# Confirmation of Callicebus dubius (Pitheciidae) Distribution and Evidence of Invasion into the Geographic Range of Callicebus stephennashi

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Source: Neotropical Primates, 16(2) : 71-73

Published By: Conservation International

URL: https://doi.org/10.1896/044.016.0207

is different on several points. With this publication, illustrated with new drawings by Stephen Nash that match the colors of the lectotypes and of animals in the wild, we hope to lessen some of the confusion involved in titi monkey identification (Figs. 1 and 2).

## Acknowledgements

I first want to thank Stephen D. Nash, who has kindly produced new drawings of both species. His work is indispensable for the publication and interpretation of taxonomic knowledge. I also thank Dr. Barbara Herzig (Natural History Museum in Vienna), Dr. Richard Kraft and Michael Hiermeier (Zoologische Staatssammlung in Munich), Eileen Westwig MS (American Museum of Natural History in New York), Dr. Victor Pacheco and Fanny Cornejo (Natural History Museum in Lima) and Dr. Dekker and Ing. Hein van Grouw (Naturalis Museum in Leiden) for allowing me to study their collection. Finally thanks to Eckhard Heymann (German Primate Center, Göttingen) and Darren Webster (Blackpool Zoo) for sharing their observations with me.

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# Confirmation of *Callicebus dubius* (Pitheciidae) Distribution and Evidence of Invasion Into the Geographic Range of *Callicebus stephennashi*

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## Introduction

Titi monkeys, *Callicebus* Thomas 1903 (Pitheciidae), one of the most speciose platyrrhine genera, are distributed in the tropical forests of the Amazon and Orinoco basins, in the Atlantic forest of northeastern and southeastern Brazil, in the Chaco and in dry forests of Paraguay and Bolivia. The southern limits are the Pilcomayo and Paraguay rivers. The distribution of *Callicebus* is generally limited by river barriers (van Roosmalen *et al*. 2002). *Callicebus dubius* was described as a hybrid form by Hershkovitz (1988) and rearranged by van Roosmalen *et al.* (2002) as a valid species of the *C. cupreus* species group. The range of *C. dubius* is still uncertain. Hershkovitz (1990) assumed the type locality to be the right (east) bank of the Rio Purus, opposite to Lake Ayapuá. Two other species, *Callicebus caligatus* and *Callicebus cupreus*, occur in this area (van Roosmalen *et al*. 2002). Some specimens of *C. dubius*, deposited in the British Museum, were obtained in nearby Humaitá, a town on the left bank of the Rio Madeira. The holotype is an adult female (skin and skull), deposited in the Field Museum of Natural History, Chicago, number 38886, collected by Carl Lako in June 1931 (van Roosmalen *et al*. 2002).

According to van Roosmalen and colleagues (2002) the distribution of *C. dubius* corresponds to the "south of the Rio Ituxí, or maybe even the Rio Mucuím, both right bank tributaries of the Rio Purus, eastern limit the Rio Madeira south of the town of Humaitá, and west to the Rio Purus, southern limit unknown". This description is partially inconsistent with or at least not logically represented by the map in van Roosmalen *et al*. (2002) that shows the Rio de las Piedras (Bolivia) as the southern limit, with the Madre de Dios and Madeira defining the eastern limit of the species distribution. Rowe and Martinez (2003), however, have registered *Callicebus brunneus* in that region. Rowe and Martinez (2003) surveyed titi monkeys and found that their distribution in northern Bolivia is not consistent with the possible southern limit suggested by van Roosmalen *et al*. (2002) for *C. dubius*, but the distribution of *C. brunneus* coincides with reports by Anderson (1997) and Hershkovitz (1990). In addition, Robert Wallace (pers. comm.) has recorded a different species, which is not *C. dubius,* in the Department of Pando, Bolivia.

The map in van Roosmalen *et al.* (2002) indicates the Rio Mucuim as eastern limit for *C. dubius*, although there is a sampling gap between this river and the Rio Ituxí. In this paper we provide additional data on the geographic

distribution of *C. dubius*, confirming (a) its occurrence between the rivers Ituxi and Mucuim (Fig. 1) and (b) the latter river as the eastern limit. We also report an observation of individuals of this species crossing eastward towards the right bank of the Rio Mucuim using a man-made wooden bridge, and discuss the implications of this observation.

## Methods

The study area was located on the left bank of the Rio Madeira in the municipality of Canutama, state of Amazonas, Brazil. This is a transitional environment between grassland ('Campinas'), 'Campinaranas', and 'Terra firme' forest, with a high density of understory babaçu-palms (*Attalea speciosa*) and typical savanna ('Cerrado') and grassland ('Campinas') vegetation in open areas (M. Hopkins, pers. comm.). About 13 km of trail routes were used for a mammal survey for 15 days in April 2007. Rapid survey methods used for mammals (Fonseca, 2001; Young *et al.*, 2003) were applied, including linear transects, search for indirect evidence (tracks, scats/regurgitations, bones, etc.) and interviews with local inhabitants. However, only *C. dubius* sighting or vocalization areas were used for mapping purposes. One voucher specimen (INPA 5671) of *C. dubius* was collected to guarantee species identification on the basis of external features (such as pelt color and pattern) according to Hershkovitz (1988, 1990) and van Roosmalen *et al.* (2002). The site coordinates were obtained with a GPS Garmin unit, and maps were produced using ArcView GIS 3.2.

## Results and Discussion

Nine groups of *C. dubius* were recorded in April 2007 (Table 1), eight of them within the Mucuim-Ituxi interfluvium. This confirms the distribution of this species (Fig. 1, 2) between the Ituxi and Mucuim rivers, as suggested by van Roosmalen *et al.* (2002) but without proof through locality records. The ninth group was recorded on the right bank of the Rio Mucuim (Table 1). *C. dubius* occupied areas of 'Campinarana' and 'terra-firme' open canopy forests covered by palms. During our survey, we did not observe *Callicebus stephennashi*, confirming its restriction to the area between the left bank of the Rio Ipixuna and the right bank of the Rio Mucuim.

On 26th April 2007 we observed several *C. dubius* during an intraspecific agonistic interaction on an unpaved road that crosses the Rio Mucuim, in the hydrographic basin of the Rio Purus. The animals were on the right bank of the Rio Mucuim, close to the wooden bridge that crosses this river. The event was observed, photographed, and reported by M. Hopkins and P. Assunção, botanical researchers from INPA, during the first Geoma Madeira-Purus Expedition. This observation could imply a possible range expansion of *C. dubius* into the distributional range of *C. stephennashi*. Bridge crossing might be a more common event than

**Table 1.** New records of *Callicebus dubius. Callicebus dubius* invasion on the right bank of the Rio Mucuim, which is in the range of *Callicebus stephennashi* (Record 1), and Callicebus dubius on the left bank of the Rio Mucuim (Records 2-8).

| Localities | Coordinates |
|---|---|
| 1. Rio Mucuim (2 individuals) | S -8° 42'02.4" W -64° 13'24.2" |
| 2. 'Campina' (2 individuals) INPA 5671 | S -8° 39'10.5" W -64° 21'31.3" |
| 3. 'Campina' (3 individuals) | S -8° 39'12.9" W -64° 21'28.0" |
| 4. 'Trilha norte' group 1 (3 individuals) | S -8° 39'10.0" W -64° 22'03.7" |
| 5. 'Trilha norte' group 2 (vocal record) | S -8° 38'40.3" W -64° 22'04.4" |
| 6. 'Curral' (2 groups vocalizing) | S -8° 38'54.3" W -64° 20'14.0" |
| 7. 'Trilha sul' 1 (4 individuals) | S -8° 40'34.9" W -64° 21'52.2" |
| 8. 'Trilha sul' 2 (vocal record) | S -8° 39'26.9" W -64' 19'21.7" |

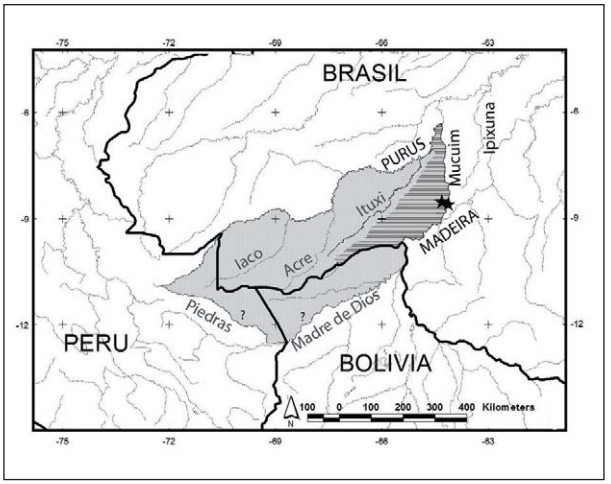


**Figure 1.** Geographic distribution of *Callicebus dubius*. The gray area represents van Roosmalen's *et al.* (2002) description of the distribution (not their map). The hatched polygon is the distribution between the rivers Mucuim and Ituxi confirmed in our study. The question marks indicate the inconsistencies in van Roosmalen´s and colleagues' map noticed by Rowe & Martinez (2003) and R. Wallace (pers. comm.).

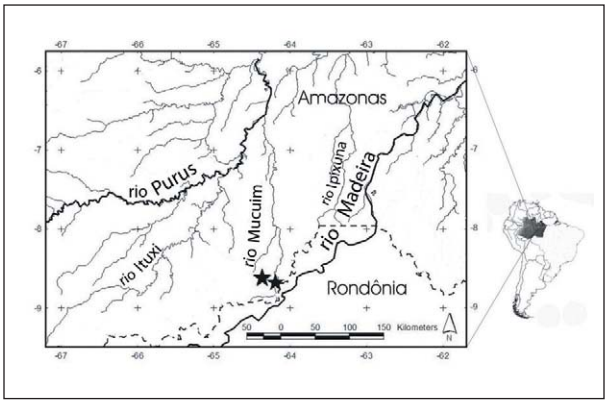


**Figure 2.** Sites of new records of *Callicebus dubius* on the left bank of the Rio Mucuim. The left star represents sites 2 to 8 and the right star represents site 1.

expected as other primate species have also been observed exhibiting this behavior. On November 2008 a group of more than 10 individuals of *Mico intermedius* was seen and three of them photographed crossing a small bridge on an unpaved road over the Rio Água Branca (9º 09' 41.4" S and 60 º 28' 03.7" W, road MT-206 connecting Colniza – Mato Grosso State and Machadinho D`oeste, Rondonia State), a small tributary of the Rio Guariba in northern Mato Grosso (I. Theobald, pers. comm.). These bridges over the rivers Mucuim and Água Branca do not exceed 30 and 15 m in length, respectively. These observations indicate that man-made structures may break down natural geographic barriers and thus interfere with biogeographic processes. The implications of such interference, e.g. potential for hybridization or displacement of one species by another, remain to be determined.

## Acknowledgments

This paper is an outcome of the project "Biodiversity of the Madeira-Purus Interfluvium" of the Geoma network of Brazil's Ministry of Science and Technology. We thank INPA (Instituto Nacional de Pesquisas da Amazonia), MPEG (Museu Paraense Emilio Goeldi), and Petrobrás for field support. Eckhard W. Heymann provided crucial comments. We thank Karl Mokross for English revision. Special thanks to Mike Hopkins and Paulo Assunção for the vegetation information and the record of *C. dubius* bridge crossing. We also thank Daniel P. Munari and Izac F.Theobald (SDS-AM) for information from the Rio Água-Branca, and Robert Wallace for the information from Pando Department, Bolivia. For grants and fellowships that made our work possible we thank the following agencies: Wildlife Conservation Society and Conservation Leadership Programme (support to F.R.).

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# Sleep Tree Use by White-Faced Capuchins (*Cebus capucinus*): Implications for Differences in Seedling Composition

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## Introduction

White-faced capuchins are highly frugivorous, diurnal animals, and previous studies indicate that they are effective primary seed dispersers (Wehncke *et al.*, 2003; Smith, 2004; Valenta and Fedigan, 2009a) across several measures of seed dispersal effectiveness: quantity of seeds dispersed (Wehncke *et al.*, 2003; Valenta and Fedigan, 2008), quality of seed dispersal (Chapman, 1989; Smith, 2004; Wehncke and Dalling, 2005; Valenta and Fedigan, 2009a), and diurnal spatial patterns of seed dispersal (Wehncke *et al.*, 2003; Wehncke and Dalling, 2005; Valenta and Fedigan, 2009b). One aspect of capuchin seed dispersal that has not been studied is nocturnal seed input at sleeping sites. White-faced capuchins spend approximately half of their lives sleeping in a limited number of trees (Fragaszy *et al.*, 2004). Although they have not been observed to consume fruit at night, their gut passage rate of 35 minutes to 5 hours (Rowell and Mitchell, 1991; Wehncke *et al.*, 2003; Valenta and Fedigan, 2009b), coupled with their consumption of fruit until minutes before they retire to a sleeping tree (pers. obs.) lead us to the inference that they defecate a large number of seeds beneath sleep trees. Additionally, a great deal of capuchin feces is observed beneath sleep trees the morning after capuchins sleep in them, and capuchins defecate first thing in the morning before leaving sleep trees. Unfortunately, attempts to quantify nocturnal seed rain have not been successful, but the combination of capuchin gut passage rates, with observations of high seed input the morning after sleep trees are utilized by groups indicate that seed rain beneath sleep trees used by this species is significant. Here, we test the effect of repeated sleep