BRIEF REPORT

Geographic Distribution and Possible Taxonomic Distinction of *Callicebus torquatus* Populations (Pithecidae: Primates) in Peruvian Amazonia

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Population densities of yellow-handed titi monkey (*Callicebus torquatus*) were estimated using transect census methods. Densities were 2.8 individuals/km² in the upper Rio Itaya basin and 2.5 individuals/km² in the lower Rio Algodon basin. Group size varied from two to five individuals, with an average of 2.9 individuals per group at the Rio Itaya. Groups were generally composed of two adults, probably the reproductive pair, with progeny from one to three previous birth seasons. Although the Rio Itaya population is phenotypically identical to populations from the rivers Nanay and Tigre, it differs from population on the rivers Napo and Putumayo. This suggests the existence of two disjunct populations of *C. torquatus* in Peruvian Amazonia whose taxonomic status warrants further examination. Am. J. Primatol. 70:1181–1186, 2008. © 2008 Wiley-Liss, Inc.

Key words: *Callicebus torquatus*; social organization; group size; taxonomy; geographic distribution

INTRODUCTION

According to Hershkovitz [1990], six species of *Callicebus* inhabit Peruvian Amazonia, one of them being *C. torquatus lucifer*, recently elevated to species rank by van Roosmalen et al. [2002]. However, the external characters described by the aforementioned authors only correspond to populations distributed in the Napo–Putumayo interfluviu, but do not coincide with populations inhabiting the Rio Nanay basin. This has generated some controversy on the taxonomic status of this species [Heymann et al., 2002].

Although *C. torquatus* has been the subject of intensive ecological studies [Defler, 1994; Kinzey, 1976, 1977; Kinzey & Gentry, 1978; Kinzey et al., 1977; Palacios et al., 1997], there is relatively little demographic information, except for population densities and relative abundance [Defler, 1983; Haugaasen & Peres, 2005; Oversluijs, 2003; Palacios & Peres, 2005; Peres, 1993, 1997]. Furthermore, there are considerable deficiencies in our knowledge of the geographic distribution of *C. torquatus*, as evidenced by obvious errors in the distributional maps provided by Hershkovitz [1990], Aquino and Encarnación [1994], van Roosmalen et al. [2002], and InfoNatura [2004]. As Heymann et al. [2002] pointed out, these authors did not consider the presence of *C. torquatus* south of the Rio Nanay, although Kinzey’s study site—Estación Biológica Callicebus—is evidently located south of this river [see also Freese et al., 1982].

The limited demographic information and existing confusion concerning the geographic distribution of *C. torquatus* motivated us to conduct this study that included surveys in different areas of the northeastern Peruvian Amazonia between April 2004 and August 2007. Here we report the results of surveys along 1,021 km of transects in the upper Rio Itaya basin, and 200 km of transects at the Rio Algodon, along with information obtained at other river basins.

METHODS

Study Areas

The study was carried out at the upper Rio Itaya and at the lower Rio Algodon (Fig. 1). The area...
surveyed on the Rio Itaya is located approximately 80 km southwest of the city of Iquitos, between the area near the mouth of the Quebrada Maquizapa and the headwaters of the Rio Itaya (coordinates: 73°38′W/04°15′S–74°00′W/04°09′S). The area is characterized by high terrace forest and low hill forest [Malleux, 1982] that grow on sandy-clay soils covered by dense mats of leaf litter, particularly on higher terraces. The vegetation is similar to that of “varillales” [Encarnación, 1993] being composed of trees with narrow trunks, generally reaching heights of 10–25 m and a few emergents up to 30 m including *Parkia nitida*, *Elaeoluma* sp., *Manilkara* sp., and *Eschweilera* sp. The understory is relatively open and often dominated by “irapay” palms (*Lepidocaryum* sp.). Generally, the forest is altered because of lumbering and extraction of “irapay” leaves. Hunting trails are common, but fauna such as woolly monkeys (*Lagothrix poeppigii*) or tapirs (*Tapirus terrestris*) are still abundant.

The study area on the Rio Algodón, in northern Peru is close to the border with Colombia, and located near the confluence of the Putumayo river (coordinates 72°05′W/02°29′S–72°10′W/02°37′S). The area is characterized by high and medium terrace forests, dominated by “varillal” vegetation with trees reaching 20–25 m height, plus emergent trees of c. 30 m such as *Eschweilera* sp. and *Pouteria* sp. Interspersed throughout the forest are dense “aguajales” (stands of the palm *Mauritia flexuosa*) that are swampy and partially subjected to temporary inundation. There is little human activity in the area.

**Survey Methods**

Seven different sites were visited on the Río Itaya and two on the Río Algodón. At each site, four to five transects of 4–6 km length were cut. The line transect method was used [Aquino et al., 2001; National Research Council. 1981]. Two teams of experienced observers (a researcher and a field assistant) simultaneously walked different transects daily between 06:30 and 12:00 hr, and 14:00 and 17:00 hr. Average walking speed was 1.0 km/hr. Each time titi monkeys were encountered, group size and composition, the perpendicular distance to the transect of the first individual detected, characteristics of the vegetation at the site of encounter, soil texture, and the presence of leaf litter were recorded. Age-classes were distinguished by size (adults, juveniles, infant 2, infant 1). Younger infants (infant 1) were distinguished by being carried, older infants (infant 2) were distinguished from infant 1 by their independent locomotion. Juveniles were distinguished from infants 2 by their larger, but not yet adult body size.
Population density at the Rio Itaya was calculated with the software Distance v. 4.0 [Laake et al. 1994]. Owing to the small number of records at the Rio Algodón, we used the formula \( D = N/2W \times L \) [Burnham et al. 1980], where \( D \) is the density (individuals/km²), \( N \) the number of animals or groups encountered along transects, \( L \) the length (km) and \( 2W \) the mean width (m) of the transect. We used \( 2W = 36 \text{ m} \) as transect width based on a mean perpendicular distance of sighted groups to the transect of 18 m.

To more fully determine the geographic distribution of *Callicebus*, we combined information obtained during the surveys with information from exploratory visits made by the first author to the rivers Curaray, Aushiri, Tigre, and Pucacuro (Fig. 1).

**Phenotypic Characterization**

To describe the phenotypic characteristics of titi monkeys in this area we examined specimens housed at the Centro de Reproducción y Conservación de Primates No-Humanos of the Proyecto Peruano de Primatología in Iquitos (\( n = 4 \)), and complemented this with observations on animals killed by subsistence hunters (Rio Itaya: \( n = 2 \), Napo-Putumayo: \( n = 2 \), and an individual found on the forest floor at the Rio Itaya. In addition, when titi monkeys were encountered during census work we observed and recorded external characteristics including pelage coloration.

Our research complied with the ASP Principles for the Ethical Treatment of Nonhuman Primates and adhered to Peruvian legal requirements.

**RESULTS**

**Phenotypic Characters**

Table I compares the external characteristics of the two populations of *C. torquatus* found in northeastern Peru. The most notable differences concern the extent and shape of white fur on the throat and the coloration of the forehead and hands (Fig. 2), which were consistent in all animals examined in detail and in all individuals observed during censuses. The Rio Itaya *Callicebus* were characterized as having a tie-like tuft of creamy-white hair and creamy-white hands, whereas the Rio Algodón *Callicebus* were characterized as having a band of creamy-white hair extending laterally to the base of the ears and yellow-creamy hands.

### Population Density, Group Size, and Social Organization

We encountered 39 groups during 1,021 km of transect walks on the Rio Itaya, and seven groups along 200 km on the Rio Algodón. Population density was 2.8 ind/km² (1.2 groups/km²) at the Rio Itaya and 2.5 ind/km² (0.83 groups/km²) at the Rio Algodón.

Group size varied from two to five individuals with a mean of 2.9 individuals (SD: ± 0.9) per group at the Rio Itaya. Groups comprising two individuals were most commonly observed (52%), whereas groups of four (7%) and five individuals (7%) were least common. The number of records was too low at

**TABLE I. External Characters of *Callicebus torquatus* Populations of Peruvian Amazonia**

<table>
<thead>
<tr>
<th>Character</th>
<th>Napo–Putumayo</th>
<th>Nanay–Tigre</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General coloration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crown with reddish brown hair; broad frontal band with dark brown hair; facial skin light and moderately covered with short white hair</td>
<td>Intensively reddish brown crown with reddish brown hair; narrow frontal band with black hair; facial skin blackish and sparsely covered with short white hair</td>
<td></td>
</tr>
<tr>
<td>Dorsal side of trunk and neck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chestnut brown; basal portion of hair</td>
<td>Reddish brown; basal portion of hair dark gray, terminal portion reddish brown</td>
<td></td>
</tr>
<tr>
<td>Throat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Band of creamy-white hair extending laterally to the base of the ears</td>
<td>Tie-like tuft of creamy-white hair, not extending laterally</td>
<td></td>
</tr>
<tr>
<td>Ventral side of trunk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light chestnut</td>
<td>Reddish chestnut</td>
<td></td>
</tr>
<tr>
<td>Arms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper arm with chestnut brown hair; forearm blackish to black hair; hand with short hair, basal part orange, terminal part yellow-creamy hair</td>
<td>Upper arm with dark brown hair; forearm with black hair; hand with short creamy-white hair</td>
<td></td>
</tr>
<tr>
<td>Legs and feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thigh with chestnut-brown hair; lower leg and foot with blackish hair</td>
<td>Thigh and lower leg with reddish brown hair; foot with black hair</td>
<td></td>
</tr>
<tr>
<td>Tail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generally blackish brown; basal portion of hair in proximal 2/3 of the tail reddish brown, terminal portion chestnut brown; remainder of tail with blackish or brownish hair</td>
<td>Generally black; basal portion of hair in proximal 2/3 of the tail reddish brown, terminal portion black; remainder of tail with black hair</td>
<td></td>
</tr>
</tbody>
</table>

**Am. J. Primatol.**
the Rio Algodón to calculate a meaningful mean group size.

The basic composition of *C. torquatus* groups was two adults, probably a reproductive pair, plus their progeny from one to three birth seasons. Two of the 19 groups for which complete counts of group membership were obtained included three adults. On five occasions solitary individuals were observed but their sex could not be determined.

**DISCUSSION**

Diagnosis and comparisons of subspecies of *C. torquatus* in Hershkovitz [1990] indicate that
there is variation in fur color within subspecies. Therefore, it is possible that the differences detected in the extent and shape of white hair on the throat, the coloration of the hands, and the width of the frontal band in *Callicebus* observed in this study simply represent intraraxa variation. However, throat collar has been used as a diagnostic criterion to distinguish *C. torquatus purinus* from *C. torquatus torquatus*, although Hershkovitz [1990] does not mention this characteristic for the other titi monkey subspecies. Hand color is described as yellow, golden, or orange for all subspecies of *C. torquatus* except *C. torquatus medemi*, where the hands are blackish. Defler [2003] reports that the Colombian *C. torquéntus lugens* and *C. torquatus lucifer* exhibit white or yellowish hands. In this study, we found consistent phenotypic differences between two disjunctive populations of *C. torquatus* in Peruvian Amazonia: the populations between the rivers Nanay and Tigre had a tie-like or rectangular creamy-white hair tuft on the throat, white-creamy hands, and a narrow frontal band (Fig. 2b), whereas the populations between the rivers Napo and Putumayo had a collar-like band of creamy-white hair extending laterally to the base of the ears, yellow-creamy to orange hands, and a broad frontal band (Fig. 2a). On the basis of difference in hand color of the Nanay population from other *C. torquatus* populations, Heymann et al. [2002] speculated on the possible existence of a distinct taxon. Only detailed examination of additional individuals and the inclusion of genetic methods will lead to a resolution of this issue.

The Peruvian *C. torquatus* are separated geographically, into a population between the rivers Napo and Amazonas in the south and the Putumayo in the north, and a population between the right bank of the Rio Nanay and the left bank of the lower Río Tigre and the Rio Pucacuro (Fig. 1). Within these areas, the species is not distributed uniformly and seems to be restricted to forests on high and medium terraces with “varillal” vegetation that is dominated by plants with sclerotic and leathery leaves growing on sandy or sandy-clayey soils [Encarnación, 1993]. The population between the rivers Nanay and Tigre is probably delimited in the north by the confluence of the Rio Pucacuro and the Quebrada Alemán, an area that also marks the distributional limit of “varillal” vegetation.

Our observations that *C. torquatus* in Peru is restricted to “varillales” growing on white-sand soils or on sandy-clayey soils coincides with information by Kinzey and Gentry [1978]. It is reinforced by (a) the lack of both “varillales” and *C. torquatus* further north of Quebrada Alemán [Aquino et al., 2000]; (b) the presence of this species southward from kilometer 25 of the highway Iquitos–Nauta, coinciding with the presence of “varillales”, and the lack of both *C. torquatus* and “varillales” north of this point. The Peruvian populations therefore seem to be more restricted than population studied by Peres [1993] and Defler [1994, 2003] who found *C. torquatus* in a large variety of habitats in Brazilian and Colombian Amazonia, ranging from flooded forests (“várzea” and “igapó”) to tierra firme forests, although Peres [1993] does not specify characteristics of the vegetation and soils. The reasons for such differences in habitat occupation remain obscure.

In conclusion, our study indicates the need for reconsidering the geographic distribution of *C. torquatus* in Peru. The taxonomic status of the different Peruvian populations of *C. torquatus* requires further scrutiny. Future studies will have to include genetic analyses of the respective populations, and additional surveys to make a more accurate delimitation of the geographic distribution, particularly of the population south of the Rio Nanay, to reach a definite conclusion.

**ACKNOWLEDGMENTS**

We thank Instituto Nacional de Desarrollo (INADE), Iquitos, for giving us the opportunity to carry out research at the Rio Algodón. Special thanks go to Gilmer Montero for assistance during fieldwork at the Rio Itaya. Finally, we thank Paul Garber and two anonymous reviewers for their very helpful comments on the manuscript. We complied with the ASP Principles for the Ethical Treatment of Nonhuman Primates and adhered to Peruvian legal requirements.

**REFERENCES**


