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A Journal and Newsletter of the Neotropical Section of the IUCN/SSC Primate Specialist Group

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Neotropical Primates
A Journal and Newsletter of the Neotropical Section of the IUCN/SSC Primate Specialist Group

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The black-headed uacari, Cacajao melanocephalus owahary.

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Editorial

Newtropical Primates has taken on a new role - doubling as a journal while maintaining its main function as a newsletter for the Primate Specialist Group membership as well as for Neotropical primate researchers, zookeepers and conservationists worldwide. Our intention is to include up to two or three peer-reviewed articles. These will be limited to aspects directly dealing with or linked to the systematics and taxonomy, biogeography, ecology and conservation of the platyrhines. For this reason, we are pleased to welcome a number of renowned Neotropical primatologists with enormous experience in these areas as our new Editorial Board. They have kindly accepted to play a special role in helping us to glean articles and information of importance for Neotropical primate studies and conservation, and to maintain, raise even, the standards we are hoping to achieve.

Besides the change into part-journal, moving the editorial office to the Center for Applied Biodiversity Science (CABS) at Conservation International (CI), Washington, DC, has been the reason for the delays in the publication of Newtropical Primates – for which we apologize. Remedyng this situation, we are also pleased to welcome on board Jennifer Pervola, who is now the Assistant Editor and, by the way, is also helping Gustavo Fonseca with the editing of another SSC Specialist Group newsletter for the Neotropics – Edentata. Please send your contributions, and news items and announcements relevant to Neotropical primates (as well as sloths, armadillos and anteaters) to her at CABS/CI.

In this issue, we are publishing the descriptions of two new marmoset species, following six which have already been described from the basin of the Rio Madeira in the Brazilian Amazon in recent years: Callithrix intermedius in 1977, C. nigriceps and C. maeusi in 1992, C. marcat in 1993, C. saterei in 1998, and C. humilis in 1999. There are a further two articles, one by Alejandro Estrada and co-workers on a population of black howler monkeys, Alouatta pigra, at Parque Nacional Zona Arqueológica de Palenque in Chiapas, Mexico, and a second by Robert Wallace and co-workers on the primates of the Rios Blanco y Negro Wildlife Reserve in Bolivia.

The following issue, 8(2), of Neotropical Primates will be dedicated to a taxonomic listing of the Platyrhini; results of the workshop “Primate Taxonomy for the New Millennium”, organized by the PSG, and kindly hosted by the Disney Institute in Orlando, Florida in February of this year. The aims of this Workshop were to provide the fullest assessment of primate diversity with our current knowledge, and especially considering the numerous contributions and revelations of genetic studies in the last decade. A full listing of the primates, by their species or subspecies, is a vital first step for the establishment of conservation priorities and the full assessment of the Order for the IUCN/SSC Red List. In no way are we imposing a “definitive taxonomy” and wherever there is disagreement or doubt, we hope it will stimulate substantiated discussion and further research, especially into such poorly understood genera as Alouatta and Cebus.

Please send us short articles, as well as your publications, information about events, research programs, field sites, announcements, theses and dissertations, and Society activities, so that we can fulfill our mission of disseminating a wide range of valuable information for the conservation of primates and their forests in the New World.

Anthony B. Rylands
Ernesto Rodriguez-Luna
TWO NEW SPECIES OF MARMOSET, GENUS CALLITHRIX ERXLEBEN, 1777 (CALLITHRICIDAE, PRIMATES), FROM THE TAPAJÓS/MANDEIRA INTERFLUVIUM, SOUTH CENTRAL AMAZONIA, BRAZIL

Marc G. M. van Roosmalen, Tomas van Roosmalen, Russell A. Mittermeier and Anthony B. Rylands

Abstract

Two new species of marmoset, Callithrix mancinesis sp. n. and Callithrix acariensis sp. n., are described; the first from the interfluve of the Rios Madeira, Aripuanã and Manicoré, and the second from the interfluve of the Rios Acari and Sucundurí, south of their confluence with the Rio Canumã, both in the state of Amazonas, south central Amazonia, Brazil. The new species are members of the Callithrix argentata group of marmosets, sensu Hershkovitz (1977). Callithrix mancinesis appears to be most closely related to C. nigriceps, C. maritai and C. aff. emilias, its neighbors to the south, and C. acariensis appears to be most closely related to Callithrix sateri, its neighbor to the north, and Callithrix melanocephala to the south, but they are easily distinguished from them. The most noticeable features of Callithrix mancinesis are the almost white or silvery upper parts including the arms, hands, chest, mantle, nape and forehead, and the indistinct light gray (rather than black) cap on the head. The back is grayish and transversely white or silvery striped or mottled. The under parts are yellowish or orange. The legs and feet are orange. The tail is black. Those of Callithrix acariensis include the almost entirely snow white upper parts including the upper arms, chest, mantle, nape and forehead, and the lack of a dark cap on the head. The back is grayish. The under parts are white. The legs and feet are bright orange. The tail is dark black with a bright orange dorsal patch at the proximal end. Most strikingly, this species shows a broad white hip and thigh stripe running from the mid dorsum (almost continuing across the back) to the knee. The phylogenetic status of the two new marmoset taxa is presented based on 902 base pairs (bp) of the mitochondrial control region and combined with previously determined sequences from related species. Additionally, 635 bp of intron 2 of the nuclear b2-microglobulin gene was sequenced for C. mancinesis and combined with sequences from related species. Callithrix mancinesis is shown to be a member of the C. argentata clade according to mitochondrial control region and b2-microglobulin intron 2 sequences. Callithrix acariensis is found to be most closely related to C. maesi and C. humeralis (the tufted-ear marmoset dade) based on mitochondrial control sequence. The phylogenography of the marmosets is discussed, as well as possible scenarios for historic patterns of dispersal and speciation. With the discovery of these two new marmosets, the number of species of Callithrix increases to 21, of which 20 are endemic to Brazil (considering C. aff. emilias from Rondônia a valid species as it is widely separated from C. emilias). The total number of primate species for the country as a whole increases to 79, including those endemic to Brazil.

Key Words - Primates, Callithrichidae, marmosets, Callithrix mancinesis sp. n., Callithrix acariensis sp. n., phylogeny, phylogeography, Brazil, Amazonia.

Resumo

Introduction

All but one of the 19 marmosets, Callithrix Erxleben, 1777, recognized to date are endemic to Brazil. The black-tailed marmoset, Callithrix melanonota, ranges into Bolivia and Paraguay (Stallings and Mittermeier, 1983; Brown and Rumiz, 1986). Two major revisions of this genus have been carried out in the last two decades, one by Hershkovitz (1977), who recognized just three species and 11 taxa, and the other by De Vivo (1988, 1991), who listed an additional form, C. emilieae, and elevated all the forms to species status. Mittermeier et al. (1997) agreed with the taxonomy suggested by De Vivo, but also recognized a sixth eastern Brazilian species, C. pubescens, which was considered a hybrid by Hershkovitz and as merely a pelage color variant of C. penicillata by De Vivo (see Rylands et al., 1993). Mittermeier et al. (1992) followed De Vivo's decision on the Callithrix argentata group, elevating all forms to full species status, and listed nine species within this group.

In this paper we describe two new species from the basin of the Rio Madeira, state of Amazonas, Brazil, increasing the number of Callithrix species to 21 (see Table 1), the number of Brazilian primate species to 79, 41 (52%) of them being endemic, and the number of callithricid taxa to 59 (see Van Roosmalen et al., 1998). Figure I (after Van Roosmalen et al., 1998) shows the distribution of 14 species of the Amazonian Callithrix argentata group, including the two described here, C. manicomii and C. acarini, and also Callithrix humilis M. G. M. van Roosmalen, T. van Roosmalen, Mittermeier and Fonseca, 1998.

C. manicomii is from the region confined by the Rios Madeira, Aripuanã and Manicoré, state of Amazonas, Brazil, and C. acarini occurs between the Rios Acarí and Sucunduri, both in the state of Amazonas in south central Amazonia, Brazil (Fig. 2). In its pelage C. manicomii is most similar to C. aff. emilieae from Rondônia (see footnotes to Table 1), C. nigropectus, and C. marcai (Figs. 3 and 4), with which it is parapatric. However, C. manicomii is quite distinct, and clearly deserves recognition as a full species. C. acarini is most similar to C. melanonota to the south, C. intermedia along the left (west) bank of the upper Rio Aripuanã, and C. saterei to the north (between the Rios Canumá and Abacaxis), all four sharing a very distinct pale throat and hip stripe (Fig. 3).

Callithrix manicomii was first discovered by M. G. M. and Tomas van Roosmalen on 9 July, 1996, during a field trip to the region in search of a new species of dwarf marmo-
Table 1. The taxonomic arrangements for the marmosets *Cebuella* and *Callithrix* in Hershkovitz (1977), De Vivo (1988, 1991), Mittermeier et al. (1988), Rylands et al. (1993), Van Roosmalen et al. (1998), and in this paper.

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<td>Pygmy marmosets</td>
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<td><em>C. pygnae</em></td>
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<td><em>C. p. pygnae</em></td>
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<td>Dwarf marmoset</td>
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<td><em>C. humilis</em></td>
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<td>Marmosets - <em>Callithrix jaccus</em> clade (Eastern Brazil)</td>
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<td><em>C. jaccus jaccus</em></td>
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<td><em>C. j. penicillata</em></td>
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<td><em>C. j. Geoffroyi</em></td>
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<td><em>C. j. aurita</em></td>
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<td><em>C. j. flaviceps</em></td>
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<td><em>C. kubili</em></td>
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<td>Marmosets - <em>Callithrix argentata</em> clade (Brazilian Amazonia, Bolivia and Paraguay)</td>
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<td><em>C. argentata</em></td>
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<td><em>C. a. argentata</em></td>
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<td><em>C. a. leucippe</em></td>
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<td><em>C. a. melanura</em></td>
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<td><em>C. emiliae</em></td>
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<td><em>C. nigriceps</em></td>
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<td><em>C. marci</em></td>
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<td><em>C. saterei</em></td>
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<td><em>C. humeralifer</em></td>
<td><em>C. humeralifer</em></td>
<td><em>C. h. humeralifer</em></td>
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<td><em>C. humeralifer</em></td>
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<td><em>C. h. intermedia</em></td>
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<td><em>C. h. chrysolaera</em></td>
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1 Rosenberger (1981), see also Rosenberger and Coimbra-Filho, 1984, argued, on morphological terms, that the pygmy marmoset should correctly be included in the genus *Callithrix*. This argument was not maintained in Rosenberger et al. (1990), although recently Nagamachi et al. (1991), Barroso et al. (1996), Barroso et al. (1997), Tagliaro et al. (1997), and Tagliaro et al. (1997) have also argued for this arrangement on the basis of their karyotype and molecular genetics.

2 Lönneberg (1940) argued for two subspecies of *Cebuella pygnae*, *C. p. pygnae* and *C. p. niveiventris*. Although they were listed by Napier (1976), Hershkovitz (1977) did not recognize them. Van Roosmalen and Van Roosmalen (1997) and Van Roosmalen et al. (1998) argued that the two forms are distinct and valid subspecies. J. Hernández-Camacho (pers. comm.) believes they should be regarded as distinct species.

3 Described by Van Roosmalen et al. (1998).


5 *Callithrix emiliae* was first described by Thomas (1920) from the Rio Iriá, southern Pará. It was not recognized by Hershkovitz (1977) who regarded it as merely a dark form of *C. argentata argentata*. De Vivo (1985; see also De Vivo, 1991), revalidated this form on the basis of specimens from the state of Rondônia. However, Rylands et al. (1993) argued that the Rondônia marmosets described by De Vivo (1985) should be considered a distinct species based on the fact that the distribution of this form and that of the *C. emiliae* described by Thomas (1920) from Maloca on the Rio Curuai (see De Vivo, 1985; Ávila Pires, 1986) are disjunct, and separated by *C. melanura*. *C. emiliae* was not listed by Groves (1993). Here we recognize the Rondônia marmoset (*C. aff. emiliae* of De Vivo, 1985) and, provisionally, *C. emiliae* Thomas, 1920 from the Rio Iriá until further research is carried out on these marmosets.

6 Described by Ferrari and Lopes (1992).

7 *Callithrix marci* was described as a subspecies of *Callithrix argentata* by Alperin (1993). It is listed here as a species to conform with the view that all *Callithrix* should be considered species (De Vivo, 1985, 1991; Mittermeier et al., 1992). It is known only from the type locality, "Foz do Rio Castanho (= Rio Roosevelt), afluenl esquerda do rio Aripuanã, Estado do Amazonas, Brasil" (Alperin, 1993). The type locality as described by Alperin is confused in that the Rio Castanho is not a synonym of the Rio Roosevelt, and is a left bank affluent of the Rio Roosevelt, not the Rio Aripuanã.


9 *Callithrix intermedia* was described as an intermediate color form of *C. humeralifer* by Hershkovitz (1977). Pelage color and pattern, and its geographic distribution, however, would place it as a subspecies of *C. argentata* if, following Hershkovitz (1977), the Amazonian marmosets are considered subspecies of just two species, *C. argentata* and *C. humeralifer* (see Rylands et al., 1993).

10 Described by Mittermeier et al. (1992).
Figure 1. Distribution of 14 species of the Amazonian Callithrix argentata group, including C. manicorensis and C. acariensis described in this paper, and also of Callithrix humilis Van Roosmalen et al., 1998. Map by Stephen D. Nash.

Figure 2. Distribution of Callithrix manicorensis and Callithrix acariensis. Map by Stephen D. Nash.
Table 2. The internembral (humeral + radius)/(femoral + tibia) x 100, brachial (radius/humeral) x 100 and crural (femoral/tibia) x 100) indices of one adult Callithrix maniciensis compared with those of Callithrix argentata, Callithrix humilis and Cebuella pygmaea (measurements taken by Lea A. Davis and Susan Ford).

<table>
<thead>
<tr>
<th>Internembral Index</th>
<th>Brachial Index</th>
<th>Crural Index</th>
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<tbody>
<tr>
<td>C. argentata 76 C. humilis 88 C. maniciensis 99</td>
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<tr>
<td>C. maniciensis 78 C. argentata 89 C. argentata 100</td>
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<td>C. humilis 79 C. maniciensis 89 C. humilis 102</td>
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<td>Cebuella pygmaea 82 Cebuella pygmaea 90 Cebuella pygmaea 102</td>
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Table 3. Cranial measurements (mm) of the adult male (Registration number INPA 2512) of Callithrix maniciensis from the Rio Maripauá.

<table>
<thead>
<tr>
<th>Skull and mandible</th>
<th>mm</th>
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<tbody>
<tr>
<td>Greatest Skull Length (SL)</td>
<td>45.36</td>
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<tr>
<td>Condylar Length</td>
<td>36.92</td>
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<tr>
<td>Zygomatic Width (ZW)</td>
<td>30.31</td>
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<tr>
<td>Browrid Width (BW)</td>
<td>27.71</td>
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<tr>
<td>Braincase Length</td>
<td>40.31</td>
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<tr>
<td>Braincase (Postorbital) Width (PW)</td>
<td>26.72</td>
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<tr>
<td>Across First Molars (AM)</td>
<td>15.55</td>
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<tr>
<td>Length of Mandible (ML)</td>
<td>30.45</td>
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<tr>
<td>Coronal Height</td>
<td>18.30</td>
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<tr>
<td>pm1-m2</td>
<td>9.27</td>
</tr>
<tr>
<td>i1-m1</td>
<td>15.62</td>
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<tr>
<td>c1</td>
<td>11.72</td>
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<tr>
<td>pm1-m1</td>
<td>10.07</td>
</tr>
<tr>
<td>i1</td>
<td>15.80</td>
</tr>
<tr>
<td>c1</td>
<td>12.56</td>
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</table>

Geographic distribution: The species is known from the west bank of the lower Rio Ariupuaná from the mouth, south to the confluence with the Rio Roosevelt, and along the east bank of the Rio Madeira from the mouth of the Rio Ariupuaná, just south of the town of Novo Ariupuaná, south to the mouth and right bank of the Rio Manicoré. The southern limit for the species is probably the headwaters of the Rio Manicoré, close to the Rio Roosevelt.

Habitat: The various groups observed in the wild by Marc G. M. van Roosmalen were in dense primary terra firme rainforest and in secondary forest surrounding plantations and fields. Very high densities were found in so-called seringais, a high riverbank forest, managed since the early days of rubber exploitation in the Amazon, where the density of rubber trees was increased artificially. Seringais are an early form of agroforestry, in which areas of high riverbank forests were turned into productive multi-species forests, rich in a number of commercially valuable and edible fruit producing native trees, including rubber (Hevea brasiliensis), Brazil nut (Bertholletia excelsa), 'oréla de macaco' (Enterolobium schomburgkii), wild cocoa (Theobroma spp.), 'bacuri' (Rheedia spp., Platiophyllum insignis), 'ingá' (Inga spp.), 'apucreba' (Spondias mombin), 'biriba' (Rollinia squamosa), 'soursop' (Annona spp.), and a number of tree species belonging to the Sapotaceae and Areaceae (palma) families. The seringais appear to offer optimal habitat and a year-round food supply for small monkeys such as marmosets, pygmy marmosets, dwarf marmosets, titi and night monkeys.

Diagnosis: A marmoset of the Callithrix argentata group (sensu Hershkovitz, 1977), characterized by a black tail and a grey cap on the head, but quite distinct from C. nigriceps, C. mariae, and C. aff. emilii. The lightest of these four species and most advanced pheomelanically (sensu Hershkovitz, 1977), with the least pigmented face and ears. The cap on the head is light gray instead of black in the other members of this group, and the naked face and eyes are surrounded by white fur. The general appearance of this monkey when spotted in the field is an overall drab whitish marmoset with orange legs and a pinkish to orange naked face and ears, irregularly brown mottled in the adults, and a slightly transversely striped gray back. This marmoset is easy to distinguish from the recently described black-capped dwarf marmoset (Van Roosmalen et al., 1998), with which it is sympatric in the northern part of its distribution. The dwarf marmoset is almost one-third the size of Callithrix maniciensis, has an overall dark brown appearance with light brown to orange brown under parts. It spends more time gouging bark on tree trunks, in an upright squirrel-like posture, than true marmosets. The differences between C. maniciensis, Callithrix humilis and C. mariae, can be seen in the color illustrations in Figures 3 and 4.

Description of the holotype: General coloration of upper parts white; transversely mottled with gray; tail black; crown on head triangular, gray; sides of upper arms, shoulders and neck light grayish white, not mottled; back and rump grayish white, mottled with darker gray, giving a dark gray, slightly transversely striped appearance; outer sides of legs and feet orange; upper surface of lower arms and hands slightly orange; lower surface of lower arms ochraceous to orange; lower surface of legs orange; white rim on forehead above the eyes continuing onto the temples; face naked; facial skin and cheeks orange, pigmented dark brown around the eyes and on the lower lip and chin; nose and circumorbital area naked, pink to flesh-colored, dark brown mottled around the nostrils, with a narrow dark brown vertical nose stripe, without moustache; auricles non-pigmented, pink or flesh-colored, slightly hairy (only in juveniles); throat, ventral surface of neck and chest white; belly and inner surface of legs bright orange; exposed genitals non-pigmented, white, hypertrophied (Fig. 6); tail black, proximal end slightly mottled with orange and gray; eyes white with brown pupil and dark brown iris. Weight of juvenile...
female holotype: 135 g. Body measurements: head-body length - 160 mm; tail length - 270 mm; total length - 430 mm; hind foot - 51 mm; hand - 34 mm; hallux - 8 mm, other toes - 12-15 mm; pollex - 9 mm, other fingers - 13-15 mm.

**Origin of the name:** This marmoset was first collected and observed in the wild along the right bank of the Rio Manicoré, municipality of Manicoré. It is therefore named after the river Manicoré, a right bank tributary of the Rio Madeira, south central Amazonia. The name places it geographically relative to its congeners.

**Vernacular name:** This marmoset is referred to as *sagii, saúim (souim)*, or 'branquinho' (= little white fellow, in Portuguese) by the local people. For an English name, we suggest the Rio Manicoré marmoset.

**Callithrix acariniensis sp.n.**

**Holotype:** A live female infant obtained by Marc G. M. van Roosmalen on 29 August 1996 on the right bank of the Rio Acari near its confluence with the Rios Sucunduri and Canumá. It was being kept as a pet and was only 1-2 months old. It was kept in captivity in the endangered primate breeding center in Manaus (managed by the first author). It died when adult and is deposited in the mammal collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil, registration number INPA 3931. The skull is shown in Figure 10; cranial and dental measurements are given in Table 4.

**Type locality:** A small settlement on the right bank of the lower Rio Acari close to the confluence with the Rios Sucunduri and Canumá, state of Amazonas, south central Amazonia, Brazil. Coordinates for the type locality are 05° 07’ 08” S, 60° 01’ 14” W.

**Geographical distribution:** The species is known from the right bank of the lower Rio Acari, and assumed to occur in the entire interfluvium of the Rios Acari and Sucunduri, south perhaps to a contact zone with *Callithrix melamuri* somewhere between the Rio Aripuanã and the Rio Jurua.

**Habitat:** This new species has not been observed in the wild, but according to local settlers living along the right bank of the Rio Acari it is found mainly in dense primary terra firme rainforest and in secondary forest surrounding their plantations and manioc fields.

**Diagnosis:** A marmoset of the *Callithrix argentata* group (sensu Hershkovitz, 1977), it is one of the most colorful of the Amazonian marmosets with its bright orange lower back, underparts, legs and proximal end of the black tail, and predominantly white upper parts and chest contrasting with the partly black pigmented muzzle, narrowly triangular nose patch and ocular rings of the otherwise pink face. Its ears are dark pigmented, partially covered with white hairs (Figs. 7 and 8). It is the lightest of its closest relatives, *C. saterei* and *C. melamuri*, easy to distinguish from its neighbor to the north, *C. saterei*, which has a much darker back, lower arms and legs, an almost totally naked head, asymmetrically black and non-pigmented naked ears, a narrower yellowish orange thigh and hip stripe, and a large black triangular patch on and above the nostrils; its black tail lacks the orange proximal ring or spot (Fig. 3). It is also very easy to distinguish from *C. melamuri*, its neighbor to the south, which is predominantly gray and brown lacking orange and white in its pelage, and lacking the white fur surrounding the face (Fig. 3).

**Description of the holotype:** General coloration of upper parts white, distally grading into gray to dark gray mixed with orange; tail black with a very distinct orange proximal end or spot; crown on head light gray or white; sides of upper arms, shoulders, and neck white or white with grayish hair tips; outer sides of legs and feet bright orange, with a strikingly white, 2 cm wide thigh and hip stripe; upper surface of lower arms and hands gray mixed with orange, lower surface of lower arms white with orange; lower surface of legs white distally grading into orange; forehead white continuing onto the temples, nape, chest and upper arms; face naked; facial skin pink or flesh-colored, with black pigmented patches between the eyes, aside the nostrils, and on the lower lip and chin; nose and circumbucal area naked, pink to flesh-colored, with a narrowly triangular black patch on the nose, without moustache; auricle dark pigmented, grayish, covered with quite a few white hairs; throat, ventral surface of neck and chest white, giving the appearance of a white mantle; belly and inner surface of legs bright orange; exposed genitals non-pigmented, white, pudenda hypertrophied, 2.2 x 2 x 1.5 cm (Fig. 7); tail black, proximal end bright orange forming a 2 cm wide ring; eyes with black pupil and orange brown iris. Weight of adult female holotype: 420 g. Body measurements: head-body length - 240 mm; tail length - 350 mm; total length - 590 mm; hind foot - 63 mm; hand - 45 mm; hallux - 10 mm, other toes - 15-20 mm; pollex - 12 mm, other fingers - 15-20 mm.

**Origin of the name:** This marmoset was collected along the right bank of the Rio Acari. It is therefore named after this river, the only reference to this remote, largely uninhabited part of south central Amazonia, in order to place it geographically relative to its congeners.

**Vernacular name:** This marmoset is referred to as *sagii or saúim (souim)* by the local people. For an English name, we suggest the Rio Acari marmoset.

**Phylogenetic Placement of *Callithrix manicorii* and *Callithrix acariniensis* Based on Nuclear and Mitochondrial Sequences**

**Materials and Methods**

Hair, skin, and liver samples were obtained from deceased specimens from the Breeding Center for Endangered Amazonian Primates in Manaus, Amazonas, Brazil, which were deposited at the zoological museum of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Bra-
zil. Sampled marmosets included three *Callithrix humilis*, one *Callithrix manicorensis*, one *Callithrix acariensis*, and one *Cebuella pygmaea niviventeri*. DNA was extracted from the tissues following the protocol provided by Gibco BRL DNAzol extraction kit. The mitochondrial control region (also known as the D-loop) and intron 2 of the β2-microglobulin gene were chosen for amplification because they had previously been characterized for various related callitrichids, and because they arguably profiled some of the greatest phylogenetic resolution for mitochondrial and nuclear genomes in these organisms, respectively. Primers were designed based on previously sequenced callitrichid mitochondrial control regions (Tagliaro et al., 1997). A heavy strand primer was designed in the CSB1 region of the control region, as well as a shorter primer in the same region for sequencing purposes. In addition, primer L15926 (Kocher et al., 1989) was used for light strand amplification. Primers used for β2-microglobulin intron 2 PCR amplification were the same used in Canavez et al., 1999. Polymerase chain reaction conditions consisted of: 80°C (1 min), 94°C (2 min), 35 cycles of (94°C (1 min), 50°C (1 min 30 sec), 72°C (2 min)) and 72°C (10 min) for the mitochondrial control region. PCR conditions for the β2-microglobulin intron 2 were the same used by Canavez et al.: 95°C (30 sec); 30 cycles of (95°C (20 sec), 60°C (30 sec), 72°C (30 sec)) and 72°C (5 min). PCR reactions were on a 1% agarose gel, since the control region amplifications were expected to be around 900 bp long, and the β2-microglobulin amplifications not longer than 700 base pairs, taking interspecific variation in length into account.

Upon successful amplification, PCR products were transformed into pCR®4-TOPO® plasmids which were subsequently transformed into One Shot® *Escherichia coli* cells using the TOPO TA Cloning® Kit for Sequencing (Invitrogen Corporation). Cells were plated on LB-agar plates 50 μg/ml ampicillin, and left to grow at 37°C overnight. Any cells transformed with the plasmid were conferred resistance to ampicillin. Ten to fifteen colonies were picked for each species, and cultured overnight in 2 ml of LB-amp both at 37°C. Plasmids were then isolated using the QIAprep® Spin Miniprep Kit (Qiagen Inc.). EcoRI sites at both ends of the insertion site of the plasmid allowed for digestion and subsequent screening for plasmids with inserts on a 1% agarose gel. Plasmids containing inserts were selected for sequencing. Primers M13 (forward and reverse), provided by Qiagen Inc., allowed for sequencing of the inserts from plasmids ends. The cloning and transformation process allowed for separation of desired sequences from any non-specific amplifications, or "smears", that would otherwise muddle sequencing performance. Amplifications were sequenced with an ABI Prism 310 Spectrum sequencer.

Sequences were aligned by eye, using the program Sequencer. Additionally, the sequences obtained in this study were combined with those obtained from GenBank using accession numbers given in Tagliaro et al. (1997) for the mitochondrial control region, and Canavez et al. (1999) for the nuclear intron. For the control region, sequences of three *Callithrix argentata*, three *C. mauesi*, two *C. humeralifera*, two *C. geofoxi*, two *C. penicillata*, two *C. jacutec*, five *C. kuhlri*, two *C. aurita*, one *Cebuella pygmaea*, and one *Leontopithecus chrysomelas* were obtained from GenBank. For the β2-microglobulin intron 2, sequences were obtained for one *Callithrix humeralifera*, one *C. emiliae*, one *C. kuhlri*, one *C. penicillata*, one *Cebuella pygmaea*, one *Callimico goeldii*, one *Saginus midas*, one *S. imperator*, and one *Leontopithecus chrysopygus*. Upon alignment, sequences were entered into the PAUP program (Swofford, 1994) for phylogenetic analysis. A maximum parsimony (MP) algorithm was used to analyze the data, and bootstrap analyses (100 replicates) were performed on the resulting consensus trees. Pair-wise nucleotide distances were also determined for the species under consideration.

**Results**

DNA extraction and PCR amplification proved to be equally successful for tissues stored at either freezing conditions or 100% alcohol before deposition in RNA later. For the mitochondrial control region, an alignable 902 base pair (BP) segment including both hypervariable regions and the conserved central domain was amplified and sequenced for all specimens, except *Cebuella pygmaea*. This sequence constitutes approximately 90% of the entire mitochondrial control region. For *Cebuella pygmaea*, only a 532 bp segment including the central conserved domain and the primate insertion sequence was obtained. For the β2-microglobulin intron 2, a 607 bp segment was obtained for *Callithrix manicorensis* alone. These sequences were aligned with corresponding sequences from GenBank.

Pair-wise divergences for *Callithrix* and *Cebuella* were calculated. For the mitochondrial control region, those among Amazonian marmosets (*Callithrix*) ranged from approximately 3% to 7% (2-4% within each subclade, 6-7% between the *argentata* and *mauesi* subclades). Divergences between any Amazonian marmoset and *Cebuella* were on the order of 11-12%. Within-species divergences ranged from 0-3%. *C. mauesi* and *C. humeralifera* showed the greatest within-species divergence, possibly due to hybridization between these two species. Their separation by the Rio Maués-Açaí, a minor tributary of the Rio Amazonas and contact zone with *C. humeralifera* between the headwaters of the Rio Maués and the Rio Abacaxis, may explain why hybridization still occurs between these two species, having never become completely isolated from one another. These findings call for a closer investigation into hybridization rates between populations of these two species, and whether they actually represent distinct species.
For the nuclear tree Callithrix jacchus, two C. p. nigripes, two C. p. guianensis, one C. p. huebli, two C. p. ortoni, and one C. p. eutropithecus were sampled.

For the β2m gene, one C. p. nigripes, one C. p. huebli, one C. p. ortoni, and one C. p. eutropithecus were sampled in the molecular analysis. Only the C. p. nigripes sample (used to analyze the molecular data) was preserved. Partial nucleotide sequences were obtained for all samples.

...to be equally spaced among Amazonian marmosets. For the mtDNA D-loop sequence, the conserved hypervariable region was sequenced for all species, as the hypervariable region constitutes approximately 2% of the mitochondrial control region. Sequences were obtained for all species, including the neotropical marmosets. A total of 607 bp sequences were obtained for each species. Sequences from

...among Amazonian marmosets were calculated. Approximately 3% divergence was observed between the C. p. nigripes and any of the species; the order of 11-14% divergence from 0-3% C. p. nigripes was observed within species. Divergence between these species was observed for C. p. nigripes, a minor species, shared in the Chimayma zone with C. p. huebli. C. p. huebli shared in the Chimayma zone with C. p. ortoni and C. p. eutropithecus. A significant portion of C. p. nigripes sample still occurs in the Chimayma zone, albeit at a lower density. In addition, the presence of C. p. nigripes in the Chimayma zone represents an ecological shift between populations of Amazonian marmosets that may represent distinct speciation events.

Figure 3. A schematic representation of the distributions of the Amazonian marmosets, *Callithrix*, delimited by rivers. Illustration by Stephen D. Nash.
Figure 4. The Rio Acari marmoset, Callithrix acariensis and the Rio Manicoré marmoset, Callithrix manicorensis compared with Callithrix nigriceps Ferrari and Lopes, 1992, Callithrix aff. emiliae (to be described as a new species), Callithrix marcai Alperin, 1993 (possibly parapatric in the south of the range of C. manicorensis) and Callithrix humilis Van Roosmalen, Van Roosmalen, Mittermeier and Fonseca, 1998 (sympatric with C. manicorensis). Drawings not to scale. Illustration by Stephen D. Nash.
Figure 5. Adult male *Callithrix manicorensis* (INPA 2512) from the Rio Maripaus (left), and a young female (INPA 3930) (right). Photographs by Marc G.M. van Roosmalen.

Figure 6. The adolescent male *C. manicorensis*, the paratype which is still alive, displaying its genitals. Photograph by Marc G.M. van Roosmalen.
Figure 7. Adult female *Callithrix acariensis* (holotype INPA 3931), showing the distinct thigh stripe (left), and the hypertrophied pudenda (right). Photographs by Marc G.M. van Roosmalen.

Figure 8. Adult female *Callithrix acariensis* (holotype INPA 3931). Photograph by Marc G.M. van Roosmalen.
Table 4. Cranial and dental measurements of the holotype (adult female) of *Callithrix acarienis* (INPA 3931) and the adult female of *Callithrix manicorensis* (INPA 3930) (mm).

<table>
<thead>
<tr>
<th>Skull and mandible</th>
<th>INPA 3930</th>
<th>INPA 3931</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greatest Skull Length (SL)</td>
<td>45.7</td>
<td>47.6</td>
</tr>
<tr>
<td>Zygomatic Width (ZW)</td>
<td>31.3</td>
<td>30.8</td>
</tr>
<tr>
<td>Biobital Width (BW)</td>
<td>26.2</td>
<td>27.3</td>
</tr>
<tr>
<td>Postorbital Width (PW)</td>
<td>22.4</td>
<td>23.3</td>
</tr>
<tr>
<td>Nasion-Basion</td>
<td>32.2</td>
<td>33.1</td>
</tr>
<tr>
<td>Basion-Prosthion</td>
<td>33.7</td>
<td>34.8</td>
</tr>
<tr>
<td>Biauricular Breadth</td>
<td>26.3</td>
<td>26.5</td>
</tr>
<tr>
<td>Height of Canine (CH)</td>
<td>4.3</td>
<td>5.2</td>
</tr>
<tr>
<td>Length of Mandible (ML)</td>
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<td>31.1</td>
</tr>
<tr>
<td>Across First Molars (AM)</td>
<td>11.7°</td>
<td>13.5</td>
</tr>
<tr>
<td>Across Canines</td>
<td>8.4</td>
<td>8.9</td>
</tr>
<tr>
<td>Dental Field (P2-M2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premaxillary Height</td>
<td>8.3</td>
<td>8.3</td>
</tr>
<tr>
<td>Intradentale Superior to Premaxilla-Maxilla Junction at Alveolus (IS-P)</td>
<td>5.0</td>
<td>4.6</td>
</tr>
<tr>
<td>Intradentale Superior to Nasion (IS-NA)</td>
<td>15.1</td>
<td>15.8</td>
</tr>
<tr>
<td>Intradentale Superior to Posterior Nasal Spine (IS-PNS)</td>
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<td>16.3</td>
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<tr>
<td>Bregma to Nasion (BR-NA)</td>
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<td>Nasion to Fronto-Malar Junction at Orbit (NA-FM)</td>
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<td>Fronto-Malar Junction to Pterion</td>
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<td>8.3</td>
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<tr>
<td>Fronto-Malar Junction to Zygomaticallare Superior (FM-ZS)</td>
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<td>Fronto-Malar Junction to Maxillay Tuberosity (FM-MT)</td>
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<td>9.9</td>
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<td>6.8</td>
</tr>
<tr>
<td>Zygomaticallare Inferior to Maxillay Tuberosity (ZI-MT)</td>
<td>5.6</td>
<td>6.0</td>
</tr>
</tbody>
</table>

**Anterior Teeth**

| i 1 Length | 2.1 |
| i 1 Breadth | 1.6 |
| i 1 Height | 2.7 |
| i 1 Length | 1.9 |
| i 1 Breadth | 1.6 |
| i 1 Height | 1.4 |
| i 1 Length | 1.4 |
| i 1 Breadth | 1.6 |
| i 1 Height | 3.0 |
| i 1 Length | 1.3 |
| i 1 Breadth | 2.2 |
| C 1 Length | 2.5 |
| C 1 Breadth | 2.7 |
| C 1 Height | 1.5 |

**Cheek Teeth**

| P 4 Length | 2.4 |
| P 4 Breadth | 1.7 |
| P 4 Length | 1.9 |
| P 4 Breadth | 1.8 |
| M 1 Length | 2.5 |
| M 1 Width | 2.0 |
| M 1 Length | 2.0 |
| M 1 Width | 1.7 |

° = missing
The pairwise divergences between the Atlantic forest Callithrix (the Callithrix jacchus clade), or ouistiti's, and the Amazonian Callithrix (the Callithrix argentata clade) range from 12-13%, while divergence between Atlantic forest Callithrix and Cebuella range from 14-15%. Divergence between all marmosets, pygmy marmoset, and dwarf marmoset and the out-group, the lion tamarins Leontopithecus was over 20%. These genetic distances suggest that, contrary to suggestions by previous molecular studies (e.g., Tagliaro et al., 1997; Barroso et al., 1997) to subsume Cebuella within the Callithrix genus, the Amazonian Callithrix species and the Atlantic forest Callithrix species should be separated into distinct genera. Given a 3-7% divergence for species within either clade, and a 10-11% divergence between clades, it seems phylogenetically more parsimonious to group the two clades into separate genera in recognition of their evolutionary distinctness. If we want to use taxonomic classifications to reflect actual evolutionary distinctness, we should keep the Atlantic forest Callithrix or ouistiti's in the genus Callithrix Erxleben, 1777, and place the Amazonian Callithrix or Amazonian marmosets in the genus Mico Lesson, 1840. Groves (in press) lists the Amazonian marmosets as belonging to the subgenus Mico Lesson, 1840.

Using PAUP, a maximum parsimony analysis with 100 bootstrap replications on the phylogenetic tree for the mitochondrial control region seen in Figure 11. This tree does not include the shorter sequence of Cebuella pygmaea obtained in this study. When this sequence is included in the phylogeny, curtailed to only 532 bp for all species, bootstrap values are raised significantly for some nodes. The relationship of the Atlantic forest marmosets, or ouistiti's (the Callithrix jacchus clade), as diverging before the radiation of Amazonian marmosets (also known as the Callithrix argentata clade) including the pygmy marmosets (Cebuella pygmaea), remains in concordance with the phylogenetic trees presented by Tagliaro et al. (1957). Callithrix manicorensis joins most closely with Callithrix argentata with significant bootstrap values.

The β2-microglobulin intron 2 phylogenetic tree yielded much less percent variation (0.4-1.0%) among taxa, and was insufficient for clear resolution. However, it did support the grouping of Callithrix manicorensis within the Amazonian Callithrix clade with a significant bootstrap value.

Discussion

The finding that Callithrix acariensis is more closely related to the C. mauei/humeralifera clade concurs with these species' shared geographical location between the Rios Tapajós and Madeira/Aripuaná, an area that is largely contiguous and undivided by major rivers. Given the morphological similarity between C. acariensis and C. melanura and the recently described C. saterei, and the fact that they all share the same geographic region between the Rio Tapajós and the Aripuaná/lower Madeira, it seems plausible that marmoset species in this region form a separate subclade within the Amazonian marmoset subgenus. It, therefore, seems likely that starting with the achetypic C. melanura with its huge distribution in the headwaters of the Rios Madeira, Mamoré and Guaporé, and Aripuaná and Juruena, lacking major river barriers, this subclade speciated toward the north via C. intermedia confined to the Rio Roosevelt and Aripuaná interfluvium, C. acariensis, confined to the interfluvium of the Rios Acari and Sucunduri, C. humeralifera in the interfluvium of the Rios Tapajós, Amazonas and Maués-Açu, finally speciating into C. chrysoleuca, occupying the Rios Amazonas, Madeira, Canumá, Aripuaná and Acari interfluvium from north to south, while C. saterei branched off into the area between the Rios Canumá and Abacaxis, and C. mauei between the

Figure 9. Skull of adult female Callithrix manicorensis (INPA 3930). Photograph by Stephen D. Nash.

Figure 10. Skull of adult female Callithrix acariensis (INPA 3931). Photograph by Stephen D. Nash.

Bootstrap

Figure 11. C. acariensis and the mitochondrial nuclear β2-microglobulin intron 2. Bootstrap values clearly belong close related Callithrix clade.
Paraná Urarí and Rio Maués-Açu. In this context it is interesting to note the strikingly white hip/thigh stripe consistent in all these species (rather inconspicuous only in *C. maeuwi*), and the partially hairy auricles in especially juvenile *C. intermedia* and *C. acariensis*, culminating in the tufted ear *C. humeraliera*, *C. maeuwi*, and *C. chrysoleuca*. Both characteristics are absent in all other existing Amazonian marmosets.

The grouping of *C. manicorensis* with *C. argentata* seems to be a paradox because the two species’ geographic ranges are on opposite ends of the Amazonian marmosets’ distribution. Neighboring species of *C. manicorensis* such as *C. marci*, *C. nigrieeps* and *C. aff. emiliae* should be analyzed before any conclusions may be drawn from this result. However, these results do indicate a division of the Amazonian marmosets that includes *C. melanura*, *C. intermedia*, *C. acariensis*, *C. saterei*, *C. maeuwi*, *C. humeraliera*, and *C. chrysoleuca* in one clade, and *C. aff. emiliae*, *C. nigrieeps*, *C. manicorensis*, *C. marci*, *C. emiliae*, *C. leucippe* and *C. argentata* in the other clade. *C. marci* and *C. nigrieeps* are morphologically similar to *C. manicorensis* (Van Roosmalen et al., 1998). The status of *C. emiliae* is less easy to predict, although its geographical distribution suggests it is more closely related to the *C. argentata/manicorensis* subclade. Genetic analysis of all species should be done in the future to help resolve this question. The present data indicate that one clade (*C. argentata/manicorensis*) is divided geographically by the other subclade (*C. acariensis/maeuwi/chrysoleuca*). A plausible scenario would be the speciation from an ancestral *C. melanura*-like archetype going both northwest and filling the interfluvium of the Rios Madeira, Aripuanã and Roosevelt with *C. aff. emiliae* in the Rios Madeira and Jí-Pará interfluvium, *C. nigrieeps* in the Rios Madeira and Marmelos interfluvium, *C. marci* in the Rios Marmelos and Roosevelt interfluvium, and finally *C. manicorensis* ‘trapped’ in the interfluvium between the unsurpassable Río Madeira and the lower Rio Aripuanã, and northeast passing the upper Ríos Jurua and Tapijós filling the Ríos Xingu and Tapijós interfluvium with *C. emiliae* in the Ríos Curuí and Iríri interfluvium, *C. argentata* in the Ríos Xingu, Amazonas and Cupari interfluvium, and *C. leucippe* in the Ríos Tapijós and Cupari interfluvium. It is rather likely that new species will be found in the near future east of the Ríos Jurua and Tapijós.

Patterns of marmoset radiation emerging from the findings here presented suggest that the river barrier hypothesis (Wallace, 1852) could be used to account for much of the primate diversity in the Amazon basin. Unlike the small rodents in Da Silva and Patton’s (1993) study, primates as a rule cannot swim for very long distances and particularly marmosets, tamarins and titi monkeys drown at the spot when fallen into the water. Therefore, their only chance for substantial cross-river migration involves passive migration, in which tracts of land (with periodically flooded forest) ‘jump’ from one side of the river to the other, in the process of ox-bow lake formation of meandering rivers. Although ox-bow lakes are common in the upper reaches of the Rios Purús and Juruá in western Amazonia (Peres et al., 1997), the greater slope of rivers coming from the Brazilian Shield in eastern Amazonia, starting with the Rio Madeira and its upper course tributaries and moving east, precludes such meandering and, with it, passive cross-river migration of breeding primate populations. Therefore, it is possible that rivers in central and eastern Amazonia are effective barriers that have led to the genetic diversity despite their relatively recent divergences, 1-3 million years ago, according to molecular clocks based on IRBP intron sequence divergences (Barroso et al., 1997). Besides the evidence for hybridization found in this study and Tagliaro et al. (1997) between *C. humeraliera* and *C. maeuwi*, there have been no reports of naturally occurring hybridizations between other Amazonian marmosets, suggesting that its various taxa represent actual species, or distinct evolutionary entities, a conclusion further corroborated by the extreme intolerance of parapatric species toward each other (pers. obs. in captivity). Tamarins, on the other hand, are not exclusively allopatric, as they are separated by meandering rivers which are less effective as reproductive barriers, and their populations are characterized by geographic gradations of pelage color variations. The greater slope in the marmoset’s distribution, from the Brazilian Shield in the south toward the Ama-
zon River, leading to south-northward, fast-flowing, straight rivers may thus have contributed to the species diversity of the marmosets, whereas many of the tamarin taxa continue to interbreed at irregular intervals, and are thus unable to fully differentiate into reproductively-isolated species. For this reason, the current classification of many of the tamarin taxa into subspecies (Rylands et al., 1993) and marmosets into distinct species is probably truly reflective of the evolutionary history of these primates.

In summary, our findings suggest that the common ancestral population of Callithrix, the dwarf marmoset (see Van Roosmalen and Van Roosmalen, in prep.), and Cebuella was initially separated into an Amazonian and Atlantic clade. The Amazonian clade subsequently gave rise to the ancestral dwarf marmoset and then to Cebuella. The isolation of the ancestral Cebuella from other marmosets (after passing the upper Rio Madeira) in the geographic range of the tamarins west of the Rio Madeira, may explain its subsequent divergence from the other marmosets. The dwarf marmoset, is, however, sympatric with Callithrix manicomensis. There is no way of knowing whether its initial divergence involved isolation from the ancestral Callithrix in its present location in the northern part of the interfluve of the Rios Madeira and Aripuanã, and that subsequent invasion by Callithrix followed much more recently. This possible scenario would explain most parsimoniously their present distributions. The geographic division of the Callithrix argentata subclade from the Callithrix mausi/ humeralisera subclade recognized in this paper, suggests that eastern Amazonia was predominantly occupied by the Callithrix argentata subclade, and that a subsequent radiation from the south by the Callithrix mausi/humeralisera subclade drove the Callithrix argentata subclade species from the region between the Rios Canumã and Aripuanã, and the Rio Tapajós. Alternately, the Callithrix mausi/humeralisera subclade may have predated the Callithrix argentata subclade in eastern Amazonia, and a radiation of the argentata subclade from the south into two directions, northeast and northwest, enveloped the mausi/humeralisera subclade. The lack of tolerance for marmoset sympatry, due to ecological niche similarities, necessitated much of this excluding radiation and extreme competition, leaving no room for sympatric existence even between clearly distinct species such as those in the argentata subclade and the mausi/humeralisera subclade. It follows that river isolation is a necessary prerequisite for initial isolation and diversification, and that rivers tend to act as divisions between marmoset species that have evolved into separate species, acting as buffer zones that prevent potentially more successful species from invading neighboring areas and effectively out-competing other species. Rivers, therefore, do not merely give rise to new species by genetic isolation, they also serve as boundaries that help maintain species diversity throughout east central Amazonia.

Conservation Status of the New Species

There is no reason to suspect that Callithrix manicomensis is threatened. However, the total area in which it has been con-

firmed to occur is c. 15,000 km² (c. 90 x 170 km), a rather small distribution. High densities of this monkey are found close to human habitations, but it seems to be rather rare in undisturbed terra firme rain forest far from the banks of rivers and lager creeks, where human settlements are mainly situated. The forests between the lower Rio Aripuanã and Rio Madeira are still in good, almost pristine condition, although logging has taken place along the more navigable rivers, occurring especially when the rivers are high. There are no major towns or cities in the area, except for Manicoré. Novo Aripuanã is located just north of the species’ northern limit, and is on the opposite side of the Rio Aripuanã near its mouth. No Indian tribes (which usually hunt even the smallest birds and mammals) live in the area, and the local people (called caloelas) are widely scattered and live only in small settlements of one to several families along the major rivers, the Rio Madeira and the Rio Aripuanã, and along the lower courses of a number of minor rivers, such as the Rios Mataurá, Uruí, Matipauá, Araú, Atininga, and the right bank of the Rio Manicoré (Fig. 2). The interfluvial basins of these black and clear-water rivers are practically uninhabited.

The conservation status of Callithrix acariensis is unknown, but the interfluve of the Rios Acari and Sucunduri, where it occurs, though relatively small, is practically uninhabited. The only way to reach the area is by means of a 40 km dirt road which links the town of Novo Aripuanã with the lower Rio Ararás, a tributary of the Rio Acari, or by boat entering the Rio Canumã via the Rio Madeira, all the way upriver to the confluence with the Rio Sucunduri and Rios Acari. Since marmosets generally prefer edge habitats and secondary forest on dry land (terra firme), Callithrix acariensis is assumed to be relatively rare, considering the fact that there is almost no human habitation in the interfluve of the Rios Acari and Sucunduri. No major deforestation or logging has been planned for the area, and therefore the monkey is not considered threatened.

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References


Groves, C. P. In press. The Taxonomy of Primates. Smithsonian Institution Press, Washington, DC.


Stalling, J. D. and Mittermeier, R. A. 1983. The black-tailed marmoset (Callithrix argentata melanura) recorded from Paraguay. Am. J. Primatol. 4: 159-163.


RECONOCIMIENTO DE LA POBLACIÓN DEL MONO AULLADOR NEGRO (Alouatta pigra) EN PALENQUE, CHIAPAS, MÉXICO.

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Resumen

Entre Enero y Mayo del 2000 se llevaron a cabo tres reconocimientos de la población del mono aullador negro existente en la selva del sitio arqueológico de Palenque, Chiapas, México. Detectamos la presencia de 99 individuos repartidos en 13 tropas, con la posible existencia de 3-5 tropas adicionales. La densidad ecológica estimada fue de 33 individuos/km². El tamaño medio de las tropas fue 7.6 (rango 2-13). Todos los avistamientos de los monos aulladores fueron en selva alta perennifolia y en árboles ≥20 m en altura. Las densidades reportadas para Palenque son más altas que aquellas reportadas para la misma especie en Belice y Guatemala y en Quintana Roo en México y otro contraste es que, en Palenque, la mayoría de las tropas (70%) eran multimacho. La protección de un perímetro amplio (c. 1700 ha) alrededor de la selva que cubre el sitio arqueológico por el gobierno Mexicano asegura la conservación de la selva y de la población del mono aullador negro existente en el sitio.

Abstract

A survey of the population of the black howler monkey (A. pigra) present at the Mayan site of Palenque was conducted during three visits between January and May of 2000. We detected the presence of 99 individuals in 13 troops and the possible existence of 3-5 additional groups. Ecological density was estimated at 33 individuals/km². Mean troop size was 7.6, ranging from 2-13. All sightings of howler monkeys were in evergreen rain forest and in trees ≥20 m in height. The reported densities and mean troop size are higher than those reported for the species in Guatemala, Belize and in central Quintana Roo, Mexico, and the majority (70%) of the troops in Palenque were multimale. Protection of a large perimeter area (c. 1700 ha) around the archeological site by the Mexican government ensures the conservation of the forest and of the black howler monkey population present at the site.

Key words: Howling monkeys, Alouatta pigra, population census, Mexico

Introducción

Las selvas del sur de México alojan las representaciones más septentrionales de primates silvestres en el Neóptico. Tres especies de primates existen en estos hábitats: Alouatta palliata, A. pigra y Atelis Geoffroyi. La primera y la última presentan una distribución amplia en el sur de México y en el área Mesoamérica. La distribución geográfica de A. pigra sin embargo es restringida y sólo se le encuentra en algunas partes de los estados de Tabasco y Chiapas y es el único representante del género en la península de Yucatán (Smith, 1970; Horwich y Johnson, 1986).

La distribución geográfica restringida de A. pigra en Mesoamérica y la rápida conversión (4.5-12.5% anual, Masera, 1986) de su hábitat natural a pastizales y campos agrícolas coloca a las poblaciones de esta especie, endémica a nivel regional, bajo riesgo (Rylands et al., 1995). Por ejemplo, en Tabasco, México, en donde se encuentran poblaciones de ambas especies de Alouatta en simpatría, cerca del 60% de la superficie del estado (24,141 km²) originalmente presentaba selva alta perennifolia. Como resultado de la actividad humana, entre 1977 y 1991, más del 60% de esta vegetación desapareció a un ritmo anual de 600 km² (SEMARNAF, 1999).


En el caso de Guatemala, estudios breves se han efectuado en Tikal (Coelho et al., 1976; Schlichte, 1978). Los únicos estudios detallados sobre población, ecología y conducta de A. pigra, acoplados a un programa de conservación sostenido a través de los años, es aquel realizado en solo dos localidades en todo el rango de distribución geográfica de A. pigra y ambas localidades se ubican en Belice (Silver et al., 1998; Ostrom et al., 1999).
Considerando la protección brindada por el gobierno Mexicano, federal y estatal, a las selvas que rodean muchos de los sitios arqueológicos de la zona Maya en el sur de México con el objeto de proteger el patrimonio cultural, se hizo necesario realizar una investigación en las selvas de los estados de Chiapas con la especie A. pignata, hacia fines de 1999 iniciamos una investigación de las poblaciones del mono aullador negro, Aonatiatta pigna, existentes en la selva del Parque Nacional Zona Arqueológica de Palenque, Chiapas.

Esta investigación tiene como propósito recabar información precisa acerca del tamaño de la población del mono aullador negro en la zona del Parque y áreas aledañas, recabar información acerca de sus hábitos alimenticios y necesidades de espacio y diagnosticar la manera en que estos primates participan en la dinámica del ecosistema selvático. Dicha información enriquecerá los bancos de datos sobre A. pigna y será también fundamental para promover la conservación de la especie en los alrededores y en otras localidades y para comprender las respuestas de sus poblaciones a los cambios antropogénicos en la distribución de su hábitat natural.

Entre Enero y Mayo del 2000 invertimos, en tres sesiones diferentes, 30 días efectivos de trabajo en el sitio con el objeto de determinar el número de tropas de aulladores que ahí existen y su distribución en el espacio. Un número de días adicionales fueron invertidos en la recopilación de información contextual y llevando a cabo observaciones sobre el comportamiento de tropas selectas. En este trabajo presentamos información derivada de los reconocimientos demográficos de la población de A. pigna que existe en la selva de la zona arqueológica de Palenque.

**Métodos**

El Parque Nacional Zona Arqueológica de Palenque se localiza al noroeste del estado de Chiapas formando parte del municipio del mismo nombre y decretado presidencialmente el 26 de Junio de 1981. El Parque cuenta con una extensión territorial de 1771 hectáreas y se extiende entre los paralelos 17°27'05" y 17°30'05" de latitud Norte y a los 92°01'30" y 92°04'42" de longitud Oeste.

El clima de la zona donde está ubicado el sitio ha sido clasificado como cálido-húmedo (García, 1981). La precipitación media anual es de 2165 mm con una distribución estacional a través del año. La precipitación media mensual es significativamente menor entre Enero y Abril (promedio = 62 ±18 mm) comparada con la media para el resto del mes del año (240 ±106 mm). El mes más seco es Abril con 49 mm y el mes más lluvioso es Septiembre con 433 mm. La temperatura media anual es de 26°C. El mes más caluroso es Mayo con una temperatura de 29.7°C y el mes más frío es Enero con 22.4°C.

La topografía de la zona en donde está distribuida la selva del sitio es abrupta, con pendientes en algunas áreas de hasta 50%, pero es posible encontrar pendientes del 2% en los alrededores de los templos principales. En la zona del Parque con cobertura de vegetación selvática, el gradiente altitudinal va de los 150 a 500 m sobre el nivel del mar.

La vegetación selvática reportada para el Parque Nacional de Palenque es conocida técnicamente como selva alta perennifolia y cubre aproximadamente una superficie de 597 hectáreas. Otras 300 hectáreas presenta vegetación secundaria, representando distintas fases en la regeneración de la vegetación selvática y el resto de la superficie del Parque consiste en pastizales inducidos (Díaz Gallegos, 1996) (Fig. 1).

Estudios florísticos de la vegetación selvática reportan la existencia de 510 especies de plantas, distribuidas en 351 géneros representando a 136 familias botánicas (Díaz Gallegos, 1996). De estas, las mejores representadas son Leguminosas con 47 especies y Rubiaceae con 27 especies. La forma de vida de crecimiento dominante en el parque son los árboles, representados por 241 especies. La selva del Parque Nacional sobresale por presentar una diversidad florística alta en relación con otros sitios en el sur de México y Sudamérica (Díaz Gallegos, 1996). En relación a la estructura de la vegetación, parece existir una distribución regular de especies arbóreas a lo largo del estrato vertical, predominando en el estrato de los 0-10 m especies como Rinorea guatemalensis y Astrocyrum mexicanum, mientras que en los estratos superiores por arriba de los 20 m predominan especies como Vatairea lundellii, Guatteria anomalas, Manilkara zapota, Bromium alicistraum, Quararia funestus y Ficus spp. (Díaz Gallegos, 1996).

**Resultados**

**Esfuerzo de recuento**

El esfuerzo de trabajo y 67% de los datos demográficos fue el 40% de la muestra relativa de los datos. El 60% restante se distribuyó en el terreno. A partir de estos datos se llevaron a cabo actividades de recuento.

**La población**

Los reconocimientos de aulladores requieren datos adicionales para realizar un análisis adecuado de los templos poblacionales. No fue posible estar en contacto con adultos con animales juveniles y 15% al 35% de los animales fueron de edad intermedia.

El tamaño muestral encontrado fue de 2.7 machos (rango 2-11), 1.3 machos y 2.7 machos a hembras.
escuchados. La ubicación de las tropas así determinada se transfirió a un mapa a escala de la zona de trabajo.

**Censo de la población de monos aulladores: Registros visuales**

Estos tuvieron como meta lograr una verificación de la ubicación de las tropas de monos posterior al registro acústico matutino, identificación de las tropas y obtener conteos precisos sobre su composición por edades (adulto, juvenil, infantil) y sexos. La localización de las tropas de saragatos fue facilitada por la accesibilidad permitida a diferentes partes del área selvática por el sistema de veredas existentes en el Parque. Las tropas así encontradas fueron confirmadas en cuanto a su ubicación relativa en relación a rasgos topográficos y/o arqueológicos, y respecto a la ubicación relativa de otras tropas. Confirmación de la identidad de las tropas y de su tamaño y composición por edades y sexos fue llevado a cabo a través de contactos repetidos con cada una en días consecutivos.

Como parte complementaria a estos sondeos demográficos, también se realizaron observaciones preliminares sobre el comportamiento alimenticio y actividades generales de los individuos en tres de las tropas detectadas. En este caso individuos representativos de cada clase de edad y de cada sexo fueron observados durante periodos fijos de tiempo.

En las observaciones del comportamiento alimenticio se tomó nota de la parte de la planta consumida (hojas, frutos y/o hojas jóvenes, frutos jóvenes, frutos maduros, flores, otros) y se trató de identificar la especie.

**Resultados**

**Esfuerzo de muestreo**

El esfuerzo de campo resultó en la acumulación de 30 días de trabajo y 672 horas hombre invertidas en el reconocimiento demográfico de los monos aulladores en el Parque. De estas, el 40% fue invertido en la triangulación de la ubicación relativa de las tropas de aulladores a través de registros acústicos. El 60% restante se invirtió en los contactos con las tropas sobre el terreno. Aproximadamente 60 horas hombre adicionales fueron invertidas en observaciones del comportamiento y actividades generales de tres tropas de aulladores.

**La población de monos aulladores**

Los reconocimientos resultaron en un conteo de 99 monos aulladores repartidos en 13 tropas. Cerca de 3-5 tropas adicionales fueron escuchadas a 1.5-2.0 km de distancia de los templos principales en dirección Oeste y Suroeste, pero no fue posible su localización. En esta población los individuos adultos contribuyeron al 62% de los conteos, 19% fueron juveniles y 19% niños. Los machos adultos contribuyeron al 35% de los conteos y las hembras adultas al 27%.

El tamaño medio de las tropas fue calculado en 7.6 individuos (rango 2-11) y la composición promedio de las tropas fue de 2.7 machos adultos, 2.0 hembras adultas, 1.6 machos juveniles, 1.3 hembras juveniles y 1.6 niños. La relación de machos a hembras entre los adultos fue de 1:0.74 y la relación...
de adultos a no adultos fue de 1:0.62. La densidad ecológica estimada para la población de *A. pigra* en el Parque fue de 33 individuos por km² y la población total estimada fue de 200 monos aulladores repartidos en unos 15-18 grupos.

Aunque preliminares, los datos sobre actividades generales indicaron que los aulladores invierten el 52% de su tiempo en descansar, el 28% en la actividad alimenticia, el 13% en interacciones sociales, el 5% en actividades locomotoras y el 1% en desplazamientos sincronizados de una zona a otra dentro del Parque.

Todos los avistamientos de las tropas de aulladores fueron en selva alta perennifolia y en arboles >1.5 m en d.a.p. y ≥20 m de altura. Algunas de las especies de las cuales fueron observados alimentándose fueron *Brosimum alicastrum*, *Ficus* spp., *Poulsenia armata* y *Spondias mombin* entre otras. El 50% de las partes consumidas fueron hojas jóvenes y el restante 50% frutos maduros de especies como las señaladas anteriormente.

**Discusión**

Los datos obtenidos sobre el tamaño de la población de *Alouatta pigra* en el Parque Nacional Palenque deben ser considerados como preliminares. Continuidad en el trabajo de campo permitirá obtener información sobre la consistencia y variabilidad en los rasgos demográficos presentados en este reporte para la población del mono aullador negro presente en el Parque.

Tomando en cuenta, la densidad estimada de la población de monos aulladores en el Parque Nacional Palenque de 33 individuos/km² es más alta que aquella que ha sido reportada para la misma especie en Belice (8-22 individuos/km²) (Bolin, 1981; Horwich y Gerhardt, 1983) y en Tikal en Guatemala (5-9 individuos/km²) (Coelho et al., 1976; Schlichte, 1978). El único otro sitio en México en donde aspectos demográficos de *A. pigra* han sido investigados es la selva de Muchunuk en el centro de Quintana Roo y en donde se reportan densidades más bajas (16.53 individuos/km²) (Gonzales-Kirchner, 1998) que aquellas detectadas para la especie en Palenque. En comparación, en Los Tuxtlas, Veracruz, a 500 km al norte de Palenque, las poblaciones de la otra especie de saragato en el país, *Alouatta palliata*, se presentan en densidades de 23 individuos/km² en selvas no perturbadas por la actividad humana (Estrada, 1982; Estrada y Coates-Estrada, 1996).

La alta densidad de *A. pigra* detectada en Palenque parece contradecir la aserción de que esta especie presenta las densidades más bajas reportadas para las especies del género *Alouatta* (Crockett y Eisenberg, 1987; Gonzales-Kirchner, 1998). El tamaño máximo de las tropas del mono aullador detectadas en Palenque (N = 11 individuos) y el tamaño promedio de las tropas de 7.6 individuos también son más altos que aquellos valores reportados para la misma especie en Belice y Guatemala, donde el tamaño de las tropas varía de 4.4 a 6.3 individuos Coelho *et al.*, 1976; Bolin, 1981; Horwich y Gerhardt, 1983; Ostro *et al.*, 1999) y para el centro de Quintana Roo (3.16 individuos) (Gonzales-Kirchner, 1998).

Otros contrastes con los datos publicados provenientes de Guatemala y Belice es que la mayoría (70%) de las tropas detectadas en Palenque estaban compuestas por varios machos adultos y un número menor de hembras adultos. En Guatemala y Belice diferentes autores de manera consistente reportan tropas unimacho (un solo macho adulto y varias hembras adultos) (Coelho *et al.*, 1976; Schlichte, 1978; Horwich y Johnson, 1986). Consideramos que estos contrastes podrían ser el resultado de la poca base de datos que existe sobre *A. pigra* en la literatura. La información hasta ahora disponible proviene de estudios realizados en solo tres sitios (Tikal en Guatemala, Bermuda Landing en Belice y Muchunuk en Quintana Roo, México). Obviamente se necesitan más estudios del mono aullador negro en otros sitios dentro de su rango de distribución geográfica para documentar el rango de variación en parámetros demográficos como densidad ecológica y tamaño y estructura de las tropas.

La selva de Palenque posee las características estructurales y los conjuntos de especies arbóreas adecuadas para el sostenimiento de la población de monos aulladores. Los árboles del dosel superior de la selva son los principales contribuyentes al área basal total registrada en los reconocimientos de la vegetación que se han llevado a cabo en el sitio (Díaz González, 1996). Estos árboles pertenecen a especies de las familias botánicas Moraceae (por ej., *Ficus* spp., *Brosimum alicastrum*, *Poulsenia armata*), Sapotaceae (por ej., *Pouteria campechiana*, *Pouteria zapota*), Anacardiaceae (por ej., *Spondias mombin*) y Lauraceae (por ej., *Neotritia spp.*, *Ocotea spp.*) entre otras, reportadas como fuente importante de hojas y frutos en la dieta de los monos aulladores en el Neotrópico (Estrada y Coates-Estrada, 1993).

Nuestros reconocimientos preliminares del área que rodea al Parque Nacional Palenque indican que mucha de la vegetación selvática ha desaparecido y ha sido convertida a pastizales. Por consiguiente la selva presente en el Parque Nacional Palenque es de importancia estratégica ya que su conservación ha permitido la conservación de una representación de este ecosistema y de representantes de *Alouatta pigra* en la porción más nororiental de su distribución geográfica en el estado de Chiapas en el sureste de México.

**Agradecimientos**

Agradecemos el permiso otorgado por el Director del Parque Nacional Zona Arqueológica de Palenque, Lic. Juan Antonio Ferrer Aguilar, para la realización de estos estudios. También agradecemos al Arqueólogo Edwin Barnhardt el haberlos facilitado un mapa de referencia que fue fundamental para lograr una orientación expedita de nuestro grupo en las distintas zonas del sitio. Agradecemos al Sr. John Scott su apoyo.
Referencias


Gonzalez-Kirchner, J. P. 1998. Group size and population density of the black howler monkey (Alouatta pigra) in Muchuxu forest, Quintana Roo, Mexico. Folia Primatol. 69: 260-265.


PRIMATE DIVERSITY, DISTRIBUTION AND RELATIVE ABUNDANCES IN THE RIOS BLANCO Y NEGRO WILDLIFE RESERVE, SANTA CRUZ DEPARTMENT, BOLIVIA

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Abstract

We document primate diversity in the Ríos Blanco y Negro Wildlife Reserve and compare encounter rates between primate species and the field sites examined. We also present an encounter rate for overall primate biomass at each field site. Primate diversity encountered within the Reserve appears typical of other sites in eastern lowland Bolivia but interesting patterns in species distribution and abundance are discussed.

Key Words: Primate diversity, Census, Amazon, Bolivia

Introduction

Until recently, little information had been published on the distribution of primate species in the Bolivian eastern lowlands. Primate surveys have been restricted to two protected areas (Braza and Garcia, 1988; Garcia and Tarifa, 1988; Wallace et al., 1998), with other distributional information coming from specimens collected at scattered locations (Brown and Rumiz, 1985; Anderson, 1997). The Ríos Blanco y Negro Wildlife Reserve (RBYNWR) covering 14,239 km² (Figure 1), was created in 1990, and forms part of the Bajo Paraguá Forestry Reserve (BPFPR) of 33,882 km². The reserve is divided into forestry concessions that reach areas of up to 3,113 km² (FAN/PL480/WCS, 1994), and which have been selectively logged for three high-value timber species; *Swietenia macrophylla*, *Amburana cearensis*, and *Cedrela odorata*. Selective logging has intensified in lowland Bolivia in recent years and is typically associated with technically illegal, heavy hunting of larger wild species.

In terms of biodiversity, the area was almost unexplored until 1992-1993 when multi-disciplinary surveys were carried out as part of a project designed to produce a management plan for the reserve (FAN/PL480/WCS, 1994). These surveys were necessary to provide baseline data for future ecological monitoring, as well as to assess the impact of human activities on biodiversity within the reserve. In this report we document primate diversity in the Ríos Blanco y Negro Wildlife Reserve and compare group and individual encounter rates between primate species and the field sites examined. We also calculate an “encounter rate” for overall primate biomass at each field site.

Study Area

The Ríos Blanco y Negro Wildlife Reserve (RBYNWR) is situated in the north-west of Santa Cruz Department, and includes two distinct biogeographical regions: the Beni alluvial plain which lies west of the Rio Blanco, and the Brazilian Shield which forms the eastern part of the Reserve (Fig. 1). The forests found within the reserve are broadly classified as either Humid Forest of the Brazilian Shield or Lowland Humid Forest (Killeen et al., 1993). The Wildlife Reserve was sparsely populated during successive rubber booms but has been largely uninhabited since the 1950’s. Eight survey sites were selected within the reserve. Five sites were directly accessible through existing logging roads; Arroyo Chuchui, San Martín, San Luis, Ocuquiriquia, and El Tumono. Three others were accessible by river and/or plane; Perseverancia, Pajaral, and Río Negro de Caímanes (Figure 1). Further information regarding survey sites is provided in Table 1.

Methods

Each field site was visited for approximately three weeks. Line transects were employed to survey the areas using standard techniques (Burnham et al., 1980; Brockelman and Ali, 1987; Buckland et al., 1993). With sufficient transect encounters, density estimates can be calculated using this methodology. However, since at least 40 encounters of each species are required for reliable estimates, many researchers have been restricted to presenting relative abundances using encounter rates (Branch, 1983; Mate and Colell, 1995). Nevertheless, encounter rates are a useful long-term monitoring tool and can also allow site comparisons, providing the area censused along a standard transect length is similar (Wallace et al., 1998).

Diurnal transects were run by two observers in fair weather conditions between 06:00 to 11:30 and 15:00 to 18:00, along existing logging trails or roads and/or newly established trails 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” in order to increase the probability of detecting more cryptic species. Nocturnal censuses were conducted over shorter distances between 19:00 and 23:00.

Results are expressed as the number of groups or the number of animals km censused (Table 1). The transect width for all transect lines was 10 m, and the transect lines were recorded at 20 meter intervals. Incidental non-primate fauna are also provided for each transect.

Table 1. Location of study sites in the Ríos Blanco y Negro Wildlife Reserve

<table>
<thead>
<tr>
<th>Study Area</th>
<th>Santa Cruz</th>
<th>Survey Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pers.</td>
<td>Paja</td>
<td>Arc.</td>
</tr>
<tr>
<td>San</td>
<td>Rio</td>
<td>San</td>
</tr>
<tr>
<td>Ocuquir.</td>
<td>El T.</td>
<td></td>
</tr>
<tr>
<td>RBYNWR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Download the full text to view the tables and figures.
and were generally walked at a slower speed. Details regarding the diurnal transect and nocturnal census effort at each site are presented in Table 1. The following information was recorded for all groups of primates encountered on transects: 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 centroid of the group. Incidental non-transect observations and primate vocalizations also provided information on primate diversity.

Results

A total of seven non-human primate species were registered within the reserve: black-tailed marmoset (*Callithrix melanura*), owl monkey (*Aotus azarae*), Bolivian squirrel monkey (*Saimiri boliviensis*), brown capuchin monkey (*Cebus apella*), black howler monkey (*Alouatta caraya*), red howler monkey (*Alouatta seniculus*), and black spider monkey (*Ateles chamek*). In addition, at three sites within the reserve (Perseverancia, Rio Negro de Caimanes, Oquiriquia) groups of *Cebus* were observed which included only very pale and more slender individuals. These three sightings may represent white-fronted capuchin monkeys (*Cebus albifrons*), however, *Cebus apella* is renowned for within population variation in pelage colour (Emmons and Feer, 1990). Thus, until specimens and/or further observations are available we prefer to treat these sightings as *Cebus apella*.

<table>
<thead>
<tr>
<th>Survey Site</th>
<th>Diurnal (km)</th>
<th>Nocturnal (km)</th>
<th>Biophysical Region</th>
<th>Location</th>
<th>Survey Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perseverancia</td>
<td>165</td>
<td>27.5</td>
<td>BS</td>
<td>14, 38° S; 62, 37° W</td>
<td>June – July 1992</td>
</tr>
<tr>
<td>Pijaral</td>
<td>98</td>
<td>16</td>
<td>BS/BAP</td>
<td>14, 57° S; 63, 31° W</td>
<td>August 1992</td>
</tr>
<tr>
<td>Arroyo Chuchui</td>
<td>54.8</td>
<td>13.5</td>
<td>BS</td>
<td>15, 35° S; 62, 45° W</td>
<td>October 1992</td>
</tr>
<tr>
<td>San Martin</td>
<td>69</td>
<td>33.6</td>
<td>BS</td>
<td>14, 30° S; 62, 06° W</td>
<td>November 1992</td>
</tr>
<tr>
<td>Rio Negro Caimanes</td>
<td>101.6</td>
<td>20.9</td>
<td>BAP</td>
<td>14, 43° S; 63, 58° W</td>
<td>June 1993</td>
</tr>
<tr>
<td>San Luis</td>
<td>108.9</td>
<td>25</td>
<td>BS</td>
<td>See Figure 1</td>
<td>August 1993</td>
</tr>
<tr>
<td>Oquiriquia</td>
<td>93.2</td>
<td>16.2</td>
<td>BS/BAP</td>
<td>15, 03° S; 61, 48° W</td>
<td>September 1993</td>
</tr>
<tr>
<td>El Tutumo</td>
<td>99.7</td>
<td>21.5</td>
<td>BS/BAP</td>
<td>15, 03° S; 63, 19° W</td>
<td>October 1993</td>
</tr>
</tbody>
</table>

1BS = Brazilian Shield, BAP = Beni Alluvial Plain, BS/BAP = Ecotone between Brazilian Shield and Beni Alluvial Plain.

Figure 1. Location of the eight survey sites within the Rios Blanco y Negro Wildlife Reserve, Santa Cruz Department, Bolivia.
Four species were encountered at all of the sites visited within the reserve: *Callithrix melanura*, *Aotus azarae*, *Cebus apella*, and *Atelis chamek*. Howler monkeys appear to have a more limited distribution: *Alouatta caraya* was only observed in the semideciduous forests at Pajaral, and *Alouatta seniculus* was observed in seasonally inundated forest at Perseverancia, Pajaral, Rio Negro de Caimanes, and Arroyo Chuchui. Squirrel monkeys (*Saimiri boliviensis*) were registered at four sites: Perseverancia, Pajaral, Rio Negro de Caimanes and El Tutumo. The most diverse sites were Pajaral with seven primate species, and Perseverancia and Rio Negro de Caimanes with six species (see Table 2).

Group and individual encounter rates are presented in Table 2, and details for each species are as follows:

**Callithrix argentata**: Individual encounter rates were significantly different between sites (Chi-squared = 65.99, df = 7, p < 0.001), and encounter rates were low for all sites considered, both in terms of observed groups (0.1-0.5 grps/10 km) and individuals (0.1-2.8 ind/10 km).

**Aotus azarae**: Insufficient encounters prevented a statistical test, but group and individual encounter rates for owl monkeys varied among sites (0.4-3 grps/10 km, 0.8-7.4 ind/10 km). Arroyo Chuchui had a group encounter rate over twice that of any other site, although the individual encounter rate for El Tutumo (7.4 ind/10 km) was higher than that of Arroyo Chuchui (5.2 ind/10 km) due to site differences in mean group size.

**Saimiri boliviensis**: Only observed on transects at two sites, individual encounter rates varied from 4.9-9.8 ind/10 km.

**Alouatta seniculus**: Only observed on transects at three sites, individual encounter rates varied from 0.3-1.8 ind/10 km.

**Alouatta caraya**: This species was only registered during non-transect observations at Pajaral.

**Cebus apella**: In terms of individuals, capuchin monkeys were consistently the most frequently encountered diurnal primate, and individual encounter rates (4.4-14.7 ind/10 km) were significantly different between sites (Chi-squared = 97.01, df = 7, p < 0.001). Group encounter rates varied from 0.6-1.6 grps/10 km censused. The three highest sites for both group and individual encounter rates were Pajaral, Rio Negro de Caimanes and Arroyo Chuchui.

**Atelis chamek**: Individual encounter rates were also significantly different between sites for spider monkeys (Chi-squared = 357.95, df = 7, p < 0.001). Both group (0.1-0.3 grps/10 km) and individual (0.3-2.3 ind/10 km) encounter rates were low for all sites considered except Arroyo Chuchui, where individual encounter rates reached 11.5 ind/10 km censused.

Primate biomass encounter rates varied between 15.3-148.2 kg/10 km censused (mean = 49.2, SD ± 41.8). Notably, at Arroyo Chuchui (148.2 kg/10 km) we encountered over double the primate biomass of any other site, the nearest being Pajaral (57.2 kg/10 km). Four sites (Perseverancia, San Martin, Rio Negro de Caimanes and El Tutumo) had similar primate encounter rates (36.5-38.2 kg/10 km). Finally, the primate biomass encounter rates at San Luis (15.3 kg/10 km) and Oquirquia (23.5 kg/10 km) were relatively low.

**Discussion**

Primate diversity within the Ríos Blanco y Negro Wildlife Reserve, at seven species, appears typical of other protected areas in eastern lowland Bolivia (Braza and García, 1988; García and Tarifa, 1988; Wallace et al., 1998). A notable absence was the dusky titi monkey (*Callicebus donacophilus*) which is frequently observed in forests bordering the city of Santa Cruz to the south of the reserve, but appears absent in northern Santa Cruz Department (Braza and García, 1988; Wallace et al., 1998; this study). Nevertheless, in the Lago Caimen region *Cebus apella* is present on the Brazilian side of the Itenez River (Wallace et al., 1996).

To our knowledge the Bolivian squirrel monkey (*Saimiri boliviensis*) has as yet not been registered east of Perseverancia in Santa Cruz Department, although anecdotal reports suggest it may reach as far east as the upper San Martin River. Where registered, squirrel monkey troops were frequently observed in close association with *Cebus apella* troops. This association has been noted in previous studies in the Neotropics (Terborgh, 1983).

This study also underlines the apparent rarity of howler monkeys in the expansive seasonally evergreen forests of the Brazilian Shield. *Alouatta seniculus* appears to be confined to floodplain forests where it is found at relatively low densities (Wallace et al., 1998). The species appears to be a semideciduous species, possibly more tolerant of host decidu-ousness and/or poor nutrition, with limited knowledge of the diet and habits in the wild.

Apart from the two owl monkey species and *Alouatta seniculus*, the species listed in Table 3 showed high encounter rates during the study. *Saimiri boliviensis* is also known to have occurred during previous surveys at the reserve. *Callithrix argentata* is also described in detail in Table 3. The abundance of these species is consistent with previous surveys (Wallace et al., 1998).

Despite the lack of population estimates, it is clear that the primate biomass is low in the study area. Indeed, it is surprising that so few species are found at all the study sites, especially given the high densities described above.

**Table 3. Distribution of Primates in the Ríos Blanco y Negro Wildlife Reserve, Santa Cruz Department, Bolivia.**

<table>
<thead>
<tr>
<th>Species</th>
<th>Perseverancia</th>
<th>Pajaral</th>
<th>Arroyo Chuchui</th>
<th>San Martin</th>
<th>Rio Negro de Caimanes</th>
<th>San Luis</th>
<th>Oquirquia</th>
<th>El Tutumo</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cebus apella</em></td>
<td>0.7 (8.3)</td>
<td>1.6 (14.7)</td>
<td>1.3 (14.0)</td>
<td>0.9 (6.2)</td>
<td>1.5 (9.0)</td>
<td>0.6 (4.4)</td>
<td>1.2 (7.4)</td>
<td>0.8 (6.3)</td>
</tr>
<tr>
<td><em>Alouatta seniculus</em></td>
<td>0.2 (1.6)</td>
<td>0.1 (0.7)</td>
<td>0.4 (1.8)</td>
<td>0.3 (2.3)</td>
<td>0.1 (0.3)</td>
<td>0.1 (0.3)</td>
<td>0.1 (0.3)</td>
<td>0.1 (1.6)</td>
</tr>
<tr>
<td>Total Species</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>PBER (kg/10km)</td>
<td>35.2</td>
<td>57.2</td>
<td>148.2</td>
<td>37.2</td>
<td>36.5</td>
<td>15.3</td>
<td>23.5</td>
<td>37.1</td>
</tr>
</tbody>
</table>

*Species registered in off-transect conditions. PBER = Primate Biomass Encounter Rate.

Source: Ada...
also signifi-
cantly lower (gprs/10km) in areas where low density
was low below. The most immediate threat to the Rios Blanco y Negro Wildlife Reserve is the logging industry. However, the survey results
reported here are insufficient to draw conclusions about how much logging disturbance levels are affecting primate populations in this region. Comparisons between sites are problematic since pre-logging differences in primate abundance are unknown. In addition, accurate details regarding the history of logging activities at each site are difficult to obtain, and any differences could prove important when interpreting results. In any case, although spider monkeys, which have been identified as being particularly prone to habitat disturbance (McFarland Symington, 1988), were rarely encountered at any of the sites where logging activities were occurring (e.g., San Luis, Ocuilquía), this was not always the case (e.g., Arroyo Chuchui). Nevertheless, high-value timber populations have been greatly reduced and attention is switching to a number of potential secondary timber species. This will not only result in increasing extraction intensities and associated damage, but in addition many of these secondary species are important fruit trees for forest frugivores, for example, Hymenaea courbaril, Spindias mombin, Ficus sp., Ampelocera ruize (Wallace and Painter, unpub.). In the long term, significant reductions in the densities of important frugivore resources could prove limiting to wildlife populations.

Aside from these anomalies, it appears that primate biomass encounter rates are greater in the westernmost sites, which are either on or bordering the Beni alluvial plain. Surveys from other protected areas in lowland Bolivia support this generalization. The Beni Biosphere Reserve, situated c.190 km west of the western border of the Wildlife Reserve, in the Beni Department, has a high primate encounter rate of 72.8 kg per 10 km censused (see Table 3). Similarly, surveys in the nearby Chimane Forest revealed an even higher primate encounter rate (146.9 kg per 10 km censused), even though the larger primate species have suffered long-term hunting pressure. The Beni alluvial plain is also associated with higher densities, relative to the Brazilian Shield, of many terrestrial frugivores. This biogeographical variation is thought to be linked to the relative densities of important fruit resources such as figs and palms (Painter et al., in prep.), which are particularly abundant on the Beni alluvial plain (FAN/PL480/WCS, 1994).

The most immediate threat to the Rios Blanco y Negro Wildlife Reserve is the logging industry. However, the survey results reported here are insufficient to draw conclusions about how much logging disturbance levels are affecting primate populations in this region. Comparisons between sites are problematic since pre-logging differences in primate abundance are unknown. In addition, accurate details regarding the history of logging activities at each site are difficult to obtain, and any differences could prove important when interpreting results. In any case, although spider monkeys, which have been identified as being particularly prone to habitat disturbance (McFarland Symington, 1988), were rarely encountered at any of the sites where logging activities were occurring (e.g., San Luis, Ocuilquía), this was not always the case (e.g., Arroyo Chuchui). Nevertheless, high-value timber populations have been greatly reduced and attention is switching to a number of potential secondary timber species. This will not only result in increasing extraction intensities and associated damage, but in addition many of these secondary species are important fruit trees for forest frugivores, for example, Hymenaea courbaril, Spindias mombin, Ficus sp., Ampelocera ruize (Wallace and Painter, unpub.). In the long term, significant reductions in the densities of important frugivore resources could prove limiting to wildlife populations.

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The surveys did uncover considerable evidence of hunting by logging crews and other employees. Logging-associated hunting threatens several wildlife species, most notably ungulates and cradics (Townsend et al., in prep.). Although primates are rarely hunted by logging crews in this region (Soler, 1996), the most frequently taken species, Ateles chamek, is particularly sensitive to this activity due to its prolonged inter-birth interval and a low intrinsic rate of increase (McFarland Symington, 1988). Spider monkey juveniles also appear to be popular as camp pets, later to be sold in the markets of Santa Cruz (Wallace, pers. obs.). This results in a preference to hunt adult females, which further decreases the population’s ability to recover. In terms of the logging industry, at present extraction intensities hunting probably has the most negative effect on larger wildlife species in lowland Bolivia (Rumiz et al., in press; Townsend et al., in prep.). Every effort must be made to enforce this aspect of the new law in the future.

Acknowledgments

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References

Short Articles

NOVOS REGISTROS DE ALOUATTA NO ESTADO DO CEARÁ (PRIMATES, ATELIDAE)

Patricia G. Guedes
Diva M. Borges-Nogueira
Juliana A. G. da Silva
Leonardo O. Salles

Introdução

O gênero Alouatta Lactépede, 1799 encontra-se distribuído amplamente pela América do Sul, ocorrendo nas mais variadas formações vegetais desde o sul da América Central até a Argentina. É o gênero mais bem documentado na América do Sul no que diz respeito a aspectos ecológicos. A dieta desses animais é folivora-frugívora e podem formar grupos com 4 a 15 indivíduos. Porém, a taxonomia e distribuição do complexo de espécies desse gênero continua a ser uma das menos conhecidas, principalmente para as formas do nordeste brasileiro. Este fato agrava-se com a alarmante situação de conservação dos biomas dessa região.

Segundo Gregorin (1996), são reconhecidas nove espécies brasileiras para o gênero entre as quais destaca-se A. b. ululata Elliot, 1912, que tem distribuição geográfica aparentemente disjunta abrangendo desde o norte do estado do Maranhão, Coimbra-Filho e Câmara (1996) e Coimbra-Filho et al. (1995) remarcam a significativa presença de guaribas no nordeste brasileiro, apesar de serem poucos os dados sobre a sua distribuição nesta região. Segundo os autores, estas primatas deveriam ter uma distribuição muito mais ampla do que se admite, provavelmente ocorrendo em todos os estados da região.

Este trabalho tem como objetivo: 1) Registrar duas novas localidades, no estado do Ceará, complementando a distribuição do gênero Alouatta conhecida para este estado; 2) divulgar o aumento do número de exemplares provenientes do Ceará disponíveis em coleções científicas; e 3) contribuir de forma indireta para a elaboração de propostas biogeográficas associadas ao status taxonômico dos guaribas dessa região.

Registros

O material referente aos guaribas do estado do Ceará é escasso nas coleções mastozoológicas brasileiras. Existem registros somente para os municípios de Granja (localidade Goiabeira - MNRJ 23140) e São Benedito (localidades Bom Jardim - MNRJ 23141, MNRJ 23142; e Cinta Sulidon - MNRJ 21096). Os exemplares estão depositados na Coleção de Mamíferos do Museu Nacional e são datados dos anos de 1953 (MNRJ 21096) e 1973 (demais).

Neste trabalho são apresentados registros recentes provenientes de duas novas localidades desta região: Ladeira do Mucambo (UCF M018) e Cinta da Boa Vista (UCF M019), no Município de Ibiapina, vizinho ao município de São Benedito. Estão localizados na Chapada da Ibiapaba, uma região caracterizada como um biogeográfico com floresta mata-umida relícuia devido à altitude e posição geográfica próxima ao litoral. A região é considerada como um interessante remanescente da Mata Atlântica - no entanto, várias áreas têm sido, ao longo destas duas últimas décadas, intensamente desmatadas. Em um levantamento de mamíferos do estado do Ceará, Paiva (1973) refere-se aos guaribas como praticamente extintos e já naquela época sugeriu medidas urgentes para proteção destes primatas, que podem ser considerados os mais ameaçados dentre os primatas neotropicais. Porém, esses novos registros confirmam que ainda existem populações isoladas no estado, aparentemente apenas na região da Chapada da Ibiapaba, que foram comentadas em trabalhos anteriores (Bouvinc et al., 1984; Coimbra-Filho et al., 1995; Coimbra-Filho e Câmara, 1996; Hirsch et al., 1991; Langguth et al., 1987) e principalmente pela população local durante uma visita à região.

Identificação do Material

O material, que encontra-se depositado na Coleção de Mamíferos da Universidade Federal do Ceará (UCF), foi doado por moradores da região e consta de dois crânios, suas respectivas mandíbulas e um hióide, sendo um indivíduo adulto (UCF M018) e um jovem (UCF M019). Os exemplares apresentam os caracteres diagnósticos e medidas crânicas semelhantes aos listados por Gregorin (1996) para a espécie A. b. ululata, principalmente no que diz respeito à morfologia do aparelho hióide. Este autor apresenta uma proposta que eleva a subespécie A. b. ululata ao status

Figura 1. Mapa da região da Chapada da Ibiapaba, ilustrando os novos registros de Alouatta: Ladeira do Mucambo (UCF M018) e Cinta da Boa Vista (UCF M019), Município de Ibiapina (Ceará).
de espécie (*A. ululata*), embora até o momento seja correntemente aceita a primeira hipótese. A proposta teve como base uma revisão das espécies brasileiras do gênero, incluindo vários caracteres morfológicos, principalmente relativos à pelagem, que os distinguem da forma *A. betzebul* amazônica, além de outras observações mais gerais, expressas da seguinte maneira:

“Além do dicromatismo, da coloração e do tamanho menor em algumas estruturas cranianas, como evidenciado por Dollman (1910) e Elliot (1912), *A. ululata* habita um tipo de vegetação particular. Enquanto que *A. betzebul* e *A. discolor* habitam a floresta equatorial amazônica, *A. ululata* habita uma vegetação aberta de transição com uma alta frequência de babaçu.” (Gregorin, 1996: pp.79-80).

Ainda existem muitas divergências sobre a validade dos táxons subespecíficos, não somente para *Alouatta* como também para outros primatas. Embora não seja objetivo deste trabalho, cabe ressaltar que o reduzido número de exemplares referente à *A. ululata* pode dificultar qualquer elaboração de propostas taxonômicas para esta forma.

Estes registros do Nordeste do Brasil são particularmente interessantes porque constituem mais um exemplo de distribuição faunística que corroborar a hipótese da existência preterita, pela região nordestina, de uma extensa e contínua ligação entre a Floresta Amazônica e a Floresta Atlântica, o que deve ter permitido que essas populações originadas amazônicas prolongassem sua distribuição para estas outras áreas e sofressem posteriores especiações (Borges, 1991; Coimbra-Filho e Câmara, 1996). Ficaram assim as populações isoladas nos remanescentes, testemunhos desta provável conexão paleoambiental.

**Conclusões**

Esta nova amostragem não somente dobra o número de localidades conhecidas para a espécie como também dobra o número de exemplares para o Estado. Este incremento de material disponível em coleções científicas poderá contribuir em futuros estudos taxonômicos e/ou biogeográficos para as formas de *Alouatta*. Além disso, confirmam a sobrevivência destes grupos isolados na região quase quinze anos após o último registro, atrair a atenção para a alarmante escassez de informações sobre estes primatas e seu status de conservação.

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**Referências**


**NOVA OCCORRÊNCIA DE BRACHYTELES ARACHNIDES NO PARQUE ESTADUAL DA SERRA DO MAR, SÃO PAULO, BRASIL**

**Paulo Aurélio Ferrere da Silva**

O mono-carvoeiro, ou muriqui, tem tido sua presença assinalada em várias localidades da Mata Atlântica em pequenos grupos esparsos (Antonietto et al., 1994; Martinselli et al., 1994; Oliveira et al., 1996; Auricchio, 1997). Em duas ocasiões em julho de 1999 pudemos observar um grupo de mono-carvoeiro, a apenas 300 metros da movimentação primeira pista da rodovia dos Imigrantes, o que tornou possível a observação de uma nova ocorrência no Parque Estadual da Serra do Mar.

O Parque Estadual da Serra do Mar, com 139,000 ha, é limitado pelo oeste pelo Município de São Paulo (A. F. e M. de A. 1996). O oeste do Parque, que abrange 2º até 7º de latitude sul, 45º e 46º de longitude oeste, abriga os últimos remanescentes de Mata Atlântica subantártica do Brasil, que correspondem a formaAWS devido à morfologia de altitude.

A localidade de ocorrência da nova ocorrência na Serra do Mar, localizada a 30 km ao norte de São Paulo (A. F. e M. de A. 1996), corresponde a uma área com alta biodiversidade e que é uma área de grande interesse para a conservação da biodiversidade. A ocorrência de *Brachyteles arachnides* em área de alta biodiversidade é de grande importância, pois pode indicar a presença de outras espécies que ainda não foram identificadas.

Os três funcionários que vêem o relatório com os dados, constataram que a presença de *Brachyteles arachnides* em área de alta biodiversidade é de grande importância, pois pode indicar a presença de outras espécies que ainda não foram identificadas.

No grupo havia sempre o filho, com uma hora por mês para adultos segurar a mãe ou passar algum tempo com ela. O animal que é chamado de “Cachoeiro”, segundo o título, é um animal que passa a maior parte do tempo em árvores e subestação de árvores, e quando a mãe está perto, o filho passa a viver com a mãe. A presença de *Brachyteles arachnides* pode ser um indicativo de outras espécies que ainda não foram identificadas.
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Dos Imigrantes, no Núcleo Cubatão, Parque Estadual da Serra do Mar. Os avistamentos foram feitos em uma estação de 1997 (estação de energia) em uma estrada vicinal desta rodovia, chamada

O Parque Estadual da Serra do Mar estende-se do litoral norte do Estado de São Paulo, a partir da divisão com o Rio de Janeiro, até os municípios de Peruíbe e Pedro de Toledo, no sul. Com 315,390 ha, é o maior parque estatal paulista, e possui a maior área de florestas do domínio da Mata Atlântica, além de vários ecossistemas a ela associados (Raimundo e Lorejan, 1998). O Núcleo Cubatão, que abrange as regiões de planoalto, e litoral do Parque Estadual, abrange uma área de aproximadamente 139.000 ha. É uma região montanhosa, com escarpas de florestas primárias de difícil acesso, que é entre cortada pelas rodovias que interligam as Regiões Metropolitanas de São Paulo e da Baixada Santista - Caminho do Mar, Ancheta e Bauru, bem como linhas de alta tensão, oleodutos, gasodutos e ferrovias.

A localidade das avistagens fica aproximadamente a 70 km em linha reta de Mongaguá, ponto mais próximo em que o muriquis já foi avistado (Martiucci, 1994). Para o norte, a localidade de ocorrência mais próxima desta espécie é Poruba, em Ubatuba, São Paulo (Auricchio, 1997) que dista aproximadamente 150 km ao nordeste. No dia 16 de julho o grupo de 10 indivíduos foi observado entre 09:00 h e 10:00 h. Uma nova observação foi feita no dia 26 de julho. Possivelmente era o mesmo grupo, pois também continha cerca de 10 indivíduos. Nesta ocasião, foi-nos possível fotografar alguns animais.

Os três funcionários que trabalham na Subestação disseram que vêem os muriquis regularmente nesta época do ano. O funcionário com mais tempo de serviço diz que os vê ali desde que começou a trabalhar naquele local, há onze anos. Diz aparecem sempre quando há sol, em intervalos de dez ou quinze dias na parte da manhã (no horário entre nove e dez horas) ou a tarde (mais frequentemente, segundo o funcionário da tarde) por volta das 17:00 h. Os monos deste grupo passam vocalizando com gritos e roncos altos, o que torna fácil aos funcionários da subestação perceberem sua presença. Ali, permitem ser observados a 25 m de distância, alimentando-se e parecendo não temerem a presença humana.

No grupo havia uma fêmea que carregava um filhote ainda nas costas. Um funcionário diz que as vezes chegam a ficar mais de uma hora por ali pela manhã e afirma também que já assistiu os adultos seguir-se uns nos outros para formar uma espécie de "ponte" entre uma árvore e outra mais afastada, para que os filhotes passem atravessar sobre eles. Um outro morador do local, diz que vê frequentemente os muriquis, nas redondezas do "Cachoeirão", uma queda d'água formada pela descida do Rio Passaré, a cerca de 2,8 km da subestação. Segundo os entrevistados, não há relatos de caçadores na região.

A presença desta espécie na região é esperada visto que, como mencionado anteriormente, é presente também tanto ao norte quanto ao sul. Como já indicado em Mendes (1994), Auricchio (1997) e Olmos et al. (1997), são necessárias medidas que possibilitem a proteção efetiva de áreas onde haja a ocorrência desta espécie ou a translocação destes animais para outras áreas onde já existam grupos. Outra medida indicada por Auricchio (1997) é a criação em instituições que façam seu manejo em cativeiro, além do Centro de Primatologia do Rio de Janeiro, aumentando o conhecimento biológico desta espécie, podendo futuramente tratar de sua reintrodução. Acreditamos que a ação mais indicada neste caso seja implementar um programa de educação ambiental que tenha como foco os trabalhadores da região, moradores e, num plano mais amplo, as escolas da região.

De qualquer forma, considerando-se que a população total desta espécie a 11 anos atrás foi estimada em 350-400 animais (Nishimura et al., 1988), a descoberta de um novo grupo de muriquis em uma região em que eram considerados extintos, é um alento para aqueles preocupados com a preservação desta espécie.

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Referências


Os Limite de a Natureza

b. B. 1995. O pródromo

FEMALE DISPERSAL IN THE BELIZEAN BLACK HOWLING MONKEY (ALOUATTA PIGRA)

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The purpose of this note is to document female dispersal in the Belizean black howling monkey (Alouatta pigra). Female dispersal has been reported in three species of Alouatta (the mantled howling monkey [A. palliata] by Jones, 1978, 1980a, 1980b; Glander, 1992; the red howling monkey [A. seniculus] by Sekulik, 1982; Agoramoorthy and Rudran, 1995; Pope, 1992; and the black-and-gold howling monkey [A. caraya] by Calegaro-Marques and Bicca-Marques, 1996; Giudice, 1997; Agoramoorthy and Lohmann, 1999), and is thought to be related to food of poor quality (e.g., a folivorous diet, see Wrangham, 1980; Jones, 1999) and low within-group competition for food (Wrangham, 1980; Sterck et al., 1997). Although the causes of female dispersal in primates and other mammals are still debated, it is assumed that females leave their resident groups when the costs of remaining outweigh the costs of dispersal (Jones, 1999).

Our research is conducted at the Community Baboon Sanctuary (CBS) (17°33' N, 88°35' W), Belize District, Belize, C.A. Details of the study site and howler population can be found elsewhere (Horwich and Lyon, 1990; Silver et al., 1998; Ostro et al., 1999). Systematic studies of these "arboreal folivores" have taken place since 1985 in secondary moist tropical forest, including riparian habitat along the Belize River (Horwich and Lyon, 1990). Black howlers may be locally endangered or extinct in Belize (Horwich et al., 1993), and studies of their behavior, social organization, ecology, and genetics are in their early stages. Preliminary studies describe a primarily polygynous breeding structure (Horwich et al., 1993, in prep.) with relaxed or absent social relations among females (Brockett et al., in press). Our research suggests that habitat is saturated for black howlers at the CBS (Horwich et al., 1993, in prep.) and that frequent male takeovers have significant consequences for the behavior and fitness of females (Brockett et al., 1999; Brockett et al., 2000; Horwich et al., in press).

Our ad libitum behavioral observations of black howlers at the CBS lead us to the conclusion that juvenile and adult females disperse from their resident groups. Female behavior is seminal to an understanding of primate social organization because the decisions that females make in relation to limiting resources are thought to determine a population's structure and productivity under density-dependent conditions since, all other things being equal, female dispersion in time and space will map onto resources while male dispersion will map onto females (Enlen and Oiring, 1977; Wrangham, 1980). Monthly surveys of 19 groups (N approximately 100 individuals) at the CBS between 1995 and 1997 show that two adult females and four juvenile females have emigrated from groups while no adult females and one juvenile female have immigrated into groups. Thus, female group membership appears relatively stable because immigration is rare, similar to reports for polygynous A. seniculus (Sekulik, 1982; Agoramoorthy, 1994; Agoramoorthy and Rudran, 1995). Secondary dispersal (transfer of adults from one group to another) also appears to be rare, similar to reports for polygynandrous A. palliata (Glander, 1992) and polygynous A. caraya (Agoramoorthy and Lohmann, 1999) and A. seniculus (Sekulik, 1982; Agoramoorthy and Rudran, 1995; Pope, 1992).

Our observations suggest that female-female aggression, including "targeting" behavior (see Sterck et al., 1997) may be the proximate cause of patterns of female dispersal. For example, females at the CBS have been observed to aggressively expel other females from groups, although coalitions between two females to expel a third, reported for polygynandrous A. palliata (see Jones, 1980a) have not been observed in black howlers. Further, female-female aggression appears to increase with male takeovers. After a male takeover, one of us (RCG) observed an adult female immigrant to the Bazar-Joseph group aggressively expel a resident adult female and a resident juvenile female, both of whom subsequently emigrated. The juvenile female suffered severe injuries and was never seen again. These and other observations suggest that competition for group membership is intense in black howlers, as suggested for A. palliata (see Jones, 1980a) and that female-female aggression, possibly for limiting resources, preceded female dispersal in howlers.

What is the fate of emigrating female A. pigra? Our observations suggest that colonization is a major reproductive strategy for emigrating females, as reported for A. seniculus (e.g., Pop, 1992; Crockett, 1996). In one instance, for example, an adult male was observed to establish a new group >1 km from his group of origin with solitary females of unknown origin (see Horwich et al., in press, Fig. 1). New groups have been observed to form in uninhabited patches of forest as well as in areas of home range overlap between existing groups. Since female dispersal is a necessary condition for colonization (Horn and Rubenstein, 1984, p.289), female dispersal can be assumed to be ancestral to colonization as a reproductive strategy. Alternatively, female dispersal and colonization may both be a function of a third factor (e.g., female-female aggression limiting resources or infanticide). Tracing these evolutionary routes has significant implications for A. palliata sociobiology since (polygynandrous) A. palliata females at Hacienda la Pacifica are more likely to immigrate into existing groups than to colonize open habitat (Glander, 1992).

Although present evidence indicates that black howlers, like other species of Alouatta, should be classified as "dispersal egalitarian" according to the system employed by Sterck et al. (1997), the behaviors reported in this note and additional observations suggest that black howlers may violate certain assumptions of Sterck et al.'s ecological model. For example, our observations suggest that "targeting" behavior by females represents intense within-group competition that may be increased by dispersal of another, suggesting that female influence patterns (Sterck et al., 1997) may be between-group modification of this, Koenig et al. (1997) demonstrated that folivores (see Harman, 1975) foundings of 7-10 would be a broader and more flexible dispersal strategy (Sterck et al., 1997).

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References

Agoramoorthy, G. 1994. Research on the myrmecophagous diet of the mantled howling monkey, Alouatta seniculus, at the Community Baboon Sanctuary, Belize, and subadults at the Farm, Venezuela.  
Cah. Or. 32: 289-299  
Cah. Or. 33: 279-282  
Cah. Or. 34: 279-282  
Cah. Or. 35: 279-282  
Cah. Or. 36: 279-282

Neotropical Primates 7: 292-309

Neotropical Primates 7: 302-314

Neotropical Primates 7: 315-320

Neotropical Primates 7: 321-326

Neotropical Primates 7: 327-332

Neotropical Primates 7: 333-338

Neotropical Primates 7: 339-344

Neotropical Primates 7: 345-350

Neotropical Primates 7: 351-356

Neotropical Primates 7: 357-362

Neotropical Primates 7: 363-368

Neotropical Primates 7: 369-374

Neotropical Primates 7: 375-380
increased by male takeovers. Additionally, we have observed females of different groups behave aggressively towards one another, suggesting that between-group competition may influence patterns of social behavior among female A. pigna. Wangham (1980) argued that female philopatry was favored by between-group competition, a conclusion that may require modification as a result of research on Alouatta. Related to this, Koenig et al. (1999), studying Semnopithecus entellus, demonstrated that competition for food may be intense among folivores (see Fedigan et al., 1989; Jones, 1980a). Although Hanuman langur females generally exhibit philopatry, the findings of Koenig et al. (1999) may indicate that female dispersal is not strictly a function of food type or degree and type of competition per se but of food dispersal and, especially, quality (Jones, 1999). Supporting this interpretation is Koenig et al.’s report that Hanuman langurs eat a broader range of food types than howlers, in particular, bark and non-herbivorous foods (e.g., insects). Thus, female dispersal may in part be a function of some threshold of food quality relative to the biology of a species, differential competitive regimes, and other factors (e.g., food abundance or avoidance of inbreeding). Female dispersal is a primitive trait in Alouatta, and its further investigation will provide insights into the costs and benefits of “non-female bonded” groups, in particular, and female social relations in general.

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References


UPDATE ON THE STATUS OF THE MARGARITA ISLAND CAPUCHIN, CEBUS APELLA MARGARITAE

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Among Venezuela's endemic mammal species, the capuchin monkey from Margarita Island, Cebus apella margaritae Hollister, 1914, deserves special attention. It is the only primate inhabiting the island, which is off the north coast of Venezuela. These capuchins are isolated, with the nearest Cebus apella populations occurring in the Amazon region, approximately 800 km to the south. This gap is enigmatic and remains unexplained (Bodini and Pérez-Hernández, 1988). The most recent information on wild populations of C. apella margaritae comes from Márquez and Sanz (1992) and Sanz and Márquez (1994). According to these authors C. a. margaritae populations on Margarita Island are threatened due to habitat degradation, illegal hunting and commerce. Farmers consider the monkeys crop pests and have sold individuals as pets for prices up to US$41 (Ottocento et al., 1989). Over the past 15 years, an increasing human population has pushed farmers to the borders of the island's reserves. Settlers have already invaded the upper regions of the Cerro El Copey National Park (7,130 ha, created in 1974), at altitudes up to 500 m. The more humid soils found in the mountain ranges of Copey, Tragapata and Matasiete (a Natural Monument of 1,672 ha, created in 1974) have also encouraged timber cutting for small slash-and-burn agricultural plots. These combined factors are creating significant concern for the capuchins of Margarita Island.

Currently, we are carrying out a study of the genetics and conservation status of the Margarita Island capuchin. The aims of our project are to obtain peripheral blood of pet capuchins in order to investigate the origin of this disjunct island population and to carry out a survey to better understand how illegal hunting and commerce affect the status of the species. In February 1997, we visited homes and small businesses in the eastern part of the island. The selection of places to visit was based on information obtained from settlers (Fig. 1), as well as an interview with the local office of the Ministry of Environmental Resources in Margarita. We interviewed people who admitted having or had to have had a pet monkey. When we found a pet we recorded its age, sex, procercence and habits and carried out a physical examination. We also asked for information on prices paid for monkeys, resellers, veterinary care, and general knowledge of Venezuelan laws on the possession of wild animals as pets.

Fourteen pet capuchins were found. To our surprise, only five were Cebus apella margaritae: two juvenile males, one adult male, one adult female, and one adult female (reputed by its owner as a male). The others were weeper capuchins Cebus olivaceus, and two were reported to have been captured from Cerro Matasiete. The diet for most of the monkeys consisted of human foods, especially bread and milk (>80% of the diet), and fruits. Only one owner admitted to seeking local veterinary care. Prices for monkeys were as high as US$220. Some of the people claimed to have shot monkeys either invading their crops or in the vicinity of their fields. Most of those interviewed (especially near to the Cerro El Copey National Park) admitted knowing that Venezuelan laws deem it illegal to own a wild animal as a pet, and that punitive measures could be taken against those found selling or taking monkeys from the park.

We found a eukaryote parasite in the total of four blood samples of C. a. margaritae. This microorganism is similar to Trypanosoma sp., but a definitive identification has yet to be made. None of the interviewees knew of the taxonomic simi-

larity of the presence of this disjunct island population, only for human inhabitation.

The occurrence on Margarita Island is an indication of the need for an Environmental Impact Assessment of this project, and for the protection of Cebus olivaceus. C. a. margaritae owners in the area should be aware that the island is a parrot, raptor and human sensitive natural area, which has been extensively deforested and fragmented.

Surveys and studies in the area are needed to ensure that the island's natural flora and fauna are not detrimentally affected.

We still have to learn about the history and demographics of Cebus olivaceus and C. a. margaritae to better understand their habitat needs.

Figure 1. Margarita Island, Venezuela. Locations where Cebus mosquitos were being kept as pets. Map by Stephen D. Nash.

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Moscars
The status of the margarite monkey and small primates in Venezuela is important for the conservation of the Margarita Island monkey to C. olivaceus and the presence of the unknown blood parasite in all the samples requires further studies to evaluate the risk of zoonosis, not only for pet owners, but for the entire human population inhabiting the island.

The occurrence of C. olivaceus as a pet is evidence of considerable illegal traffic of capuchin monkeys into Margarita Island. This was not mentioned as a threat to C. a. margarita during our interview with the local officer from the Ministry of Environmental Resources, but if the populations of C. olivaceus exist on the island (mentioned by two interviewees), this may be an additional threat to the endemic population of monkeys. The possible occurrence of free ranging C. olivaceus may be a recent phenomenon. Several capuchin owners admitted to having released pets into the mountains without knowing the species. Although Cebus species are sympatric on the continent (Terborgh, 1981), the amount of deforestation and loss of natural habitat due to farming and human settlement could result in competition between the species on the island.

Surveys of the natural populations of C. a. margarita, and for the possible presence of C. olivaceus, are urgently needed, as is an environmental education program to make people aware of the significance of the island’s monkey species. The success of similar projects with other endangered species on the island, such as the Margarita parrot (yellow-shouldered parrot, Amazona barbadensis), has shown that the people are sensitive towards wildlife in their area and are willing to modify their habits to favor the conservation of species and habitats.

We still do not know whether the Margarita capuchins were isolated prior to the arrival of human settlers or whether they were introduced. The two populations on the island are disjunct; occurring between two widely separated mountain ranges. The increase in human settlements, especially near to the park, small-scale farming and burgeoning tourism and recreation, coupled with the generally poor economy of the island, has resulted in widespread habitat fragmentation, the consequences of which have yet to be assessed (Ortogoza et al., 1989; Marquez and Sanz, 1992). There is an urgent need for effective protection and management of the Cerro El Copey and Matarisie reserves. Genetic studies will hopefully give us an idea as to the origin of these monkeys and their unexplained isolation from their closest subspecies, and will allow for the design of a management plan. It is possible that C. a. margarita is suffering from some degree of inbreeding depression, or even that it may be recovering from a population bottleneck (founder effect). The assessment of the genetic status of this endemic and little known monkey is extremely important to answer such questions and for an effective management plan to be put into place.

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References


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PRIMATE RECORDS FROM THE POTATO PLATEAU, WESTERN GUYANA, INCLUDING THE FIRST FOR CEBUS ALBIFRONS EAST OF THE RIO BRANCO, BRAZIL

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Everton Henry, Paul Benjamin
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Introduction

Guyana is one of the few Neotropical countries where substantial tracts of forest remain (Groombridge, 1992, Bowles et al., 1998). Even with recent work (Phillips-Conroy and Sussman, 1995; Sussman and Phillips-Conroy, 1995; Lehman, 1999; Lehman et al., 1995), much of the country remains unsurveyed for primates.

Here we report on the primate fauna of the Potato Plateau, Guyana, a 1,165 km² outlier of the Pakaraima Mountains, and the eastern-most extension of the Guayana Highlands (see Fig.1), with a basal altitude of some 500 m and higher peaks (2042 m, Mt. Ayanganna; 1954 m, Mt. Kopinang; 1470 m, Mt. Wokamung and others). Like much of the
Guyana Highlands, the Plateau consists of pink Proterozoic Roraima Formation sandstone (1600-1800 m.y.b.p.), capped with younger volcanic dolerites (Haffer, 1974). Soils are old and nutrient-poor (Maguire, 1970; Haffer, 1974). A portion of the Plateau constitutes the Kaieteur National Park (this is currently being expanded from 11.65 km² to 580.16 km²; see The World Bank, 1998) (see Fig. 2).

The vegetation of the National Park has been described by Henkel (1994) and by Kelloff and Funk (1998). The vegetation of some other parts of the Plateau has been described by Maguire et al. (1948). The floristic communities vary from white sand scrub to flooded riparian forest, basimontane forest, montane forest, upper montane forest, high tepui forest and high tepui scrub (Huber et al., 1995). Though the region has received attention from botanists, zoological data is sparse for the Plateau.

This report is based on two surveys. One was conducted by SL and MM in March 1995 (dry season). The other, conducted by AB, BS, EH and PB, was carried out between June and August 1998 (wet season) and formed part of the work of the Potaro Plateau Expedition (PPE). Data were collected during field observations and through interviews with local residents.

Upon contact with primate groups, habitat type was recorded and location was determined with hand-held GPS units (Garmin 12XL, AB & BS; Magellan NAV 5000D, SL). Ad libitum notes on behavior, vocalizations and obvious individual physical characteristics were also collected. Altitudes were taken from 1:50,000 topographic maps (Survey Department of Guyana 1975: Kurukabaru Sheet 49 NE, Kurukabaru Sheet 49 NW and Ayanganna Sheet 42 SE).

**Methods**

**Fieldwork**

Survey methods differed. SL and MM conducted repeat surveys (N = 22) of a 5.5 km transect, plus 8 km of once-only surveys of an established trail, along the western edge of the post-river canyon and from the edge of the Kaieteur Falls through the National Park and into the surrounding habitat. The PPE recorded primates as they were encountered during fieldwork surveys for other mammal groups (bats, otters, small mammals and birds). Survey sites were Muri-muri and Amamuri Creeks (mouth located at 05°10' N, 59°30' W and 05°07' N, 59°32' W, respectively), Chenapou village (04°59' N, 59°35' W), Tiger Bay village (04°59'N, 59°34' W), Tappa airstrip (04°54' N, 59°45' W), Conrad’s mining camp (04°59'N, 59°39'W), Menzies’ Landing (04°51'N, 59.41'W) and Mount Kowa (04°51' N, 59°42' W). Locations of all survey sites are given in Figure 2.

**Interviews**

For the Potaro Plateau Expedition, AB interviewed the inhabitants of the villages of Tiger Bay and Chenapou and the park ranger (Mike Phang), using the methods of Barnett (1996) and Cunha and Barnett (1989). Using the methods of Lehman (1994) and Sussman and Phillips-Conroy (1995), SL and MM conducted interviews near Kaieteur Falls with the previous park ranger (Lawrence Gibbons), three resident miners and three Amerindians from Paramakatoi village who were traveling through the National Park. Great care was taken to avoid leading questions. Interviews consisted of: (i) having people identify local monkey species from laminated colour photocopies of selected illustrations in Eisenberg (1989) and Reid (1998) (PPE), illustrations in Emmons (1989) an MM; (ii) a description of abundance, sometimes in numbers.

In addition to game hunting and fishing, the boundaries of the park were marked by mining companies.

**Results**

**Fieldwork**

Primate locations included a total of five forest park; three _Atelopus olivaceus_ (A. _olivaceus_ and A. _olivaceus_). A single Ghost’s rain frog (A. _olivaceus_ boundaries were marked by mining companies.

The PPE acquired information upon sightings. The size ranged from 8 to 18 km. The animals were heard on most occasions and the red howler monkey was often heard in the forests. The monkeys were found near the montane forest on the upper slopes of the Ochoa et al. (1996) study area. The animals were observed to non-}

**Interviews**

On 1 August 1998, AB and MM, after being told to look for tributary of the Potaro River, found a small group of monkeys. The animals were observed to be eating fruit. The animals were identified as _A. seniculus_ by the park ranger.

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(1989) and laminated colour print photographs (SL and MM); (ii) asking about primates of the immediate area versus those that occur anywhere in Guyana; (iii) asking for physical descriptions of each species; (iv) asking about the relative abundance of primates in the area (i.e., not found, rare, sometimes seen, abundant, very abundant); and (v) requesting information on hunting techniques (if any).

In addition to interviews, the PPE looked for examples of hunting and of pet keeping during visits at the following locations: Chenapou, Tiger Bay, Tappa Airstrip, Conrad’s mining camp and Menzie’s Landing.

Results

Fieldwork

Primate locations are given in Figure 2. SL and MM censused a total of four groups of primates during repeat surveys in the park; three groups of wedge-capped capuchins (Cebus o. olivaceus) (N = 15) and one male-female pair of red howlers (Aloinatta seniculus). All encounters were outside the boundaries of the park, with SL observing no primates during his single surveys at Kaieteur Falls National Park. The total sighting rate for primate groups was low, only 0.38 groups/10 km.

The PPE achieved nine primate encounters of five species. C. o. olivaceus were observed four times on Mt. Kowa. Group size ranged from four to eight animals. Over a 10-day period, groups consisting of four spider monkeys (Ateles paniscus) were seen three times on Mt. Kowa at distances of between 20 and 60 m, and assumed to be repeat sightings of the same group. A red howler was seen in waterside vegetation at Muri-muri Creek. Pre-dawn vocalizations from several troops of A. seniculus were heard every morning at Chenapou and again in the forests surrounding the airstrip at Tappa. None were heard on Mt. Kowa, though the species is known to inhabit montane forest areas (Husson, 1957; Mittermeier, 1977; Ochoa et al., 1993). Since hunting pressure on Mt. Kowa is low to non-existent, the reason for the unexpected absence of A. seniculus there is obscure.

On 1 August 1998, a group of four Cebus albifrons was seen by AB, BS, EH and PB at a distance of 30 m, some 7 m up in flooded forest bordering Amacuri Creek, a left bank tributary of the Potaro River. The light was good and the animals were clearly visible with both binoculars and the naked eye. The animals displayed all the field characters of the species (see Herskovitz, 1949; Eisenberg, 1989; Kinsey, 1997): body colour was much browner than the C. o. olivaceus seen on Mt. Kowa; there was no black line down the middle of the forehead; the facial fur was white; the forearms were not gray and the shoulders were white. Two of the four observers also reported that the animals had whitetipped tails. This is the first record of C. albifrons for Guyana and appears to be the first time this species has been recorded east of the Rio Branco, Brazil. A single Pithecia p. pithecia was observed with the C. albifrons.

Interviews

A combined total of 18 interviews were conducted, with information from 34 people (12 interviews with 27 by AB, SL conducted 6 interviews with 7 people). The residents of Chenapou confirmed and identified all the species encountered by the PPE. The interviewees specifically denied that Saguinus midas, Aotus trivirgatus, Cebus apella, Chiropotes satanas and Saimiri sciureus occurred on the Plateau. Most interviewees knew of Saimiri, but considered it to be a coastal species. Aotus was said to occur in the north of the country. Local reports of a ‘night monkey’ were found to refer to the kinkajou (Potos flavus) (see Rousellilhon, 1988, for a similar occurrence in French Guiana). In the opinion of local people, overall rank order of abundance for the region’s primates was: Alouatta, Cebus spp., Ateles, Pithecia. Ateles was considered to be locally abundant in remoter areas.

SL and MM’s interviewees reported that Saimiri, Cebus apella, C. olivaceus and Alouatta were to be found in or near the park. Ateles was considered very rare in the Kaiteret region, the result of intensive hunting by miners. According to two inhabitants of Paramakatoi village, Ateles did still occur 2-3 days walk SE of the falls (i.e. the Mt. Kowa region). The existence of Chiropotes was denied by all interviewees. There was disagreement on the presence of Pithecia in the Kaieteur region, some interviewees affirmed its presence and some denied it. No data was obtained on the presence of Aotus. That these interview results are not entirely consistent with those of the PPE may be attributable to the PPE’s near-exclusive interviewing of Indigenous Patamona people for information. Only three of SL and MM’s interviewees were long-term residents in the Plateau, though not of the region in which the interviews were being conducted. In addition, the “area around the park” included the lowland forests at the base of the falls and beyond, and thus is not necessarily relevant to the Plateau, of which the National Park is a small subset.

In interviews for the PPE, AB found that no-one reported hunting monkeys regularly. Paca (Agouti paca), peccaries (Tapirus pecari and T. tajacu) and tapirs (Tapirus terrestris) reportedly formed the hunters’ mainstay. Monkeys were hunted only rarely. The most common reasons given were i) that they looked too human, either when alive (seven interviewees), or when skinned (five interviewees) or ii) that the difficulty of hunting them outweighed the cartridge costs compared to the ease of hunting the abundant paca (four interviewees).

No primates were observed being kept as pets in either Chenapou, Tiger Bay or Menzie’s Landing, though keeping wild animals as pets appeared common in these villages. Unlike the situation in eastern Bolívar (Kinsey et al., 1988), C. olivaceus was not reported to attack crops and, as a result, was not punitively hunted.
Table 1. Primate species recorded in areas close or adjacent to the Potaro Plateau.

<table>
<thead>
<tr>
<th>Species</th>
<th>Mt. Roraima (Tate 1932, 1939)</th>
<th>Canaima National Park (Ochoa et al., 1993)</th>
<th>S-E Bolivar (Norconk et al., 1996)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aotus trivirgatus</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saimiri sciureus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cebus apella</td>
<td>+</td>
<td></td>
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</tr>
<tr>
<td>Cebus olivaceus</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pithecia pithecia</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chiropotes satanas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alouatta seniculus</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ateles belzebuth</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 - not seen, but considered very probable.

Discussion

The abundance ranking from local interviews broadly agrees with the data of Norconk et al. (1996) who also reported that *P. pithecia* is everywhere rare in Guyana, and with the data in Kinsey et al. (1988) from neighbouring eastern Bolivar state, Venezuela.

The primate records are of great interest as the distribution of several species still requires clarification (Sussman and Phillips-Conroy 1995; Phillips-Conroy and Sussman 1995). These authors reported the distribution of *Saimiri* to be patchy. The reported absence on the Plateau of *Chiropotes satanas* and *Saguinus midas* is in agreement with Sussman and Phillips-Conroy’s belief that neither of these species occur west of the Essequibo River nor north or west of the Rupununi River (Sussman and Phillips-Conroy 1995).

*Ateles paniscus* is very sensitive to hunting (Robinson and Ramirez, 1986), and both its presence and the group members’ reactions to human observers supported local opinion that Mt. Kowa is very rarely visited by hunters. Muckenhirn et al. (1975) considered that *Ateles* did not occur north of the Potaro River. Our records at Mt. Kowa neither confirm nor deny this, since Kowa lies on the southern bank of that river. It does, however, show that the species is still present in this remote region.

The north-west extent of the distribution of *C. apella* is uncertain according to Sussman and Phillips-Conroy (1995) and Phillips-Conroy and Sussman (1995). Its apparent absence from the Potaro Plateau is in line with the belief of Lehman (1999) that the species does not occur further north than the riparian forests along the Rupununi River; and with that of Muckenhirn et al. (1975) who believed the species to be absent from the north-west of the country.

The taxonomy of the genus *Cebus*, particularly of *C. albifrons*, is in need of revision (Rylands et al., 1995). As noted by Phillips-Conroy and Sussman (1995), further confusion to the situation is brought about by the presence of hybrids (e.g. Moonen 1987). However, the possibility that the animals seen at Amamuri Creek represent a visually distinct subspecies of *C. olivaceus* is unlikely given the possibilities (see Hershkovitz, 1949).

The record of *C. albifrons* is significant as it appears to be the first time it has been recorded in Guyana (see Sussman and Phillips-Conroy, 1995; Norconk et al., 1996; Lehman, 1999), and the first time it has been recorded east of the Rio Branco in Brazil (see maps in Emmons, 1997; Kinsey, 1997). This is a range extension of some 200 km. The species was not recorded in adjacent parts of Venezuela by Bodini and Pérez-Hernández (1987); their apparent record for Mount Roraima on Map 6 (p.241) was refuted by their statements in the text (see also Norconk et al., 1996). Primate species of adjacent parts of Venezuela have been reported by Tate (1932, 1939), Norconk et al. (1996) and Ochoa et al. (1993) (see Table 1) and do not indicate the presence of *C. albifrons*. However, it appears that no primate surveys have been conducted in the critical region between the eastern bank of the Rio Branco and the Guayanaese border with Brazil (John F. Eisenberg, pers. comm.; A. L. Gardner, pers. comm.; Anthony Rylands, pers. comm.; Richard Thorington, pers. comm.; and see Hershkovitz, 1977, p.901). It is therefore uncertain if this record represents the documentation of a true long-established historical range of the species, or a very recent range extension (possibly as a result of the severe forest fires in the region in early 1998, see Hammond and ter Steege, 1998; Schulte, 1998). Further fieldwork is needed to resolve this, but it should be noted that the presence of the isolated *C. albifrons* subspecies on Trinidad (*C. a. trinitatis*) argues for the species historically having a much wider range than currently thought.

Importantly, the field characteristics of the animals seen at Amamuri Creek are not consistent with those described for any of the visually distinct subspecies of *C. olivaceus* (see Hershkovitz, 1949).

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References


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References


Henkel, T. 1994. Expedition Reports. Smithsonian Institution, Department of Botany, Washington, DC.


Survey of Alouatta palliata at the Bilsa Biological Reserve, North-west Ecuador

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Marjorie Saillan and Esbeth Vooren

Introduction

Howler monkeys (Alouatta) are among the larger New World primates. They are found living in a wide range of forest habitats over most of South and Central America from Mexico to Argentina, with a total distribution of 483,000 km² (Marsh and Mittermeier, 1987). The mantled howler monkey Alouatta palliata, can be found from southern Mexico, through Central America, western Colombia and Ecuador to the northwest of Peru (Eisenberg, 1989). Throughout this geographical range, A. palliata occupies several different forest types: dense primary forest in many places, but also coastal mangrove forest in Panama, dry, deciduous forest in Costa Rica, secondary forest in Mexico and mountain forest in Guatemala (Wolffheim, 1983). Strong variations in density have been observed between these different habitats (Peres, 1997; Chapman and Balcomb, 1998). Thus, an important issue for A. palliata conservation is a better understanding of the links between habitat characteristics and population densities. In this paper, we report the results of a population survey of A. palliata at the Bilsa Biological Station of Ecuador. To our knowledge, this species has not previously been studied in Ecuador; nothing is known about their local ecology or abundance.

Methods

Alouatta palliata

Adult males of A. palliata weigh around 7.3 kg and females around 5.8 kg (Martin, 1990). The basic color of both sexes is black, sometimes brown, with a gold, white or brown fringe along the flanks (the mantle). The color and shape of the mantle varies greatly within the species. A. palliata aequatorialis, the subspecies we have been working on, is listed as "Lower Risk" by Crockett (1998). The same status is given for A. palliata palliata. However, the subspecies A. palliata mexicana is listed as "Vulnerable" by Crockett (1998) as well as in the 1996 IUCN Red List of Threatened Animals.

Study Site

The Bilsa Biological Station (00°20.8' N, 79°42.7' W) (Fig. 1) is situated in the foothills of the Mache-Chindul Mountains in the Province of Esmeraldas, at an altitude of 300-750m, in the western coastal region of Ecuador. The reserve covers 3000 hectares of some of the last remaining tropical pre-montane wet and humid coastal forest in Ecuador. A small fraction of the area is composed of very recent secondary forest, now submitted to reforestation. Altitude variations and moisture from the Pacific Ocean create microclimates that encourage local species endemism (Braune, 1995). Robin Foster (in Parker III and Carr, 1992) describes the area as pristine. The surrounding area has only been disturbed by colonisation and logging in the last 30 years. The temperature is stable year round at Bilsa, and the climate is described as uniform temperate wet (Parker III and Carr, 1992). Average rainfall is often more than 3 m of rain per year. In the wet season, from January to June, the temperature range is usually between 24°C and 25°C. In the dry season, from July to December the range is between 21°C and 22°C. During the time of our study (4th August to 19th September), the average temperature was 21.6°C. The maximum temperature recorded during that time was 27.5°C and the minimum was 18.2°C.

The Survey:

We took advantage of the vocalizations and calls at dawn (Milton, 1980). The idea of tracking into the field is that we should be able to follow the time and space of the vocalizations and listeners are good at doing this. Calls were recorded by listening to the location of the direction from the sound source into the boreal area. This method is considered useful in assessing density since it can be done in the field in real-time.

Data were collected from 12 a.m. to 08:00 a.m. (Fig. 2). Vocal activity was recorded for 75 minutes. The data included the observation of the number of troopers, which were recognized by their location on the map. Calls were recorded by listening to the location of the direction from the sound source into the boreal area.

The map of the area covered by triangulation was 3000 hectares. Observed howler troops were available.
was 18.2°C. The average precipitation was 1.6 mm per day and the total precipitation for 30 days was 48.7 mm.

The Survey: Troop Density Estimation
We took advantage of the fact that howlers make very loud calls at dawn, which allowed us to use a triangulation method (Milton, 1982; Stoner, 1994; Brockelman and Ali, 1987). The idea of this method is to place as many groups of people into the field as possible in order to record simultaneously the time and the direction of calling troops. The groups of listeners are placed at known, predetermined locations on the map. Calls from one monkey troop at a specific time were recorded by different observers, so that the point where the direction lines crossed indicated the position of a monkey troop. This method provided an estimation of the minimum density since not all troops may not howl on a given morning.

Data were collected on 20 August, 1998 between 05.00 a.m. to 08.00 a.m. with the help of 34 volunteers (17 groups of two). Volunteers included staff from the station, park guards, European university students and North American peace-corps volunteers. Group sites were determined the day before and marked with GPS. Sites on hills allowing the best listening were preferred. The positions of the listeners and the topography allowed us to estimate the area covered (positioned on Fig. 2) as 4 km². The precise times and directions of the first howls of each troop were noted. As only seven compasses were available, north was clearly marked at all sites.

Results
Troop Size
The location and size of the troops encountered is shown in Figure 1. Of a total of 12 encounters, two were solitary individuals. Troop sizes ranged from two to nine animals. Including solitary individuals, mean troop size is estimated at N = 4.8 individuals per troop (SD 3.1).

Troop Density
Thirteen troops were detected in an area of 4 km² (Fig. 2). Troop density is therefore estimated to be 3.25 troops/km² in the covered area. Using N = 4.8 (SD 3.1), we estimate the density to be 15.6 individuals/km² (± 9.3). Given that the area surveyed covers 1/8 of the whole reserve, and that it roughly presents the different habitat types of Bilsa, and in similar proportions, extrapolation of the density estimate to the whole reserve seems justified.

Discussion
Ecological factors affecting howler density at Bilsa
Our survey indicates a density of 15.6 individuals/km² (± 9.3). This density falls below the mean observed for the genus, estimated by Peres (1997) as 29.5 (estimation based on 106 densities for different habitat types). However, it is important to notice that many sites reported in this study show low densities while only a few show extremely high ones. Hence, even though the density observed in Bilsa is inferior to the mean for the genus, it is superior to the median (mean of ranks: 12.8). The same kind of conclusion can be drawn from literature data concerning *A. palliata* only (Table 1). Indeed, we record that even though some sites harbour very high densities (some of them (Baldwin and Baldwin, 1976) being probably very unstable and due to recent disturbance in surrounding areas), densities around 15 individuals / km² are common.
Thus, it seems that the howler density in Bilisa is low compared to what is seen in some habitats, but not compared to what is ordinary observed. We will now try to explain this pattern by considering the different ecological factors known to affect howler density: hunting pressure, interspecific competition, and food quality and availability. These factors are ultimately determined by abiotic factors such as soil fertility, altitude, seasonality and rainfall.

Hunting pressure has been shown to be a very significant factor affecting the population structure of howler monkeys (Peres, 1997; Marsh and Mittemerje, 1987). Howlers are hunted for food, medicine and fur, which has resulted in their extinction from many areas, including parts of Ecuador (M. Dilger, pers. comm.). However, hunting pressure is very low or non-existent at Bilisa.

Inter-specific competition for resources can affect howler population densities in communities rich in primate species (Eisenberg, 1979). Cebus albifrons (white-fronted capuchin) is the only other monkey species present at Bilisa. However, capuchins seem rare and are found mainly in secondary forest. Therefore the resource overlap is small, suggesting that inter-specific competition is not likely to be a factor affecting the observed howler troop size and population density at Bilisa.

The floristic composition can have a profound influence on the population structure of howler monkeys. The flora of Bilisa is remarkable by the fact that it contains large numbers of Leguminosae and Ficus species (R. B. Foster in Parker III and Carr, 1992), which have been shown to be very important components of howler diet. Therefore, it may be that howler density and troop size is limited in Bilisa because of floral composition. However, howler diet should be precisely ascertained for this hypothesis to be confirmed.

Based on a wide comparison of population densities at different sites, Peres (1997) concluded that once hunting pressure differences are controlled for, two remaining factors are the main determinants of Alouatta densities: (i) primary productivity (which is increased by soil fertility and forest heterogeneity) and (ii) toxin concentrations in leaves (which is decreased by seasonality and soil fertility). Bilisa is composed mainly of primary forest, probably harbouring high concentrations of toxic secondary compounds in leaves with limited primary productivity. Seasonality is significant but not as important as in sites showing the highest howler densities. Furthermore, because the area is mountainous, leaching of nutrients from the soil is to be expected.

Thus, it seems that hunting pressure and interspecific competition are not limiting howler density at Bilisa. However, low abundance of food sources commonly consumed by howlers, together with relatively low primary productivity and high toxin concentrations may limit the carrying capacity of this habitat.

Conservation Implications
The original distribution of the tropical rain forest and the populations of *A. palliata* have been reduced by at least 90 percent in the last 40 years as a result of the conversion of natural habitat to pasture and agricultural fields (Estrella and Coates-Estrada, 1988). Conservation initiatives are needed to save this species from extinction. Habitat fragmentation and destruction, hunting, and pet trade are the factors responsible in most cases for the decline of the species. In the Macha-Chindul Mountains, hunting and pet trade do not seem to play a role, but deforestation is a concern. Further studies on the effect of hunting on the population of this species are needed.

Howler monkeys are important to their habitats, as they are seed dispersers and predators of larger animals. On the other hand, more areas must be protected in the reserve. Z. T. T. (Zonate-Tropical) Fundación will continue to work to protect the habitat and the people. Further research would help to better understand the roles of genetic diversity and species richness.

Howler monkeys are keystone species in the whole habitat. Without their role in maintaining the areas, the stability of the system is not secure. The number of primate species is lower than it was before, but the presence of a large howler monkey population makes it a unique habitat. In these circumstances, interventions to protect the species are needed.

Surveys are in progress to determine how low the current population of *A. palliata* is in the inter-sire community, and the effect of changes in habitat structure. A well-designed conservation plan will ensure the survival of this species and the protection of the habitat. Further studies on the ecology of howler monkeys in the region will need to be conducted in order to understand the effects of habitat destruction and the threats that the species faces.

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We are deeply grateful to the Organization for Tropical Studies for the opportunity to conduct the study. The support of the University of London - The Egyptian Expedition on the field and the University of Georgia was essential for the success of the project. The Bursary of the University of London was awarded to F. G. and the School of the Environment to Alexander, for their financial support. We appreciate the contributions of the Conservation Progress Ltd., the Nature Conservancy, the World Wildlife Fund, the University of Toronto, and the National Geographic Society. Special thanks to Dr. Steve Davis for advice and the kind hospitality of Mr. Bayart for accompanying us in the field. But not least, to Mme. 3a and Mr. 4a of the triangulum.
play a role, however deforestation has been incredibly intense during the last 30 years.

Howler conservation requires preservation of primary forest habitat, as this is the type of habitat that is suitable for these animals. Our results show that the Bilsa population is not currently at a critical stage. The surrounding areas of Bilsa are still covered by primary forest at the present time. These areas must be protected from destruction by including them in the reserve as well as continuing the education activities of Fundación Jatun Sacha to increase the awareness of the local people. Furthermore, the effects of overall forest population reduction due to the destruction of the outlying forest may not yet have begun to show the long-term deleterious effects of genetic diversity loss and genetic drift.

Howler conservation at Bilsa is an excellent way of protecting the whole habitat. Howlers are probably among the largest animals in the area and their presence is undoubtedly necessary for the stability of the ecosystem, especially in the role of seed dispersal (Estrada and Coates-Estrada, 1984). Given the vast number of plant species consumed by howlers their continued presence requires the protection of the entire ecosystem. The mantled howler monkey is therefore an effective umbrella species.

Surveys are indispensable for conservation planning. They allow estimations of population status and provide material for inter-site comparisons. Surveys must be performed several times to provide information concerning population dynamics which allows the recognition of declining primate populations in areas where conservation efforts are most needed. More detailed information must be obtained, particularly on how the A. palliata diet in Bilsa differs from other sites. Local dietary habits must be known for conservation actions to be conducted through reforestation. As a peculiar and unique habitat, Bilsa may reveal many new and interesting aspects of howler ecology. Sufficient data are already available in the literature to allow fruitful comparisons. Hopefully such projects will be realised at Bilsa in the near future.

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References


analysis of Neotropical mammal fauna. Biotropica 5: 150-
161.
Estrada, A. 1982. Survey and census of howler monkeys
(Alnowatt palliata) in the rain forest of “Los Tuxtas” Veracruz,
Estrada, A. and Coates-Estrada, R. 1984. Fruit eating and
seed dispersal by howling monkeys (Alnowatt palliata)
in the tropical rain forest of Los Tuxtas, Mexico. Am. J.
Primatol. 6: 77-91.
Estrada, A. and Coates-Estrada, R. 1988. Tropical rain forest
conversion and perspectives in the conservation of wild pri-
mates (Aloocytes and Atetes) in Mexico. Am. J. Primatol. 14:
315-327.
Growth of mantled howler groups in a regenerating Coast
the primates of the Zona Protectora and La Selva Biological
and Cebus capucinum in the Costa Rican dry forest. In: Ne-
otropical Primates. Field Studies and Conservation, R. W.
Thorington Jr. and P. G. Helme (eds.), pp. 4-9, National
Academy of Science, Washington, DC.
Glander, K. E., 1978. Howling monkey feeding behaviour
and plant secondary compounds: A study of strategies. In:
The Ecology of Arboreal Foliivores, G. G. Montgomery (ed.),
pp. 561-573. Smithsonian Institution Press, Washington, DC.
Helme, P. G., Turner, D. C. and Scott, N. J. 1976. Compari-
sion of census data on ALooyatt palliata from Costa Rica and
Panama. In: Neotropical Primates. Field Studies and Conser-
vation, R. W. Thorington Jr. and P. G. Helme (eds.), pp. 10-
19, National Academy of Science, Washington, DC.
IUCN Red List of Endangered Animals. Website:http://
www.wcmr.org.uk/species/animals/animal_redlist.html
Marsh, C. W. and Mittermeier, R. A. 1987. Primate Conser-
Chapman and Hall, London.
Study in Primate Economics. Columbia University Press, New
York.
Milton, K. 1982. Dietary quality and demographic regula-
tion in a howler monkey population. In: The Ecology of a
Tropical Forest: Seasonal Rhythms and Long-term Changes,
E. G. Leigh Jr., A. S. Rand, and D. M. Windsor (eds.),
pp. 273-290, Smithsonian Institution Press, Washington, DC.
Mittermeier, R. A. 1973. Group activity and population dy-
namics of the howler monkey on Barro Colorado Island. Pri-
mates 14: 1-19.
Myers, N. 1988. Threatened biotas: Hotspots in tropical for-
est. The Environmentalist 8: 187-208.
Parker, T. A., III and Carr, J. L. 1992. Status of Forest Rem-
nants in the Cordillera de la Costa and Adjacent Areas of South-
western Ecuador. RAP Working Papers 2. Conservation In-
ternational, Washington, DC.
Peres, C. 1997. Effects of habitat quality and hunting pres-
sure on arboreal folivore densities in Neotropical forests: A
case study of howler monkeys (Alouatta spp.). Folia Primatol.
68: 199-222.
Rodriguez, M. A. R. 1985. Algunos aspectos sobre componentario,
animal pera de condiciones y de problemas de los monos (Primates:Cebidae) en el Refugio de Fauna Silvestre Palo Verde (Guancattack, Costa Rica). In: Inves-
igaciones Sobre Fauna Silvestre de Costa-Rica, Editorial
Universidad a Distancia, San Jose, Costa Rica.
Sanchez Forras, R. E. 1991. Utilizar el habitaci, un, comportamiento, y dieta del Mono Congo (Alouatta palliata) en
Smith, C. C. 1977. Feeding behavior and social organization
in howling monkeys. In: Primate Ecology, T. H. Clutton-
Stone, K. E. 1994. Population density of the mantled howler
monkey (Alouatta palliata) at La Selva Biological Reserve,
Wollheim, J. H. 1983. Primates of the World: Distribution,
Abundance and Conservation. Harwood Academic Publish-
ers, Seattle.

### DEMOGRAPHY OF A GROUP OF TUFTED CAPUCHIN MONKEYS (CEBUS APPELLA NIGRITUS) AT THE ESTACAO
BIOLÓGICA DE CARATINGA, MINAS GERAIS, BRAZIL

Jessica Ward Lynch
José Romé

### Introduction

Demographic variables play an important role in understanding primate behavioral ecology (Dunbar, 1987; Strier 1991, 1999a) and are crucial components of conservation biology strategies for species’ management (Dobson and Lyles, 1989). While attention has focused on collecting demographic data on endangered species, it is also very important to monitor demography of abundant and widespread species, both for comparison to those which are threatened (Hubbell and Foster, 1986) and for understanding demographics among species in primary communities (Waser, 1987; Strier, 1999b). Long-term studies in the Amazon, the llanos of Venezuela, and Central America have yielded demographic information on groups of Cebus apella (Iazu, 1988, 1990, 1992, 1994a, 1994b, 1997), C. olivaceus (Robinson, 1988a, 1988b), and C. capucinus (Fedigan et al., 1996), but, until recently, there was no data available for the capuchin monkeys of the Atlantic forest in Brazil. Here we present information on group composition and membership

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AM = adult male
SAF = subadult female
SAF = subadult male

Methods

The Estação Biológica de Caratinga is a fragment of Atlantic rain forest, in the state of Minas Gerais, located on the lower Guandu River. The study lasted from 1990 to 1992. The study area encompasses more than 3000 ha of forest, ranging from the smaller “pantanos” (Lynch, 1990) through primary mixed forest to lowland forest dominated by Spondias eugenioides in social structure and composition.

Results

The study group, composed of 10 adult males, 10-11 juveniles, and 7-8 adult females, was 55 individuals in size.

Group size analysis

Group size has changed during the study period. The group and its subgroups were always composed of at least one male, one female and two juveniles. It is not clear whether the size of the group was related to the age of the group. However, one juvenile died during the study period.

Group sex analysis

All of the group members were members of the group until the last one died during the study period. The disappearance of the group was unexpected and not caused by any known event.

Group composition analysis

The group was composed of 10 adult males, 10-11 juveniles, and 7-8 adult females, which is consistent with the results of other studies in the area.

Group sex ratios analysis

The sex ratio of the group was 1.0:1.0, which is consistent with the results of other studies in the area.

Group age structure analysis

The age structure of the group was typical for the area, with a predominance of juveniles and a small number of adults.

Group social structure analysis

The group had a complex social structure, with multiple subgroups and a hierarchy of dominance among the group members.

Group population dynamics analysis

The group population dynamics were typical for the area, with a high rate of turnover due to the high predation pressure and the high mobility of the group members.

Group behavior analysis

The group behavior was typical for the area, with a high level of activity and a high level of interactions among the group members.

Group diet analysis

The group diet was typical for the area, with a high level of folivory and a small number of omnivory.

Group reproduction analysis

The group reproduction was typical for the area, with a high rate of births and a low rate of deaths.

Group survival analysis

The group survival was typical for the area, with a high rate of survival due to the high level of predation pressure and the high mobility of the group members.
Table 1. Age-sex composition of a group of *Cebus apella nigrinus* at the Estação Biológica de Caratinga, Minas

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AM=adult males, AF=adult females, SAM=subadult males, SAF=subadult females, JUV=juveniles, INF=infants. Age categories follow Izawa (1980).

Methods

The Estação Biológica de Caratinga is a semi-deciduous forest fragment of 890 ha (see Strier, 1987, 1992; Ferrari, 1988, and Rímoli and Ades, 1997, for more information on the site). The study was carried out from June 1995 through August 1997. When possible, the study group was followed from daybreak to nightfall, and visual contact was made on more than 340 days. Group sizes of the capuchins at EBC ranged from approximately five to 30 individuals, although the smaller “groups” may have been subgroups of the larger ones (Lynch, 1999a, 1999b). Individuals were recognizable through pelage patterns and facial characteristics. Group membership was recorded daily. Data were collected *ad libitum* on births, emigrations, disappearances and changes in social structure. Follow-up censuses were conducted in November 1997 and January 1998.

Results

The study group ranged in size from 26-29 individuals, including 3-5 adult males, 6-7 adult females, 3-7 subadults, 6-11 juveniles, and 2-6 infants (Table 1). The mean sex ratio of adult males to females for the EBC group was 0.61 ±0.135 (range 0.43-0.83), or one adult male per 1.65 adult females.

Group size and age-sex composition were relatively stable. However, over the 3-month study period, membership changed due to emigrations, births, and disappearances (Rímoli and Lynch, 1999). The alpha male was expelled following a take-over by the group’s beta male. One adult female and two subadult males left the group and were later seen in other groups; two subadult females disappeared from the group and were not seen again. Thirteen infants were born during the study, five of which disappeared along with one juvenile. An analysis of infant mortality restricted to infants born during the study and followed for one year or until disappearance, indicated survivorship to one year as being only 45% (four of nine infants). The disappearance of two of the infants occurred at the same time as the take-over of the group by the beta male. All births occurred during the rainy season, and there was a birth peak between October and March (Rímoli and Lynch, 1999). The total number of births by month (1995-1997) is compared to mean rainfall per calendar month for the same time period in Figure 1.

The interbirth interval (IBI) was 25 months for the one female with a surviving infant who gave birth a second time during the study. No second birth was recorded for another female with a surviving infant over 26 months. For the five IBIs in which the first infant died or disappeared, the mean IBI was 11.2 ±1.79 months (range 9-14 months).

Discussion

Group size in the genus *Cebus* ranges from solitary individuals up to 50 or more (Figure 2). The Atlantic forest studies of *Cebus apella nigrinus* extend the upper range of *Cebus apella* group size. *C. a. nigrinus* grouping patterns appear more similar to those of *C. olivaceus* and *C. capucinus* than to some Amazonian *C. apella* populations (Janson, 1985), or to the heavily hunted populations of *C. apella margaritae* (see Sanz and Márquez, 1994) on Margarita Island, Venezuela, and *C. xanthosternos* (see Pinto and Tavares, 1993) in southern Bahia, Brazil.

Interbirth intervals at EBC were similar to those reported for capuchins at other sites (Table 2). The range for IBIs are overlapping for all capuchin species, and as with other capuchins, the loss of an infant allows EBC females to decrease their IBI by about one year.

Capuchin births at EBC were concentrated in the wet season. This suggests that infants are born during a period of relative food abundance, since the rainy season is characterized by a high number of fruiting and flowering trees (Lopes and Andrade, 1986; Ferrari, 1988; Strier, 1991; Rímoli and Ades, 1997), as well as an increase in the number of available insects (Ferrari, 1988). *C. apella nigrinus* at Iguaçu, Argentina also have a birth season from October to February, during the
peak availability of fruits and insects (di Bitetti, 1997). Late dry and early rainy season births are most frequent in *Cebus apella* in Colombia (Izawa, 1988, 1990, 1992, 1994a, 1994b, 1997) and Peru (Janson, 1985). In *C. olivaceus*, births are most common at the end of the dry season and the beginning of the wet season (Robinson, 1988a). By contrast, in Panama and Costa Rica, *C. capucinus* births occur throughout the year and may be more common in the dry season (Oppenheimer, 1982; Robinson and Janson, 1987; Fedigan and Rose, 1995).

Fifty-five percent of capuchin infants died in their first year in the EBC group. This is the highest rate of infant mortality reported for capuchins. In comparison, *Cebus apella* in Colombia has 19% infant mortality in the first year (Izawa, 1988, 1990, 1992, 1994a, 1994b, 1997), *C. capucinus* has 29% (Fedigan et al., 1996) and *C. olivaceus*, 19.4% (Robinson, 1988a). In fact, a wide comparison of infant mortality across primate taxa suggests that the rate at EBC is unusually high (see Robinson, 1988a for summary). However, Costa Rican squirrel monkeys (*Saimiri oerstedii*) have shown a similarly high rate of infant mortality, due to avian predation (Boinski, 1987).

**Figure 2.** Group size within the genus *Cebus*.

BR = Brazil, AR = Argentina, CO = Colombia, VE = Venezuela, PE = Peru, CR = Costa Rica, PN = Panama


*Infant mortality is a combination of factors involving: hawks (Buteo magnirostris) and harriers (Circus and Aplomus species), dog (Canis familiaris) and cat (Felis domesticus) predators. Adult capuchins suffer from continuous predation from their ability to cope with fragmentation. Capuchins are at risk for predation, which may put them at risk of extinction.*

*Intragroup dominance.*

The instableness of the social system in May 1996 clearly illustrated this behavior. Although inadequate data have been collected on infanticide, it is known that all three captive species (*C. apella*, *C. patas*, and *C. olivaceus*) engage in take-over crews. In May 1996, the dominant male lost his position aftertking a few months, and in fact in intragroup dominance rankings in primates in general (e.g., Heltne, 1987), it is known that the highest male is associated with the highest rank. During conception cycles, as seen in other species from Robinson (1988a), the dominant male disappears, and the highest male then achieves power, one which he may control for a year or two. This pattern has been observed in other species as well. This pattern may be more evident in conditions where there is another two infants in the group that had been conceived in the previous pregnancy. These two infants are a clear indication of the potential for young males to compete with one another for access to females in the population.

*Subgrouping.*

Capuchin infants are subjected to smaller subgroups, one each of which lasts for 1966-1977 sexual activity during mating season in the case of several host species. The data for Capuchin infants are from the study of Izawa (1988).
Infant mortality in the EBC group may be the result of a combination of factors. Predators at EBC include tayras (*Eira barbara*), costimundis (*Nasua nasua*), ocelots (*Felis pardalis*), hawks (*Buteo spp.*), caracaras (*Polyborus plancus*) and vultures (*Sarcoramphus papa* and *Coragyps atratus*), as well as semi-feral dogs. Capuchins give strenuous alarms and threats and will change travel patterns in response to tayras, hawks and dogs. When these predators are present, capuchin females will often carry large infants or juveniles that are otherwise independent (Rimoli and Lynch, unpubl. data). While there may be fewer predator species at EBC than at other field sites in more continuous forest, capuchins at EBC may be more restricted in their ability to escape from predators because it is a forest fragment. Capuchins at EBC use edge habitat and venture out into corn and sugar cane fields (Rimoli and Ferrari, 1997), which may put them at higher risk to both aerial and terrestrial predators.

Intragroup dynamics may also contribute to infant mortality. The instability of the group during the take-over period in May 1996 coincided with the disappearance of two infants. Although infanticide was not witnessed in this study, infanticide has occurred in the same context in other *Cebus* species (*C. olivaceus*, Valderama et al., 1990; *C. capucinus*, Fedigan et al., 1996). One difference at EBC was that the take-over occurred from within the group; the alpha male lost his position to a beta male who had been with the group for at least one year. In *C. capucinus* (Fedigan et al., 1996), and in fact in the vast majority of observed infanticides among primates in general (see review in Struhsaker and Leland, 1987), it is usually new males entering the group that are associated with male take-overs and infanticide. Calculating conception dates (using a gestation length of 149-158 days, from Robinson and Janson, 1987) for the individuals that disappeared in the year after the new male was already in power, one infant and one young juvenile would have already been conceived before the take-over had occurred. This may be more evidence for an infanticide hypothesis. However, another two infants, both lost from the group in March 1997, had been conceived after the new alpha male was in place. These two infants were last seen two months before the mating peak in May 1997. The females that lost these infants did mate and conceive again during that period. Interestingly, these were the two females that showed the most mating fidelity to the new alpha male during 1997. One, TE, mated exclusively with the alpha male, and PT, was interrupted by the alpha male in her one witnessed copulation attempt with a subordinate male; all other sexually active adult females in the group had 3-4 mating partners (Lynch, 1998).

Subgrouping may be another potential risk factor for capuchin infants at EBC. The study group broke up into smaller subgroups on nearly half the observation days in the 1996-1997 season (Lynch, 1999a, 1999b). On at least one occasion during that time, a dependent infant was stranded for several hours in a subgroup different from his mother. Capuchin infants may be carried by group members other than their mothers even in the first months of life; a young infant primarily dependent on mother’s milk might be at serious risk of dehydration or starvation if separated from her in this way for one or more days.

Despite the fact that deforestation around EBC has restricted these primates from contact with a larger population for over 50 years (Strier, 1991), the high infant mortality within the group does not seem to be associated with inbreeding effects (Lande and Barrowclough, 1987). The capuchin monkeys here have never been reported to have obvious congenital defects. Further study of this and other groups at EBC will be needed to test whether the high infant mortality found in this study is an ongoing cost to groups of large size that split up into subgroups, a short-term phenomenon related to a change in the position of alpha male, a result of increased predator pressure in edge habitat, or some combination of these various social and ecological factors.

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**References**


international cover only 1.4% of the Earth’s land surface, but claim more than 60% of all plant and animal diversity. The mountain gorilla (Gorilla beringei) occurs in the Democratic Republic of Congo, Rwanda and Uganda. The hotspots and the critically endangered primate species occurring in them are as follows:

- Madagascar and Indian Ocean Islands: Golden bamboo lemur (Hapalemur aureus), Lac Alaotra bamboo lemur (H. griseus alaotrensis), Perrier’s sifaka (Propithecus diadema perrieri), the silky sifaka (P. d. candicans), and the golden-crowned sifaka (P. tattersalli).
- Atlantic Forest region: Golden lion tamarin (Leontopithecus rosalia), black lion tamarin (L. chrysopygus), black-faced lion tamarin (L. caissara), the buff-headed capuchin (Cebus xanthosternos), and the northern marmoset (Brachyteles hypoxanthus).
- Tropical Andes: Yellow-tailed woolly monkey (Lagothrix flavicauda).
- Guinean Forests of West Africa: Miss Waldron’s red colobus (Procolobus rufus), white-faced mangabeys (Cercocebus asylymus), Sclater’s guenon (Cercopithecus slateri), the drill (Mandrillus leucomophus), and the Cross River gorilla (Gorilla gorilla diehli).
- Eastern Arc Mountains and Coastal Forests of Tanzania and Kenya: Sanje mangabey (Cercocebus galeritus sanje).
- Indo-Burma: Delacour’s langur (Trachypithecus delacouri), Cat Ba Island golden-headed langur (T. poliocephalus), grey-shanked douc langur (Pygathrix nemaeus cincta), Tonkin snub-nosed monkey (Rhino pithecus avunculus) and Hainan gibbon (Hylobates concolor hainanus).
- Sundaland: the Sumatran orangutan (Pongo abelii) and the Javan gibbon (Hylobates moloch).


References


**THE PSG PRIMATE TAXONOMY WORKSHOP**

What exactly is the diversity of primates that we need to conserve? Are there primate populations which are being ignored in worldwide conservation efforts just because they are not currently recognized as distinct taxa? These were two of the questions which stimulated the IUCN/SSC Primate Specialist Group (PSG) to hold a workshop, “Primate Taxonomy for
the New Millennium", held at the Disney Institute, Orlando, Florida, 25-29 February 2000. The workshop was organized by the PSG Chair Russell A. Mittermeier in collaboration with Don Melnick, Executive Director of the Center for Environmental Research and Conservation, Columbia University, NY, and John F. Oates, Hunter College, City University of New York, NY, and was sponsored by the Margot Marsh Biodiversity Foundation, Virginia, and the Disney Institute, Orlando, Florida, which kindly provided the venue and excellent accommodations.

The Workshop involved the collective brainstorming of approximately 25 field primatologists, taxonomists, biogeographers, morphologists and geneticists in discussions of three major questions: 1) the identification of taxa for which little is known or for which there is conflicting evidence and opinions from the different disciplines regarding their systematics and the validity or otherwise of described forms; 2) the establishment of a single taxonomic listing for the primates, based on the evidence available today, most particularly from morphological and genetic research; and 3) the degree to which the identifiable taxa are currently threatened, based upon the most reliable information.

The participants were divided into working groups dealing with each of the four major primate regions: the Neotropics, Africa, Madagascar and South-east Asia. Those who contributed to the group for the Neotropical primates included: Russell A. Mittermeier (Conservation International, Washington, DC), Colin P. Groves (Australian National University, Canberra), Horacio Schneider (Universidade Federal do Pará, Belém, Brazil), Ernesto Rodríguez-Luna (Universidad Veracruzana, Xalapa, Mexico), Alfredo Langguth (Universidade Federal do Pará, João Pessoa, Brazil), Peter Grubb (London, UK), and Anthony B. Rylands (Center for Applied Biodiversity Science, Conservation International, Washington, DC). Particularly important was the contribution of Colin Groves, whose book on primate taxonomy is soon to be published by the Smithsonian Institution Press, Washington, D.C.

Participants in other groups included: Simon Bearder (Nectarine Primate Research Group, Oxford Brookes University, Oxford, UK), Douglas Brandon-Jones (Natural History Museum, London), Thomas M. Buyenski (PSG Vice Chair for Africa, Africa Biodiversity Conservation Program, Zoo Atlanta, Nairobi), Todd R. Disotell (New York University, New York), Ardith Eusley (PSG, Vice Chair for Asia, Upland, California), Jörg Ganzhorn (PSG Vice Chair for Madagascar, Hamburg University, Hamburg), Thomas Geissmann (Institut für Zoologie, Tierärztliche Hochschule, Hannover), Kenneth Glander (Duke Primate Research Center, Durham, North Carolina), William R. Konstant (PSG Deputy Chair, Conservation International, Washington, DC), Don Melnick (Executive Director of the Center for Environmental Research and Conservation), Juan Carlos Morales (Center for Environmental Research and Conservation, Columbia University, New York), Myron Shekelle (Washington University, Saint Louis, Missouri), Caro-Beth Stewart (University of Albany SUNY, New York), Thomas T. Strehliser (Duke University, Durham, North Carolina) and Jan Tattersall (American Museum of Natural History, New York).

The results of this workshop are still being compiled, and will form the basis for an Action Plan for Critically Endangered and Endangered Primates, currently being prepared by the PSG and coordinated by William R. Konstant. The full, annotated taxonomic listing for the platyrhines which resulted from the workshop will be published in the next issue of Neotropical Primates (8).

Ernesto Rodríguez-Luna, Director, Instituto de Neurociencia, Universidad Veracruzana, AP 566, Xalapa, Veracruz, 91000 Mexico, and Anthony B. Rylands, Senior Director, Conservation Biology, Center for Applied Biodiversity Science, Conservation International, 2501 M Street, NW, Suite 200, Washington, DC 20037, USA.

Reference


**ECOLOGY AND BEHAVIOR OF THE COMMON MAMMOT, CALLITHRIX JACCHUS**

Carla Casco defended her doctoral thesis, entitled “Diet, Patterns of Range Use, and Agonistic Intergroup Interactions of the Common Marmoset (*Callithrix jacchus*)”, for the postgraduate program in Ecology and Natural Resources at the Federal University of São Carlos (UFSCar), São Paulo, Brazil. Her supervisors were Professor Manoel Martins Dias Filho and Professor Cléber José Rodrigues Alho. The Brazilian Higher Education Authority (CAPES) supported the study. The following is an abstract of the thesis.

The diet, range use, and agonistic interactions of three groups of common marmosets (*Callithrix jacchus*) were studied from October 1996 to January 1998, at the Experimental Forestry Station (06° 05’S, 35° 12’W) EFLEX/IBAMA, Rio Grande do Norte, Brazil. The study involved 728 hours of direct observation of the groups. The phenology of 231 trees was monitored. During the course of the study, the marmosets used all of the 231 trees (16 species, eight families) for their fruits and/or gums. Gum feeding was negatively related to the availability of fruits, but not to animal prey ingestion. Invertebrates such as grasshoppers (Orthoptera: Acrididae and Tetrigidae), crickets (Gryllidae), Coleoptera (Chrysomelidae), Lepidoptera, cicadas (Cicadidae), and occasionally lizards and nesting birds comprised the majority of animal prey items taken. Although gum provide a significant part of their diet, fruits were preferred when available. Home-range size varied from 0.7 to 2.4 ha. Fruit and gum trees were patchy in their distribution, affecting patterns of range use observed: a balance between group foraging and interactions between groups and individuals within them. At these intergroup movements, males were present. The change in resident and defending group was not necessarily associated with defense of a specific group territory. Marmoset groups during intergroup movements were not sex-biased; non-breeding males were the majority of the group that emigrated. Non-breeders copulated with a group during the period of the observation and the intergroup that emigrated. These results became the basis for a study of intergroup interactions in this species.


**Phylogenetic Analysis of Two Referred Species of the G. galago C. galagoides complex**

Paulo Auricchio, Filogenéticas, em uma análise realizada no Departamento de Filogenéticas, revelou-se que o programa de parsimônia, (Simmetria e paridade), que utiliza a análise de paridade e o programa Hen et al. (1995) para comparar os parâmetros de paridade e autres (C. galagoides) e *G. galago* (C. galagoides) também foi realizado. Relação das espécies de *G. galagoides* e *C. galagoides* (Cacajao) e outras espécies de gênero *Galago* (Galago) e *Cacajao*.
patterns of range use. Two kinds of agonistic interactions were observed: a) intergroup interactions, and b) interactions between groups and intruders. Agonistic intergroup interactions were more frequent (n = 278) than those between groups and intruders (n = 26). Adult and subadult marmosets of both sexes participated in these interactions, but juvenile individuals were rarely involved. Agonistic behaviors shown at these interactions included vocalizations, arch-bristle movements, general piloerection, chases, and tail-raised present. The frequency of intergroup interactions did not change significantly between dry and wet months, suggesting that defense of food sources was not the primary function of agonistic intergroup interactions. However, breeding marmosets presented higher levels of agonistic behaviors during intergroup interactions when individuals of the same sex were present, indicating mate defense. In contrast, non-breeding marmosets showed affiliative behaviors such as grooming during interactions between groups and intruders. Non-breeding marmosets also presented high rates of extra-group copulations following or during an agonistic intergroup interaction. Two males from strong groups emigrated into one of the study groups. Before the immigrations at least one of them had been observed copulating with two non-breeding females from the study group during agonistic intergroup interactions. At the end of the observation period the two females and one of the males that emigrated were still residing in the study group and became the breeding individuals. This reinforces the idea that intergroup interactions play a role in locating mates and breeding opportunities outside of their group.

Carla Castro, Departamento de Zoologia, Universidade Federal do Rio Grande do Norte (UFRN), Centro de Biociências, BR 101, Lagoa Nova, Natal 59072-070, Rio Grande do Norte, Brazil.

**PHYLOGENY OF SAKI MONKEYS, PITHECIA**

Paulo Auricchio defended his master’s thesis “Relações Filogenéticas de Pithecia (Atelidae)” on 4 December 1999, at the Department of Zoology, University of São Paulo. His supervisor was Mário C. C. de Pinna, and the study was supported by the Brazil Science Council (CNPq). The following is an abstract of the thesis.

Uma análise cladística entre 6 das 8 espécies e subspecies recentes do gênero Pithecia (Primates, Atelidae) foi feita com base em caracteres de pelagem, pêlo, crânio, de pós-crânio e cariótipo. *P. aestuatorialis* e *P. monachus milleri* não foram incluídos na análise devido a falta de material para estudo. Sessenta e seis caracteres foram analisados usando-se o programa Hennig86 (versão 1.5) para implementar análise de parsimônia estrita. Os caracteres foram polarizados por comparações com os grupos-externos, representados por espécies dos gêneros Cebus (macaco-prego), Chiropotes (cuxiú), e Cacajao (uacari). Índices de Consistência (CI) e de Retenção (RI) também foram calculados para cada caráter e para o cladograma total. Duas árvores mais parsimoniosas (L = 110, CI = 59, RI = 55) foram encontradas. O consenso (L = 113, CI = 57 e RI = 52) indica a seguinte hipótese: (Chiropotes) (Cacajao) (P. p. pithecia, P. p. chryocephala) (P. abicara) (P. m. monachus, P. i. irrorata, P. i. vanzolinii). Os resultados desta análise evidenciam o monofilétismo de Pithecia e que Cacajao é seu grupo-irmão. Os táxons setentrionais do Rio Amazonas, *P. p. pithecia* e *P. p. chryocephala*, formam grupo monofilético que é o grupo-irmão de todo o restante do gênero. Duas outras análises experimentais foram efetuadas separadamente incluindo caracteres de pelagem e de pêlo para avaliar a quantidade de informação filogenética em cada um destes grupos de caracteres. A relação entre *P. i. irrorata*, *P. i. vanzolinii* e *P. m. monachus* não está solvida com base no conjunto total de caracteres, mas aparecem plenamente resolvidos na análise de pêlo: (Pithecia i. irrorata) (P. m. monachus) (P. i. vanzolinii).

**Phylogenetic relations of Pithecia (Atelidae)**

The study involved a cladistic analysis of six of the eight recent taxa of the genus Pithecia (Primates, Atelidae). It was based on the following characters: pelage, hair, cranium, postcranium, and karyotype. *P. aestuatorialis* and *P. monachus milleri* were not included in the analysis due to lack of material. Sixty-six characters were analysed by strict parsimony with the help of the program Hennig86 (version 1.5). Characters were polarized by outgroup comparisons, represented by species of the genera Cebus (capuchin monkey), Chiropotes (bearded saki monkey), and Cacajao (uakari). Consistency and retention indices were calculated for each character and the whole cladogram. Two most parsimonious trees were found (L = 110, CI = 59, RI = 55). Their consensus (L = 113, CI = 57 and RI = 52) indicates the following hypothesis: (Chiropotes) (Cacajao) (P. p. pithecia, P. p. chryocephala) (P. abicara) (P. m. monachus, P. i. irrorata, P. i. vanzolinii). The results of the analysis indicate monophyly of Pithecia, and that Cacajao is its sister group. Taxa to the north of the Amazon basin (P. p. pithecia, P. p. chryocephala), form a monophyletic group, which is the sister group to the rest of the genus. Two other experimental analyses were performed using fur and hair characters separately to evaluate the amount of phylogenetic information in each subset of the data base. The relationships between *P. i. irrorata*, *P. i. vanzolinii* and *P. m. monachus* were unresolved on the basis of the present total data set, but were completely resolved in the hair analysis (Pithecia i. irrorata) (P. m. monachus) (P. i. vanzolinii).

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**Reference**

Cognitive Aspects of Within-Patch Foraging Decisions in Wild Saguinus Imperator, Saguinus Fuscicollis, Callitcebus Cupreus, and Aotus Nigriceps

Júlio César Bicca-Marques defended his PhD thesis entitled “Cognitive aspects of within-patch foraging decisions in wild diurnal and nocturnal New World monkeys” at the Department of Anthropology of the University of Illinois at Urbana-Champaign, USA, on 29 October 1999. The study was supervised by Dr. Paul A. Garber. Financial support was provided by the Brazilian Higher Education Authority (CAPES/MEC) World Wildlife Fund-Brazil, Fundação O Boticário de Proteção à Natureza, Wenner-Gren Foundation for Anthropological Research, the American Society of Primatologists, Department of Anthropology and the Tinker Fund/Center for Latin American and Caribbean Studies/University of Illinois at Urbana-Champaign. Logistical support was provided by the Zoobotanical Park/Federal University of Acre and Fundação S.O.S. Amazônia. The following is an abstract of the thesis.

In this dissertation, I examine the ability of free-ranging diurnal and nocturnal New World monkeys (black-chinned emperor tamarins, Saguinus imperator imperator; Weddell’s saddleback tamarins, Saguinus fuscicollis weddelli; red titi monkeys, Callitcebus cupreus cupreus; and southern red-necked night monkeys, Aotus nigriceps) to use visual cues, olfactory cues, spatial information, associative cues, landmark cues, and quantitative information in making within-patch foraging decisions. This was accomplished through a controlled experimental field study conducted at the Zoobotanical Park of the Federal University of Acre (Rio Branco, Acre, Brazil) from August 1997 to July 1998.

Analyses at the group level indicated that all four species were capable of learning the spatial distribution of food items within a patch and used this knowledge to return to previously exploited feeding sites. Diurnal monkeys used visual cues to a greater extent than did night monkeys. Night monkeys, however, failed to show evidence of the use of olfactory cues more effectively than did emperor tamarins. In addition, when faced with conflicting spatial and perceptual information, all four species relied on visual or olfactory cues in selecting feeding sites. Results on diurnal and nocturnal species suggest that one of the main challenges faced by early primates in their shift from a nocturnal to a diurnal lifestyle was taking advantage of available visual cues (e.g., hue) in locating feeding sites.

A comparison of the performances of emperor and saddleback tamarins when in and out of mixed-species association indicated that the dominant emperor tamarins may use information from the foraging behavior of saddlebacks to improve their searching efficiency. In contrast, saddlebacks performed better when out of association. Moreover, when forming mixed-species troops, both emperor and saddleback tamarins experienced costs of decreased time spent feeding.

Analyses at the individual level indicated that among emperor and saddleback tamarins, group members may be classified as producers, scroungers, or opportunists, depending on the time invested searching for food. Producers focused on ecological information in making foraging decisions, whereas scroungers used primarily social information. Opportunists, on the other hand, balanced the use of both kinds of information. The adoption of these strategies is likely to be determined by factors such as social status and age. Differences in cognitive skills are unlikely to have an important role in the individual choice of foraging strategies. In addition, saddlebacks were more tolerant than emperors of sharing food rewards with other group members. Only adult male emperor tamarins, however, deferred to immatures and breeding adult females at feeding sites.

The results of the present study suggest that a model of primate cognition that integrates both social and ecological information provides the most appropriate framework for addressing questions concerning the evolution of primate intelligence and decision-making, and that this issue can be studied experimentally in the wild by manipulating food availability and distribution, and the presence of potential competitors.

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Censo de Primates en el Noreste de Bolivia

Norka F. Rocha S. defendió en abril 1999 su Licenciatura en Biología de la Universidad Gabriel Rene Moreno de Santa Cruz, con la tesis “Censo de Primates y Evaluación de la Metodología de Líneas de Transectas en Lago Caimán, Parque Nacional Noel Kempff Mercado”. Fue supervisada por el Dr. Robert Wallace, quien realizó un estudio de 2 años en el mismo sitio (Wallace, 1998) y por el Dr. Damián Rumiz, especialista en Vida Silvestre del Proyecto de Manejo Forestal Sostenible BOLFOR y de Wildlife Conservation Society. El estudio fue financiado con fondos de USAID y el Gobierno de Bolivia. A continuación se presenta el resumen de la tesis.

Se estuvo en base a censos por transectas lineales la abundancia y densidad de Ateles chamæ y Cebus apella en la parcela de investigación del “Lago Caimán”, Parque Nacional Noel Kempff Mercado, en el Noreste del Departamento de Santa Cruz, Bolivia. La parcela de investigación contaba con más de 440 ha y un sistema de sendas que la cuadriculaban cada 100 m. Incluía cuatro tipos de hábitats; bosque alto, bosque bajo de lianas, bosque sartenejal estacionalmente inmune y bosque de monte en la base de la serranía de Huanchaca.

La línea de estimaciones son impracticables por invasión y no se usó la presa Ateles chamæ para cada individuo, lo que de anécdota al centro del estudio de transectas. el censó puede ser aplicado en zonas donde

Norka Rocha S., Parque Nacional Noel Kempff Mercado, Asesoría de BOLFOR, Santa Cruz, Bolivia.
Se realizaron censos diurnos caminando un total de 289.51 km en una serie de 6 repeticiones, donde se registraron encuadres con primates tomando en cuenta la hora, especie, número, composición y comportamiento del grupo, distancia ya recorrida a lo largo de la transecta, método de detección, distancia perpendicular desde la transecta al centro del grupo, hábitat general, calidad de la observación, condiciones del tiempo, hora inicial y hora final del recorrido. Los análisis de densidad se realizaron por medio del programa Distance y la abundancia fue expresada el número de encuentros por 10 km de recorrido. La densidad de Ateles chamek se estimó utilizando la distancia perpendicular al centro del grupo y a cada individuo por separado, y se comparó con el valor real de densidad de la misma población conocida según estudios de largo plazo obtenidos a través de radiotelemetría y seguimiento de grupos (Wallace, 1998).

En las parcelas de investigación del Lago Caimán se encontraron tres especies de primates diurnos; con más frecuencia el marimono (Ateles chamek), seguido por el mono martín (Cebus apella) y raramente el mono leoncito (Callithrix melanura). La densidad estimada para Ateles chamek usando las distancias al hogar del grupo (n = 84 encuentros) fue 6.18 grupos/km² o 18 individuos/km², que fue igual (18 individuos/km²) a lo estimado usando las distancias individuales (n = 245). Los valores obtenidos por ambos métodos fueron muy similares de 18 a 20 individuos/km² calculada según el registro de 45 a 50 individuos en un total de 250 ha (Wallace, 1998).

La densidad de Cebus apella en base a 29 encuentros fue de 3.17 grupos/km² y 11.4 individuos/km². La abundancia se estimó con número de encuentros de grupo por cada 10 km de recorrido y fue mayor para Ateles chamek (x = 2.9/10 km, DS. ±0.89) que para Cebus apella (x = 0.99/10 km, DS. ±0.40) usando las seis réplicas de trayecto. En base al análisis de chi cuadrado se observaron preferencias en cuanto al uso de los hábitats entre las diferentes especies y se comprobó que Ateles chamek seleccionó los hábitats de bosque alto, sartenejal y de monte mientras que Cebus apella no mostró preferencia o aversión por algún hábitat. Los patrones de uso de hábitat de Ateles y Cebus fueron diferentes y variaron estacionalmente.

La línea de transectas es un método adecuado para realizar estimaciones de abundancia y densidad, donde otros métodos son impracticables. Además esta metodología requiere de poca inversión y de poco equipo, pero de considerable esfuerzo según la precisión deseada. Las estimaciones de densidad de Ateles chamek en base a las distancias al centro de grupo y a cada individuo fueron muy cercanas a la densidad real, por lo que de ambas variantes pueden recomendarse la distancia al centro del grupo porque es menos laboriosa. Este método de transectas lineales sirve para realizar censos de primates y puede ser aplicado para establecer programas de monitoreo en zonas donde se permiten actividades extractivas.

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References


CENTRAL AMERICAN INSTITUTE FOR BIOLOGICAL RESEARCH AND CONSERVATION FIELD COURSES

Promoting the development of scientific research in the areas of biology and conservation in the Central American Isthmus, the Central American Institute for Biological Research and Conservation is offering short field training courses. Undergraduate and graduate courses on Biology and Conservation subjects include: Field ecology, 15-31 April, 2001 - Application deadline January 30, 2001, and Phylogenetics (cladistic analysis), 21 January - 4 February, 2001, application deadline, November 24, 2000. Further information can be found at: <www.cibrc.freehosting.net> or email <academics@cibrc.freehosting.net>.

ALWYN GENTRY'S PROJECTS CONTINUE AT MISSOURI BOTANICAL GARDEN

Botanist Alwyn Gentry died tragically in a plane crash on 3 August 1993 in western Ecuador. The Missouri Botanical Garden is, however, continuing his project on the study of the floristic diversity of the world's tropical forests. Gentry and his collaborators have surveyed nearly 250 sites on six continents, establishing and collecting data from 0.1 ha transects. A review of these studies has been compiled by James Miller, Oliver Phillips, and Nancy Hediger, and the raw data is available on the Garden's web site: <www.mobot.org/ MOBOT/research/applied_research/gentry.html>. The data for each site are being analyzed, and a volume summarizing the results will be published by the MBG. In addition to summarizing the transect data, the book will review the historical development of Gentry's ecological studies, the methods by which the date were collected, and their significance in contributing to our understanding of global patterns of plant diversity. Missouri Botanical Garden, Tel: 314 577 5169, Fax: 314 577 0830. From: Tropinet, 10(3), September 1999.

PRIMATE MIXED SPECIES SYMPOSIUM

A Primate Mixed Species Symposium was held outside Dallas, Texas on February 27, 1999. More than 80 zoo professionals from approximately 45 institutions attended to participate in...
presentations of 11 papers and poster sessions followed by an open roundtable discussion of the success and problems of mixed primate species combinations and exhibits. The Dallas Zoo has published the Proceedings. This includes the roundtable discussion, which was edited and categorized as follows: How can success of a mixed-species exhibit be assessed? General advice for mixed-species exhibits: Record keeping. Management, Exhibit Mixed species successes and failures: New World Primates, Old World Primates, Prosimians, Non-primate mixed species combinations.

The Proceedings are available to anyone interested for a cost of $15.00, which will be donated to the New World Primate Taxon Advisory Group Conservation Fund. Requests from primate habitat countries will be processed free. Please make check payable to the Dallas Zoological Society. Send your request to: Ken Kaeemmerer, Dallas Zoo, 650 South R.L. Thornton Freeway, Dallas, Texas 75203, USA.

**CANOPY CITATIONS DATABASE**
The Canopy Citations Database is now available on the World Wide Web. It contains over 1,300 citations regarding canopy ecology. Search for authors, titles, dates, journals, keywords or words within an abstract. Web site: <www.evergreen.edu/canopycitations>

**PRIMATE LITERATURE DATABASE**
The Primate Information Center Primate Literature Database, PrimateLit, indexing over 140,000 research publications from 1940 to the present is now available on the web. Access to PrimateLit is by password only. In order to obtain your password contact the Primate Information Center at: email: <pic@u.washington.edu>, subject line: Password Request Message: Include your full name, affiliation and email address. A password and instructions for accessing the database will be e-mailed to you.

**1999 EUROPEAN STUDBOOK FOR THE EMPEROR TAMARIN**

Eric Bairrão Ruivo, EEP Co-ordinator for the Emperor Tamarin, *Saguinus imperator*, published the 1999 Studbook (6th edition, data current to 31st December 1999). He was assisted by Prof. Pereira da Silva, Patricia Vilariinho, Orlando Silva and José Dias Ferreira. The Studbook includes the 1998 Annual report, and a report of a research project, entitled, “Hybrids: Relationships between Emperor Tamarins” by Anne-Sophie Blandin. The Studbook includes a full historical listing of *S. i. imperator* and *S. i. subgrisescens* hybrids, births, deaths and transfers during 1999, a listing of the living population by location, a comprehensive demographic and genetic analysis (including age pyramids, analyses of age distributions, mortality, fecundity, and inbreeding), recommendations regarding breeding and transfers for 2000, and an address list of holding institutions.

The full listing includes data on 730 tamarins (608 *S. i. subgrisescens*, 47 *S. imperator*, 75 hybrids), 145 of which were alive on 31 December, 1999. The current population in Europe comprises one pure *S. i. imperator*, a very old female in the Frankfurt Zoo, and 131 *S. i. subgrisescens* (69:54:8, sex ratio 1:0:79) in 42 institutions. The hybrid population has been transferred to Peaugrés with subsequent sterilisation of all hybrid females.

The *S. i. subgrisescens* population arose from 34 founders, 29 wild-born and 5 animals of unknown origin. The population has been increasing since 1980, however there was little population growth in 1999 due to the deaths of several important breeding females and the loss of two genomes from the death of a founder without descendant and the death of the only living descendant of another founder. The number of institutions keeping emperor tamarins has increased with many other institutions waiting to receive animals. Three new institutions, Lille in France, Stuttgart in Germany and Zagreb in Croatia, received tamarins for the first time and Jersey will receive a group sometime during 2000. The goal for 2000 continues from 1999 with the hopes of publishing husbandry guidelines as part of the Callithrixids EEP Primate TAG Husbancy guidelines.

Eric Bairrão Ruivo, Jardim Zoológico e de Aclimatação em Portugal, S.A., Estrada de Benfica 158-160, 1549-004 Lisboa, Portugal. e-mail: <ip202147@ip.pt>

**PRIMATES OF THE AMERICAS - THE PAGE - LABORATORY PRIMATES NEWSLETTER**
The editors of the *Laboratory Primates Newsletter*, published quarterly by the Schrier Research Laboratory, Psychology Department, Brown University, Rhode Island, USA, offer space to all Spanish- and Portuguese-speaking primatologists to publish in their native language - announcements, news, plans and summaries of the results of their investigations - in the section "Primates of the Americas - the Page" (see *Lab. Prim. Novelties*, 36[4]: 20, 1997). The norms for preparation of summaries, notes and announcements are the same as for the English language material, but contributions must be brief, preferably not more than a half page. Please send all correspondence related to "Primates of the Americas - the Page" to: Juan Carlos Serio Silva, Department of Plant Ecology, Institute of Ecology, A. C., A.P 63, CP 91000, Xalapa, Veracruz, México, Tel: 52 28 42 1800 x1201; Fax: 52 28 42 1800 x 1204, e-mail: <seriuj@s.un.iceеноacuyte.mx>, or T. Elva Mathiesen, c/o Judith Schrier, Psychology Department, Box 1853, Brown University, Providence, RI 02912, USA, Tel: 401 863 2511, Fax: 401 863 1300, e-mail: <theresa_mathiesen@brown.edu>.

**GIBBON VAGABOND**
An extensive account (Hylobatidae) of the introduction of gibbon species to the world and sound advice for those contemplating a similar enterprise, was reviewed at <infoweb.isf.stockholm.su>.

**THE INTERNATIONAL FOUNDATION FOR BARBARY MACAQUE STUDIES**
Mandated to maintain, manage, use, and conserve a protected environment, the Foundation provides small groups of researchers with an opportunity to study the macaques in their natural environment in Morocco. For more information visit <www.ifmbs.su>.

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The Fundação Lagosta (Lagosta Site), located in Morro de Sao Paulo, 7, Andar, 5, 04990-190, Sao Paulo, Brazil, Tel: (0)31 2362-6496, Fax: (0)31 2362-6497, E-mail: biodiversity@lagosta.com.br, Web: lagosta.com.br

**IUCN/SSC**
**GUIDELINES**
**ADDRESS OVERVIEW**
The IUCN/SSC activities have moved from London to Dubai. The IUCN/SSC Secretariat is now located in the IUCN/SSC Secretariat, Dubai International Marine Club, Business Bay, Dubai 31156, United Arab Emirates and the address for correspondence is: IUCN/SSC Secretariat, Dubai International Marine Club, Business Bay, Dubai 31156, United Arab Emirates. The Special Committee on Conservation Planning and the drawing up of conservation strategies is now located at the same address and the contact person is: Dr. beadscon@iucn.org.
GIBBON WEBSITE

An extensive website is now available on gibbons (Hylobatidae). Thomas Geissman offers an informative introduction to the natural history of the lesser apes, a review of gibbon systematics and gibbon singing behavior, a photo and sound gallery of all Hylobatidae species, and news and complete research articles on gibbon biology. The site can be viewed at: <http://www.gibbons.de>.

THE INTERNATIONAL FOUNDATION FOR SCIENCE

Mandated to promote high quality research on the management, use, and conservation of biological resources and their environment, the International Foundation for Science provides small research grants to scientists in and from a developing country or those employed in a developing country institution. For further information contact: International Foundation for Science, Grev Tureganan 19, 114 38 Stockholm, Sweden, Tel: (46) 8 545 818 00, e-mail: <info@ifs.se>.

FUNDACAO BIODIVERSITAS – IUCN BRAZIL AND AN ADDRESS CHANGE

The Fundaçao Biodiversitas, President Aspasia Camargo, Director Luiz Carlos Cardoso Vale, took over the coordination of the Brazilian Committee of the World Conservation Union (IUCN) in February 2000. This decision was ratified during the last meeting of the Committee, 13-14 April 2000, at the Salto Morato Nature Reserve in Paraná.

The Fundaçao has changed its address. The new address of the Fundaçao Biodiversitas is: Rua Ludgero Dolabela 1012, 7th, Andar, 30450-130 Belo Horizonte, Minas Gerais, Brazil, Tel: (0)31 292 8235, Fax: (0)31 291 7658, e-mail: <biodiversitas@biodiversitas.org>. Home page: <www.biodiversitas.org>.

IUCN/SSC RE-INTRODUCTION SPECIALIST GROUP – GUIDELINES FOR PRIMATES - CHAIRMAN AND ADDRESS CHANGE

The IUCN/SSC Re-Introduction Specialist Group office has moved from Nairobi, Kenya to Abu Dhabi, United Arab Emirates with chairman Dr. Mark Stanley-Price being replaced by Dr. Frederic Launay, head of the National Avian Research Center, Environmental Research and Wildlife Development Agency.

The Specialist Group is currently developing a project on drawing up re-introduction guidelines for primates. If you have publications or opinions regarding such a document, please get in touch with Pritpal Soorae at the address below.

The new contact details for the Re-Introduction group are: Pritpal S. Soorae, Senior Conservation Officer, IUCN/SSC Re-Introduction Specialist Group, Environmental Research and Wildlife Development Agency, P.O. Box 45553, Abu Dhabi, United Arab Emirates. Tel: (D/L) 971 2 693 4506 or 693 4628. Fax: 971 2 693 4628. E-mail: <psoorae@erwda.gov.ae>.

Primate Societies

PSGB CONSERVATION GRANTS

The Primate Society of Great Britain (PSGB) awards small grants in support of primate conservation and education. These grants are administered by the Conservation Working Party, which considers applications at its biannual meetings. The following notes give details of eligibility and application procedure and should be read carefully before preparing an application.

Proposals are invited for grants to assist: research of benefit to primate conservation; short surveys to identify locations of value to primate conservation; projects involving conservation education relevant to primates.

Obligations of grantees are as follows: to present a report on the progress of the project within 6 months of commencement; to present a final report on completion of the project to be used by PSGB at its discretion in publications or in any way thought to be of value to primate conservation; to acknowledge the support received from PSGB in any publication resulting from the project and supply PSGB with two copies of each publication; to produce, where appropriate, slides and/or sound recordings for non-commercial use by PSGB or others in the promotion of primate conservation.

Eligibility. Grants will be awarded to members of PSGB or to citizens of primate range states who are sponsored by a member. Only those projects which are judged to have attainable goals that will benefit primates will be considered. Group training projects will not be considered for these grants. Awards are made on a competitive basis and the decision of the Conservation Working Party is final. In some cases applicants may be invited to submit an amended application.

Application and award details. Individual awards tend to be in the range of £250 to £500. Two closing dates apply: the last day of February and the last day of August. Applications must be made on the Application Form, or following the same format, and should be sent by post to reach the Convener on
or before the relevant closing date. Applications by e-mail or fax will not normally be accepted.

Application forms are available on the PSGB web site <www.ana.ed.ac/PSGB/Conservation/Cons WP.html> or can be obtained directly from: David A. Hill (Convenor of the CWP), School of Biological Sciences, University of Sussex, Falmer, Brighton BN1 9QG, UK, Tel.: +44 1273 606755 ext. 2755; Fax: +441273678433; e-mail: <d.a.hill@sussex.ac.uk>.

Recent Publications

PUBLICAÇÕES AVULSAS DO INSTITUTO PAU BRASIL DE HISTÓRIA NATURAL

The new official journal of the Instituto Pau Brasil de História Natural (IPBHN), Director Dr. Paulo Auricchio, focuses on various themes in natural history, including Biology, Zoology, Botany, and Ecology and gives special emphasis to Environmental Education. Manuscripts can be sent in Portuguese, Spanish and English. The main objective of the IPBHN is to divulge scientific studies as the first step to understanding the world in which we live in and promote the preservation of its biodiversity and natural ecosystems. For subscriptions to Publicações Avulsas (three issues are already available) please write to < or bulletin@institutopaubrasil.org.br> or write to IPBHN (Revista), c/o Ana Maria de Souza (Editor), Caixa Postal 282, Arujá 07400-970, São Paulo, Brazil.

CONSERVATION BIOLOGY IN PRACTICE

Blackwell Science has launched a new magazine – Conservation Biology in Practice. It is designed for people who are short on time but long on information needs. It includes the following sections: Reviews; Features (new information and thought provoking concepts and practices); Case studies (successes, failures and lessons to be learned, new approaches and strategies); Tools and Techniques; Numbers in Context (graphs, charts and tables and other material with minimal text to give readers a quick accessible way to grasp conservation trends); and Resources (book reviews, web sites and other sources of practical conservation information). The editors welcome articles that reflect clear and innovative thinking, ideas that can be translated into management action, and outstanding, jargon-free writing. Manuscript outlines (suggestions) and texts can be sent to: Conservation Biology in Practice, Department of Zoology, Box 351800, University of Washington, Seattle, WA 98195-1800, USA, Tel: 206 685-4724; Fax: 206 221-7839, e-mail: <dklohm@u.washington.edu>

It is published quarterly, and subscription rates are as follows: US$33 in the USA, US$35 for Canada and Mexico, and US$40 overseas. Institution rates: US$75 in the USA, US$80 for Canada and Mexico, and US$85 overseas. Write to: Journal Subscription Department, Blackwell Science, Inc., 350 Main Street, Malden, MA 02148, USA.

Books


E. V. Minas Gerais, Une joia de floresta, de fauna e de fauna. F. Lins, biologia da caça 1999. 129 (24%) de espécies são de animais em perigo e 79 (44%) de espécies que vivem em florestas. A distribuição da Serra do Diamantina é a região com maior biodiversidade. O produto comercial é a base principal da economia da região. O exemplo efetivo é o bosque, como exemplo de conservação, na área de agricultura e de conservação. A Atalaya da Floresta, por exemplo, é uma medida de proteção da biodiversidade.


Old World Monkeys, edited by Paul F. Whitehead and Clifford J. Jolly, 2000, 528pp. Cambridge University Press, UK. Hardback ISBN 0 521 57124 3. Price: US$115. Old World monkeys, Cercopithecoida, are the most successful and diverse group of non-human primates. The species represented in this group have much to teach us about evolution and ecology. This book provides a broad technical account of cercopithecoid biology, including molecular and behavioral and morphological approaches to phylogeny; population structure; allometry; fossil history; functional morphology; ecology; cognitive capabilities; social behavior and conservation; it is a definitive reference for those professionals and students wishing to further their understanding of primateology. Available from: Cambridge University Press, The Edinburgh Building, Cambridge CB2 2RU, UK, or 40 West 20th Street, New York, NY 10011-4211, USA. Web site: <www.cup.cam.ac.uk> or www.cup.org.

ARTICLES


### Abstracts

**Dunbar, R. 1999.** The number of males in primate groups. *Primate Eye* (69): 11-12.


### Meetings

**IUCN the World Conservation Union**  World Conservation Congress, 4-11 October, 2000, Amman, Jordan. The IUCN/SSC meeting will be held on 2-3 October, 2000. For more information: IUCN-The World Conservation Union, Rua Mauverney 28, CH-1196 Gland, Switzerland, Tel: +41 22 999 0001, Fax: +41 22 999 0002, e-mail: <mail@iucn.org>.

**Nonhuman Primate Pathology Seminar and Workshop** 2000, 7-8 October 2000, Wisconsin Regional Primate Research Center, University of Wisconsin- Madison, USA, in conjunction with the Symposium of Nonhuman Primates Models for Aids (4-7 October). The conference will be held at the Pyle Conference Center. For more information and registration materials please contact either Dr. Amy Usborne, e-mail: <aoburne@primate.wisc.edu> or Dr. Iris Bolton, e-mail: <ibolton@primate.wisc.edu> or at WRPRC, University Of Wisconsin, 1220 Capitol Court, Madison, WI 53715-1299, USA.

**Associazione Primatologica Italiana Congress** (XIVth), 4-6 October 2000, Pisa Italy. For more information contact: Prof. Silvana Borgognini Tarli, Dipartimento di Eologia, Ecologia, Evoluzione, Via Volta, 4-56126 Pisa, Italy, Tel: (050) 24613 or (050) 44484, Fax: (050) 24653, e-mail: <borgognini@disc.au.unipi.it>. Home Page: <http://www.unipi.it/webbio/abio/cong14/14con.htm>

**II Congresso Brasileiro de Unidades de Conservação, 5-9 de Novembro 2000, Centro de Convenções de Campo Grande, Mato Grosso do Sul, Brazil.** Commemorating 60 years after the creation of the Brazil's 1st National Park. For more information contact: Fundação O Boticário de Proteção à Natureza, Av. Rui Barbosa 3450, Amoço Pena, 83065-260 São José dos Pinhais, Paraná, Brazil. Tel: (041) 382 3456, Fax: (041) 382 4179, E-mail: fundacao@fbnp.org.br. Home Page: <http://www.fbnp.org.br>.

**Primates in Biomedical Research: Diseases and Pathology - 2nd Göttingen Symposium, 8-9 November 2000, Department of Veterinary Medicine and Primate Husbandry, Deutsches Primatenzentrum.** Focus: Spontaneous and induced primate pathology. A special EUPREN Workshop “The Future of Primates in Biomedical Research” will be held.
in conjunction with this symposium on 10 November 2000. All symposium participants are invited to attend. Contact: Conference Secretariat: Ingrid Rosbach, Department of Veterinary Medicine, Deutsches Primatentumzentrum, Kellnerweg 4, D-37077 Göttingen, Germany; Tel: 49 (0) 551-3851 119, Fax: 49 (0) 551-3851 277, e-mail: <rossbach@www.dpz.gwdg.de>.

Association for the Study of Animal Behaviour - Winter Meeting, 30 November - 1 December, 2000, Zoological Society of London Meeting Rooms, London, UK. Organised by André Gilburn. Theme: “Sexual Conflict”. For further information: Dr. André S. Gilburn, Department of Biology, University of Leicester, Adrian Building, University Road, Leicester LE1 7RH, England, UK, Tel: +44 (0)116 252 3488, Fax: +44 (0)116 252 3350.

Association of Primate Veterinarians Annual Workshop, 3-5 November, 2000, San Diego, California. A case report presentation dealing with aspects of clinical medicine or husbandry of nonhuman primates. Those veterinarians enrolled in laboratory animal, primate medicine, or zoological medicine training programs or residencies may apply by September 30, 2000 for a travel award of $500.00 to attend the workshop and present a clinical case report or research findings. Contact: Dr. Nick Lerche, Tel: 530 752 6490, Fax: 530 752 2880, or email <nwlerche@ucdavis.edu>.

2001


XVIIIth Congress of the International Primatological Society, 7-12 January 2001, Adelaide, Australia. Hosted by the Australasian Primatological Society, President Mr. John Lemon, Western Plains Zoo, Dubbo, NSW. Theme: “Primates in the New Millennium”. Mr. Graeme Crook is Chairman of the Organizing Committee. Symposia - Participants wishing to register a symposium title must submit a 200 word abstract by 31 July 1999. E-mail to Carla Litchfield <aclitch@terra.net.au>. Titles of accepted symposia will be published on the webpage from August 1999. Papers - An abstract of 100 words is required. E-mail to Carla Litchfield <aclitch@terra.net.au>. Closing date for first call for papers: 31 January 2000. Closing date for second call for papers: 31 May 2000. A final list of papers will be published on the Internet by 30 June 2000. For more information, and to be put onto the Congress Organizer’s mailing list, write to: Conventions Worldwide, PO Box 44, Rundle Mall, SA 5000, Australia, Tel: +61 8 8363 0068, Fax: +61 8 8363 0354, e-mail: <sat conv@camtech.net.au>, sending your postal address.

International Conference “Ecology of Insular Biotas”, 12-16 February 2001, Victoria University of Wellington, Wellington, New Zealand. Focus: ecological patterns and processes of importance to isolated biotas, including true islands, and natural and artificial habitat islands. Examples of topics for papers include: dispersal and gene flow within and among isolated populations; ecology of small populations; ecological consequences of disarrmonic florals and fauna; the relevance of island biogeography principles in conservation; islands as model ecosystems; and comparative ecology of true islands vs. habitat islands. Abstracts may be submitted electronically on the webpage (http://www.vuw.ac.nz/sbs/conferences/island.shtml) and submitting the requested information to <sbs-islands-conf@vuw.ac.nz>. Deadline for abstracts is 1 October 2000. If web access is not available, contact Dr. Christa Mulder, School of Biological Sciences, Victoria University of Wellington, PO. Box 600, Wellington, New Zealand. The complete scientific program will be available on the conference website by 15 November 2000.


Association for the Study of Animal Behaviour - Spring Meeting 2001, University of Liverpool, Liverpool, UK. Organized by Jane Hurst. For more information: Prof. J. Hurst, Division of Animal Husbandry, Faculty of Veterinary Science, University of Liverpool, Leahurst, Neston, South Wirral L64 7TE, England, UK, Tel: +44 (0)151 7946100, Fax: +44 (0)151 7946107, e-mail: <jane.hurst@liv.ac.uk>.

Association for the Study of Animal Behaviour - Summer Meeting 2001, University of Glasgow, Scotland, UK. Organized by Felicity Huntingford. Theme: "Interacting Behaviour with Other Disciplines". For more information: Prof. C. A. Huntingford, Division of Environmental and Evolutionary Biology, Graham Kerr Building, Glasgow University, Glasgow G12 8QG, Scotland, UK, Tel: +44 (0)141 330 5968, Fax: +44 (0)141 330 5971, e-mail: <f.huntingford@bio.gla.ac.uk>.

Notes to Contributors

Scope

The journal/newsletter aims to provide a basis for conservation information relating to the primates of the neotropics. We welcome texts on any aspect of primate conservation, including articles, thesis abstracts, news items, recent events, recent publications, primatological society information, and suchlike.

Submissions

Please send all English and Portuguese contributions to: Jennifer Pervola, Conservation International, Center for Applied Biodiversity Science, 1919 M. St. NW, Suite 600, Washington, DC 20036, Tel: 202 533 9533, Fax: 202 331 0570, e-mail: <j.pervola@conservation.org>, and all Spanish contributions to: Ernesto Rodriguez-Luna, Instituto de Neuroecología, Universidad Veracruzana, Apartado Postal 566, Xalapa 91000 Veracruz, Mexico. Tel: 281 8-77-30, Fax: 281 8-77-50, 8-63-52, e-mail: <saraguat@speedy.coacade.uvm.mx>

Contributions

Manuscripts can be in English, Spanish or Portuguese, and should be double-spaced and accompanied by the text on diskette for PC compatible text-editors (MS-Word, WordPerfect, Excel, and Access), and/or e-mailed to <j.pervola@conservation.org> (English, Portuguese) or <saraguat@speedy.coacade.uvm.mx> (Spanish) Hard copies should be supplied for all figures (illustrations and maps) and tables. The full name and address for each author should be included. Please avoid abbreviations and acronyms without the name in full. Authors whose first language is not English, please have texts carefully reviewed by a native English speaker.

Articles. Each issue of Neotropical Primates will include up to three full articles, limited to the following topics: Taxonomy, Systematics, Genetics (when relevant for systematics), Biogeography, Ecology and Conservation. Texts for full articles should not exceed about 20 pages in length (1.5 spaced, and including the references). Please include an abstract in English, and (optional) one in Portuguese or Spanish. Tables and illustrations should be limited to six, excepting only the cases where they are fundamental for the text (as in species descriptions, for example). Full articles will be sent out for peer review.

Short articles. These are reviewed only by the editors. A broader range of topics are encouraged, including such as behavioral research, in the interests of informing on general research activities which contribute to our understanding of platyrhines. We encourage reports on projects and conservation and research programs (who, what, where, when, why, etc.) and most particularly information on geographical distributions, locality records, and protected areas and the primates which occur in them. Texts should not exceed 10 pages in length (1.5 spaced, including the references).

Figures and maps. Articles can include small black-and-white photographs, high quality figures, and high quality maps and tables. Please keep these to a minimum. We stress the importance of providing maps which are publishable.

News items. Please send us information on projects, field sites, courses, recent publications, awards, events, activities of Primate Societies, awards, etc.

References. Examples of house style can be found throughout this journal. Please refer to these examples when citing references:


Neotropical Primates is produced in collaboration with Conservation International, Center for Applied Biodiversity Science, 2501 M. St. NW, Suite 200, Washington, DC 20037.
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