter and possibly had grey-red agouti fur on the back. All individuals of Group 6 also had a denser layer of white hairs on the face and a whitish anterior base of the tail.

Museum specimens

An examination of the holotypes (Fig. 6) suggests that Groups 1–3 were *C. olallae* and Groups 4 and 5 were *C. modestus*. In contrast to the illustration provided on page 10 of Van Roosmalen *et al.* (2002) the *C. olallae* holotype does not have a conspicuous black face ring. Our examination of the original specimens does, however, concur with the descriptions provided by Lönnberg (1939) and Hershkovitz (1990).

Notes on behavior and feeding

All groups appeared to be diurnal and principally arboreal, as is consistent with this genus. They were found in dry, open woodland vegetation with dense tangles of vines and thorny understorey plants. The thorny tree species Naranjillo (*Styloceras columnare*, Buxaceae) was characteristic of the vegetation type in both locations. *Callicebus olallae* was observed eating the seeds of the Mapajo tree (*Ceiba pentandra*, Bombacaceae). One adult in each of Group 1 (*C. olallae*) and Group 6 (unidentified) were observed to display an aggressive behavior involving standing up on their hind legs and moving the upper body up and down while waving their arms at us. A male *C. modestus* of Group 4 broke off a stick and threw it in our direction.

Discussion

Hershkovitz (1988) suggested that all *Callicebus* species can be readily separated by color pattern alone. We observed two distinct members of the genus *Callicebus* that, using our observations of the holotypes and the criteria of Lönnberg (1939) and Hershkovitz (1990), we identified as *C. olallae* and *C. modestus*. In contrast to the geographic distributions for these species described and mapped in Van Roosmalen *et al.* (2002), they were only located, and to our knowledge have only ever been located (Lönnberg 1939; Anderson 1997), to the east of the Río Beni.

Callicebus olallae was located along a 2-km stretch of riparian vegetation on the northern side of the Río Yacuma, near Puerto Santa Cruz, 22 km from the original Olalla collection site (Fig. 1). The only locality where we found *C. modestus* was at Naranjal, west of the highway, near the township of Santa Rosa, 45 km from the original Olalla collection site (Fig. 1). The unidentified group of *Callicebus* (Group 6), which we encountered on the east side of the highway at Naranjal, possessed a pelage that combined aspects of both *C. olallae* and *C. modestus*. Although individuals had prominent white ear tufts, they lacked the agouti pelage so characteristic of *C. modestus*. Their faces were also almost entirely covered with white hairs, giving individuals a striking and unique appearance. An adult of this group displayed the same aggressive behavior as an individual in Group 1 (*C. olallae*) involving standing up on his hind legs and moving the upper body up and down while waving its arms at us. We have not seen this behavior reported for other *Callicebus* species, although a similar behavior has been observed in the white-faced saki, *Pithecia pithecia*, also a member of the family Pitheciidae. The appearance of the unidentified group raises questions as to whether sympatry, or even hybridization, occurs between *C. modestus* and *C. olallae*, as found in other New World primates (e.g., *Saguinus*; Peres *et al*. 1996).

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Although we can be confident that we have found individuals that are representative of the two species originally classified by Lönnberg in 1939, this does not imply that we are certain of the taxonomic distinctiveness of *C. modestus* and *C. olallae*. The identification of individuals that possessed characteristics in keeping with both *C. modestus* and *C. olallae* certainly raises questions regarding their taxonomy. There is also reason to question previous views that these species are parapatric (Hershkovitz 1988), as no rivers or watersheds separate the populations observed in this study. It is our opinion that the proximity of the original collection site for *C. olallae*, and the current known distribution of *C. modestus*, suggests that they share at least part of their respective geographic ranges. Nevertheless, further investigation is needed to establish whether these species may be genetically isolated by stretches of open grasslands. Similarly, variations in the composition and structure of vegetation across forest patches should be determined in order to assess possible differences in habitat preferences between the two. We concur with Anderson (1997) that further information is needed to determine the taxonomic distinctiveness of *C. modestus* and *C. olallae*. Preferably this would consist of taking genetic material from existing museum specimens or wild populations. For the moment we are cautious to argue for further specimen collections from the wild due to uncertainty regarding their remaining numbers.

The size of the groups we observed for both *C. olallae* and *C. modestus* covered the full range of group sizes known for other members of this genus (Wright 1984; Pinto *et al.* 1993; Bennett *et al.* 2001; Bicca-Marques *et al.* 2002). In our sample, *C. olallae* were observed in small family units of two individuals with either two adults or an adult male with offspring. In contrast, *C. modestus* groups were at the upper limits for this genus consisting of five to seven individuals. Only *C. personatus* (*v*. Pinto *et al.* 1993) and *C. cupreus* (*v*. Bennett *et al.* 2001; Bicca-Marques *et al.* 2002) are also known to have groups of up to seven individuals. Female *Callicebus* have only one offspring per year (Tardif 1994; for an exception see Knogge and Heymann 1996), and reproductive maturity is reached after approximately three years (Robinson *et al.* 1987). Assuming that *Callicebus* groups are family units it appears that at least several individuals in *C. modestus* groups, in addition to the parents, had reached reproductive maturity. Hence, it appears that mature offspring may be staying with their natal group and are, therefore, similar in this sense to the *C. cupreus* studied by Bicca-Marques *et al.* (2002). It is also possible that these large groups of *C. modestus* result from limited dispersal opportunities in the fragmented landscape of Naranjal.

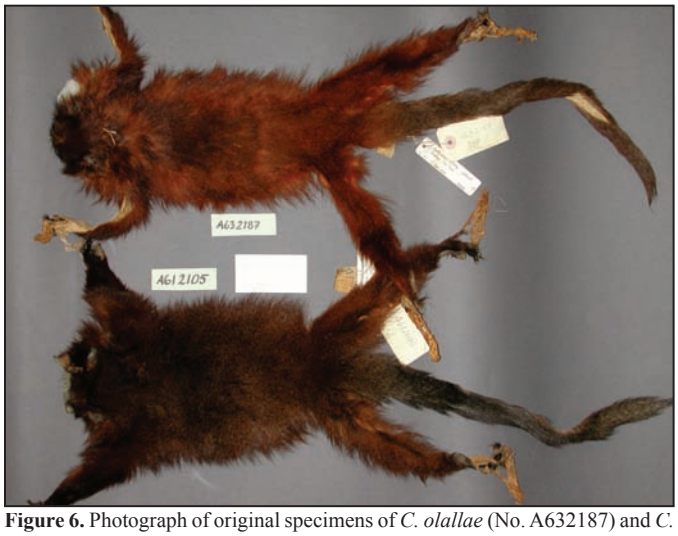

Figure 6. Photograph of original specimens of *C. olallae* (No. A632187) and *C. modestus* (No. A612105). Photograph by Olavi Gronwall.

Groups of *C. modestus* and *C. olallae* were known to local residents, and observed by ourselves, only in pockets of remnant vegetation surrounded by grazed woodland on cattle ranches. Some cattle ranchers actively discouraged hunters from entering their lands and this may have assisted the continued presence of titi monkeys and other wildlife in the region. For example, the only location where we found *C. modestus* close to the village of San Cristobal was on a ranch where owners prohibited hunting. Our surveys were brief, but it seems likely that the population of *C. olallae* at La Laguna, the original collection site for this species by A. M. Olalla on 12 February 1938, is now extinct. No individuals were encountered or heard, despite our searches of the area and attempts to induce calling using playback. San Cristobal residents confirmed that *Callicebus* and black howler monkeys (*Alouatta caraya*) previously inhabited the area but were recently extirpated due to excessive hunting.

A study of *Callicebus melanochir* in eastern Brazil suggested that, although the species preferred undisturbed habitat, groups continued to use resources in disturbed areas (Heiduck 2002). Within the fragmented habitat of our study both *C. olallae* and *C. modestus* appeared to be surviving by being able to travel on the ground between remnant forest patches. We were told by a farmer in Naranjal that he had watched groups, most likely *C. modestus*, cross grassland gaps of 300–400 m to reach patches of surrounding forest. We also found an adult male *C. olallae* and young in a single isolated tree (*Stylocercas columnare*), the canopy of which was at least 6 m from the closest neighboring canopy, suggesting that they reached the tree from the ground. Terrestrial travel, although risky in terms of predation, would certainly be beneficial to the continued survival of both species in these patchy habitats. It remains to be seen, however, whether this increasingly fragmented landscape can sustain populations of *Callicebus* in the long term, particularly given the proposed improvement of the existing main road to an asphalted thoroughfare as part of the Bolivian national transport network.

Callicebus modestus and *C. olallae* are currently classified as Vulnerable in the IUCN Red List of Threatened Species (Rylands and Tarifa 2003). At present, both species are known only from single localities. The original population of *C. olallae* found at the type locality La Laguna is presumably extinct due to hunting. Given their apparently restricted and patchy distribution, and the threat they face from over-hunting

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and proposed infrastructure development, further information regarding the range and population size of *C. modestus* and *C. olallae* is urgently required.

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