

## Short Communication

# Distribution and status of the Critically Endangered blond titi monkey *Callicebus barbarabrownae* of north-east Brazil

RODRIGO C. PRINTES, ANTHONY B. RYLANDS and JÚLIO CÉSAR BICCA-MARQUES

**Abstract** The blond titi monkey *Callicebus barbarabrownae* lives in forest fragments in the caatinga (tropical thorn scrub and forest) of north-east Brazil. In 2004–2005 we carried out five surveys to determine its current distribution and conservation status; surveying forest fragments, interviewing local people, and recording vegetation types and patterns of land use. The blond titi monkey occurs mainly in Dense Arboreal Caatinga and Highland Coastal Rainforest in the state of Bahia, at elevations of 241–908 m. Its range extends over 291,438 km<sup>2</sup>, with an area of occupancy of 2,636 km<sup>2</sup>. Estimated minimum population was 260 individuals. It was not recorded in any protected area. Cattle ranching favours the persistence of forest fragments for this species, whereas agriculture, subsistence or commercial, does not. Our findings supported the IUCN Red List assessment of Critically Endangered for this species.

**Keywords** Brazil, caatinga, *Callicebus barbarabrownae*, conservation status, distribution, titi monkey

The blond titi monkey *Callicebus barbarabrownae* (Plate 1) lives in dry forest fragments in the caatinga (tropical thorn scrub and deciduous forest) in north-east Brazil. The colonization of this region and the widespread destruction of its vegetation began in the early 1500s and the caatinga forests have been largely destroyed, reduced to widely dispersed, small, degraded patches surrounded by scrub, barren pasture and crops (Coimbra-Filho & Câmara, 1996). When Hershkovitz (1990) described *C. barbarabrownae* it was known from just three localities in the state of Bahia: Lamarão (Table 1, Fig. 1: locality 40), Formosa (locality 41), and Bandeira de Mello (locality 39). Marinho-Filho & Veríssimo (1997) reported a specimen from Mirorós, Bahia (locality 38), which extended the range to the west, and indicated that the western limit was the Rio São Francisco. It has been categorized as

Critically Endangered on the IUCN Red List since 1996 based on these four localities and a general understanding of the widespread destruction of the caatinga (Veiga et al., 2008). Here we report a 2004–2005 survey of *C. barbarabrownae* in the states of Bahia, Sergipe and Alagoas that was designed to obtain a better understanding of the species' habitat preferences and the extent of its geographical range and to verify its conservation status.

From June 2004 to May 2005 (130 days of field research) we surveyed 353,925 km<sup>2</sup> of the caatinga between the Rios São Francisco and Jequitinhonha in Bahia, including Sergipe and the deciduous and transitional deciduous to humid forests of Alagoas. We surveyed forest fragments and gallery forests, which local people (farmers, farm workers and hunters with demonstrable expertise in the local fauna; Davis & Wagner, 2003) indicated as having resident titi monkeys. We conducted 124 interviews using formal questionnaires: 37 where the species was eventually recorded and 87 in areas where it was not found. We interviewed owners and employees of each farm we visited to obtain information on the size of the forest remnants, the presence of areas protected by Brazilian law (e.g. Legal Reserves), land use (agriculture, cattle ranching, fruit crops or mining), and the extent and impact of hunting and other threats affecting the species. Surveys were carried out in the early morning when titi monkeys are more active and often call. We played recordings of calls of the closely related *Callicebus personatus* from Emmons et al. (1997) to elicit responses by titi monkeys (37% of the new locality records resulted from vocal responses to the playback recording).

The vegetation was classified based on physiognomy and the presence of typical plant species, following Andrade-Lima (1981): Dense Arboreal Caatinga (closed canopy, 20 m in height), Open Arboreal Caatinga (sparser forest with a broken canopy), Dense Shrubby Caatinga (*Carrasco* in western Bahia; cacti, shrubs, sparse trees, predominantly Euphorbiaceae); Sparse Shrubby Caatinga (cacti, shrubs), and Highland Coastal Rainforest (also called *Agreste*; deciduous pre-montane and montane, palm trees, arboreal cacti, epiphytic bromeliads, transitional between the caatinga and the rainforest sensu stricto), and Gallery Forest.

We estimated the extent of occurrence of *C. barbarabrownae* as the area of the polygon with angles  $\leq 180^\circ$  that encompasses all records. Area of occupancy was estimated

RODRIGO C. PRINTES (Corresponding author) Universidade Estadual do Rio Grande do Sul, Rua Assis Brasil, 842, Centro, São Francisco de Paula 95400-000, Rio Grande do Sul, Brazil. E-mail rodrigo-printes@uergs.edu.br

ANTHONY B. RYLANDS Conservation International, Arlington, Virginia, USA

JÚLIO CÉSAR BICCA-MARQUES Laboratório de Primatologia, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil

Received 21 October 2010. Revision requested 16 December 2010.

Accepted 18 January 2011.

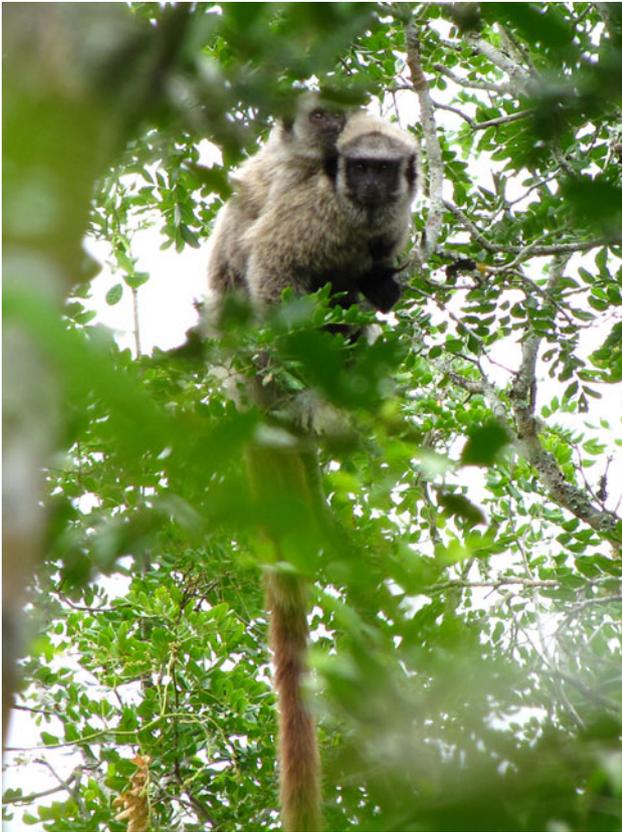


PLATE 1 Blond titi monkey *Callicebus barbarabrownae* family group (photograph: Antônio Estrela).

by overlaying a grid with cells of area  $0.01 \text{ km}^2$  (equivalent to an area of  $0.25 \text{ km}^2$  on a map scale of  $1:5,000,000$ ). Titi monkeys live in family groups of 2–4 individuals (adult pairs and up to two offspring). We estimated the size of the *C. barbarabrownae* population by the number of groups we located, considering each individual sighting or vocal contact as representing a social group of four.

We obtained 37 new locality records for *C. barbarabrownae*, all in Bahia (Table 1, Fig. 1). The northern limit of the species' distribution was identified as the Serra do Minuim (Table 1, Fig. 1: locality 10), the southern limit the Serra do Sincorá, Lamarão (locality 12), the eastern limit the municipality of Coronel João Sá (locality 8) on the border of the states of Bahia and Sergipe, and the western limit the municipality of Gentio do Ouro, 107 km from the Rio São Francisco (locality 36). Extent of occurrence was  $291,438 \text{ km}^2$  over altitudes of 241–908 m (Table 1). Area of occupancy was  $2,636 \text{ km}^2$ . The population size was estimated to be 260 based on records of 65 social groups (51 individuals sighted and 14 vocal contacts). The species was not found in any protected area.

Agriculture was the major economic activity in 56% of the farms inhabited by titi monkeys, followed by cattle ranching (28%), and diversified land use (combinations of coffee plantations, horticulture, sheep farming, and fruit growing, e.g. watermelon and mango). Agriculture, especially of beans (24%), maize (22%) and manioc (4%), was the

major economic activity in 50% of the farms where titi monkeys were not found, whereas cattle ranching accounted for 15% and diversified land use for the remaining 35%.

*C. barbarabrownae* is endemic to the caatinga but occupies  $< 30\%$  of this biome. In the north it does not reach the Rio São Francisco, as had been proposed by Hershkovitz (1990). Canudos and Minuim,  $< 100 \text{ km}$  south of the Rio São Francisco, are the current northern limits of its range. This study confirmed Hershkovitz's (1990) supposition that the relief (or phytogeographical changes related to it) of the western Chapada Diamantina is a barrier for the species.

A lack of sightings of *C. barbarabrownae* in Dense Shrubby Caatinga and Gallery Forest, both seemingly adequate habitats, was significant because both provide arboreal corridors between the many isolated patches of Dense Arboreal Caatinga and Highland Coastal Rainforest where most of the remaining populations were found. The ubiquitous loss of Gallery Forest compromises habitat connectivity for arboreal species in the caatinga. Different forms of land use also affect the persistence of *C. barbarabrownae* in habitat patches. Although the prevalence of agriculture was not related to the likelihood of occurrence of titi monkeys, cattle-ranching was. This is possibly because cattle ranches have larger forest reserves (the stipulated Legal Reserve comprising a minimum of 20% of a landholding; Brazilian Federal Law 4771/1965) than crop farms, and a larger number of cattle ranches maintained titi monkeys than those which did not.

The urbanization of rural areas has probably contributed to the local extinction of the species from many areas. Feira de Santana and Serrinha are examples of municipalities that have experienced significant human population growth and where titi monkeys have now disappeared. Extirpation near human settlements is due not only to hunting but also to the fragmentation, degradation and disturbance of vegetation, and exposure to dangers such as dogs and electrocution on power lines, and road kill (Printes, 1999; Lokschin et al., 2007).

Our estimate of the total population size for *C. barbarabrownae* is a minimum and an underestimate because the species is cryptic and shy. Some vocal contacts may have involved more than one group. However, it is unlikely that the species reaches a minimum functional viable population size because of the wide dispersion of its small and isolated subpopulations in tiny forest patches over  $291,438 \text{ km}^2$ . Less than 4% of the caatinga is officially protected (TNC do Brasil & Associação Caatinga, 2004) and blond titi monkeys were not found in any protected area. The isolation of the known remnant populations poses significant challenges to dispersal. Our baseline data on the distribution and size of these populations will help in designing future surveys at finer spatial scales, an urgent task for developing effective landscape conservation, habitat restoration and management strategies for *C. barbarabrownae*.

TABLE 1 Locality records of *Callicebus barbarabrownae* (see numbers in Fig. 1) obtained in this study (localities 1–37) and by Marinho-Filho & Veríssimo (1997; locality 38), and evidenced by specimens in the British Museum (Natural History), London, UK (localities 39–40; Napier, 1976) and the Field Museum of Natural History, Chicago, USA (locality 41; Hershkovitz, 1990).

Locality	Coordinates	Altitude (m)
1. Fazenda Floresta, Jeremoabo	9°58'57.00"S, 38°15'09.79"W	336
2. Fazenda Mineiro, Jeremoabo	10°03'19.80"S, 38°15'33.55"W	287
3. Lagoa do Nolasco, Cícero Dantas	10°27'54.02"S, 38°21'19.35"W	424
4. Cícero Dantas	10°31'18.56"S, 38°20'50.10"W	390
5. Raso do Santo, Cícero Dantas	10°29'06.50"S, 38°18'13.50"W	432
6. Antas	10°26'43.80"S, 38°18'43.42"W	330
7. Sítio do Quinto	10°14'53.99"S, 38°15'04.54"W	268
8. Coronel João Sá	10°13'53.30"S, 38°02'05.04"W	245
9. Pedro Alexandre	9°59'48.40"S, 37°58'35.57"W	339
10. Minuim, Santa Brígida	9°49'36.18"S, 38°05'44.74"W	451
11. Bela Vista or Boa Vista, Tanquinho	11°56'32.90"S, 39°04'05.90"W	477
12. Lamarão	11°49'55.30"S, 38°54'14.60"W	270
13. Casa Nova, Candéal	11°46'58.10"S, 39°13'50.90"W	241
14. Mandacaru, Quijingue	10°57'19.40"S, 39°05'11.80"W	450
15. Monte Cruzeiro, Quijingue	10°57'19.90"S, 39°04'50.50"W	346
16. Mirandela, Banzaê	10°39'39.60"S, 38°37'53.10"W	300
17. Soturno Farm, Banzaê	10°35'25.90"S, 38°35'23.10"W	415
18. Contendas, Monte Santo	10°26'44.60"S, 39°10'11.70"W	626
19. Serra Branca, Monte Santo	10°24'32.40"S, 39°20'27.80"W	587
20. Itiúba	10°41'53.20"S, 39°49'34.80"W	711
21. Serra Branca, Canudos	10°18'18.90"S, 38°57'44.30"W	551
22. Fazenda Lagoa Funda, Campo Formoso	10°26'36.10"S, 40°22'21.70"W	768
23. Fazenda Corcovado, Contendas do Sincorá	13°54'21.40"S, 41°09'55.10"W	603
24. Fazenda Corcovado, Contendas do Sincorá	13°54'52.10"S, 41°10'23.70"W	712
25. Fazenda Trancada II, Andaraí	12°57'56.30"S, 41°14'27.80"W	708
26. Road to Remanso, Lençóis	12°33'17.10"S, 41°21'52.40"W	490
27. Fazenda Morro Redondo, Itaberaba	12°24'09.00"S, 41°24'56.50"W	341
28. Marcionílio Souza	13°02'07.90"S, 40°25'38.00"W	598
29. Fazenda de Garcia, Rui Barbosa	12°23'35.90"S, 40°31'56.20"W	464
30. Fazenda Serra Azul, Mandacaru, Baixa Grande	11°52'40.40"S, 40°04'36.80"W	357
31. Fazenda Deus Dará, Mandacaru, Baixa Grande	11°52'40.20"S, 40°05'46.90"W	424
32. Fazenda Junco, Maxixi, Miguel Calmon	11°29'28.00"S, 40°41'45.50"W	656
33. Fazenda Bastião, Saúde	10°57'38.70"S, 40°21'08.30"W	524
34. Faendas Nova Esperança & Passagem, Morro do Chapéu	11°53'21.90"S, 41°04'36.50"W	776
35. Fazenda Roça Grande, Morro do Chapéu	11°53'33.00"S, 41°04'28.07"W	766
36. Salitre, Gentio do Ouro	11°32'54.40"S, 42°22'58.70"W	908
37. Fazenda J. Viana, Wagner	12°15'35.50"S, 41°12'41.50"W	609
38. Fazenda Conceição, Mirorós, Ibipeba	11°24'S, 42°17'W	
39. Bandeira de Mello, Rio Paraguaçu	13°03'S, 41°49'W	
40. Lamarão (type locality)	11°46'S, 38°52'W	300
41. Formosa	11°18'S, 41°02'W	700

The assessment of *C. barbarabrownae* as Critically Endangered (Veiga et al., 2008) was supported by our findings. Six years on, we have no indication that the status of the species has changed for the better or for the worse. A potential threat in the coming years is the transposition of the Rio São Francisco, a mega-project already underway to provide water to semiarid areas of four Brazilian states (Suassana, 2010). Direct or indirect impacts could result from urban and transport infrastructure, agricultural development and increased human populations, although they will be concentrated to the north of the river; i.e. north of the species'

range. The creation of protected areas, measures to maintain and augment their habitats through reforestation, and further research on ecology and behaviour are needed to protect the blond titi monkey, one of the few mammals endemic to the caatinga and its threatened forests.

### Acknowledgements

We thank the Primate Action Fund, Critical Ecosystem Partnership Fund, Fundação Biodiversitas, Instituto de Estudos Sócio-Ambientais do Sul da Bahia, Coordenação

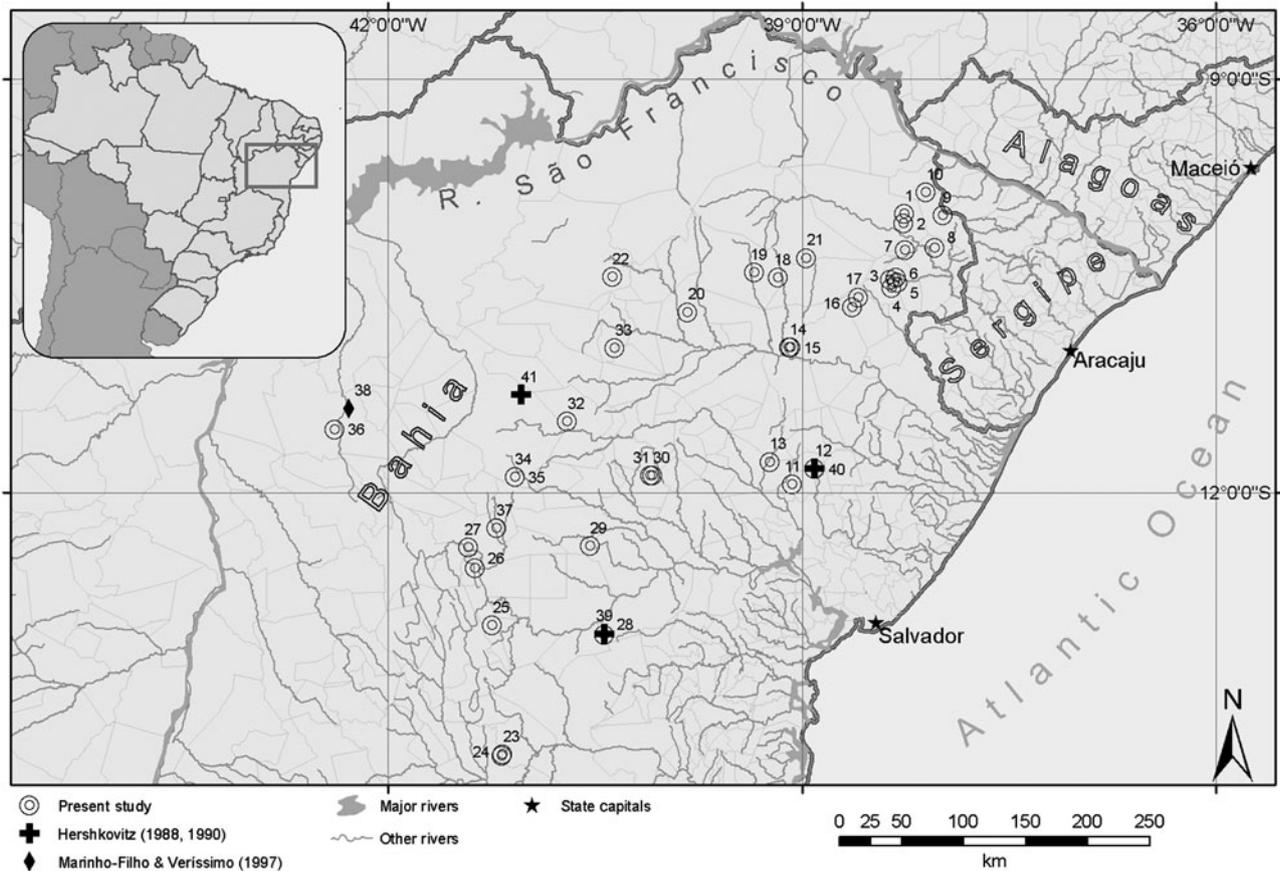


FIG. 1 Occurrence localities (see details in Table 1) of the blond titi monkey *Callicebus barbarabrownae*. The inset indicates the location of the main map in north-east Brazil.

de Aperfeiçoamento do Ensino Superior, Centro de Proteção de Primatas Brasileiros, and the Núcleo de Extensão Macacos Urbanos for their support, and André C. Alonso, André Hirsch, Antônio Estrela, Ayr Müller Gonçalves, Carlos E. Guidorizzi, Cassiano Gatto, Elena Charlotte Landau, Gabriel dos Santos Rodrigues, Jader Marinho-Filho, Jaques Pinto Rangel, Jocélia Grazia, Leandro Jerusalinsky, Leonardo Oliveira, Luisa Lokschin, Marcos de Souza Fialho, Marcelo Sousa, Marcelo Xavier, Maria Cecília Kierulff, Raquel Moura, Roberto W. Groehs and Waldney Martins.

## References

- ANDRADE-LIMA, D. (1981) The caatingas dominium. *Revista Brasileira de Botânica*, 4, 149–163.
- COIMBRA-FILHO, A.F. & CÂMARA, I. DE G. (1996) *Os limites originais do bioma Mata Atlântica na região Nordeste do Brasil*. Fundação Brasileira para a Conservação da Natureza, Rio de Janeiro, Brazil.
- DAVIS, A. & WAGNER, J.R. (2003) Who knows? On the importance of identifying “experts” when researching local ecological knowledge. *Human Ecology*, 31, 463–489.
- EMMONS, L.H., WHITNEY, B.M. & ROSS, JR, D.L. (1997) *Sounds of Neotropical Rainforest Mammals—An Audio Field Guide*. Library of Natural Sounds, Cornell Laboratory of Ornithology, Ithaca, USA.
- HERSHKOVITZ, P. (1990) Titis, new world monkeys of the genus *Callicebus* (Cebidae, Platyrrhini): a preliminary taxonomic review. *Fieldiana Zoology*, 5, 1–109.
- LOKSCHIN, L.X., PRINTES, R.C., BUSS, G. & CABRAL, J.N.H. (2007) Power lines and howler’s conservation (*Alouatta guariba clamitans*; Cabrera, 1940) in urbanizing areas, Porto Alegre, Rio Grande do Sul, Brazil. *Neotropical Primates*, 13, 4–8.
- MARINHO-FILHO, J. & VERÍSSIMO, E.W. (1997) The rediscovery of *Callicebus personatus barbarabrownae* in north-eastern Brazil with a new western limit for its distribution. *Primates*, 38, 429–433.
- NAPIER, P. (1976) *Catalogue of Primates in the British Museum (Natural History). Part 1: Families Callitrichidae and Cebidae*. British Museum (Natural History), London, UK.
- PRINTES, R.C. (1999) The Lami Biological Reserve, Rio Grande do Sul, Brazil, and the danger of power lines to howlers in urban reserves. *Neotropical Primates*, 7, 135–136.
- SUASSUNA, J. (2010) *Transposição do Rio São Francisco: possibilidades técnicas versus vontade política*. Fundação Joaquim Nabuco, Recife, Brazil. <http://www.fundaj.gov.br/docs/tropico/desat/sf.html> [accessed 9 January 2011].
- TNC (THE NATURE CONSERVANCY) DO BRASIL & ASSOCIAÇÃO CAATINGA (2004) As unidades de conservação do bioma caatinga. In *Biodiversidade da Caatinga: Áreas e Ações Prioritárias para a Conservação* (eds J.M.C. Silva, M. Tabarelli, M. Fonseca & L. Lins), pp. 295–300. Ministério do Meio Ambiente, Brasília, Brazil.
- VEIGA, L.M., PRINTES, R.C., RYLANDS, A.B., KIERULFF, C.M., DE OLIVEIRA, M.M. & MENDES, S.L. (2008) *Callicebus barbarabrownae*. In *IUCN Red List of Threatened Species v. 2010.4*. <http://www.iucnredlist.org> [accessed 1 March 2011].

**Biographical sketches**

RODRIGO CAMBARÁ PRINTES is an ecologist interested in primate conservation, reserve management and environmental policy development. He has conducted research on brown howler monkeys,

northern muriquis, and blond titi monkeys. ANTHONY RYLANDS is a zoologist with wide interests in primate conservation, systematics, and ecology. JÚLIO CÉSAR BICCA-MARQUES is an anthropologist whose research focuses on primate ecology, behaviour, cognition and conservation biology.