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Neotropical Primates

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Front Cover:
The black-headed uacari, *Cacajao melanocephalus ouakary.*

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Editorial

Neotropical 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 platyrrhines. 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 *Neotropical Primates* – for which we apologize. Remedying 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. mauesi* in 1992, *C. marcai* 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 Platyrrhini; 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, be they 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 Rodríguez-Luna

Two New Species of Marmoset, Genus *Callithrix* Erxleben, 1777 (Callitrichidae, Primates), from the Tapajós/Madeira Interfluvium, South Central Amazonia, Brazil

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Abstract

Two new species of marmoset, *Callithrix manicorensis* sp. n. and *Callithrix acariensis* sp. n., are described; the first from the interfluvium of the Rios Madeira, Aripuanã and Manicoré, and the second from the interfluvium of the Rios Acarí 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 manicorensis* appears to be most closely related to *C. nigriceps*, *C. marcai* and *C.* aff. *emiliae*, its neighbors to the south, and *Callithrix acariensis* appears to be most closely related to *Callithrix saterei*, its neighbor to the north, and *Callithrix melanura* to the south, but they are easily distinguished from them. The most noticeable features of *Callithrix manicorensis* 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 b$_2$-microglobulin gene was sequenced for *C. manicorensis* and combined with sequences from related species. *Callithrix manicorensis* is shown to be a member of the *C. argentata* clade according to mitochondrial control region and b$_2$-microglobulin intron 2 sequences. *Callithrix acariensis* is found to be most closely related to *C. mauesi* and *C. humeralifera* (the tufted-ear marmoset clade) based on mitochondrial control sequence. The phylogeography of the marmosets is discussed, as well as possible scenarios for historic patterns of dispersal and speciation. With the discovery of these two marmosets, the number of species of *Callithrix* increases to 21, of which 20 are endemic to Brazil (considering *C.* aff. *emiliae* from Rondônia a valid species as it is widely separated from *C. emiliae*). The total number of primate species for the country as a whole increases to 79, 41 of which are endemic.

Key Words - Primates, Callitrichidae, marmosets, *Callithrix manicorensis* sp. n., *Callithrix acariensis* sp. n., phylogeny, phylogeography, Brazil, Amazonia.

Resumo

Descreve-se duas novas espécies de sagüi, *Callithrix manicorensis* sp. n., do interflúvio entre os Rios Madeira, Aripuanã e Manicoré, e *Callithrix acariensis* sp. n., do interflúvio entre os Rios Acarí e Sucundurí, afluentes do Rio Canumã, estado do Amazonas, Amazônia Central Sul, Brasil. As novas espécies são alocadas no grupo de sagüis *Callithrix argentata, sensu* Hershkovitz (1977). A nova espécie, *Callithrix manicorensis,* parece ter maior parentesco com *C. nigriceps, C. marcai,* e *C.* aff. *emiliae,* os seus vizinhos ao sul, ainda que muito distinta destas. *Callithrix acariensis* parece ter maior parentesco com *C. saterei*, o seu vizinho ao norte, e *C. melanura* ao sul da sua distribuição. As diferenças mais notáveis em *Callithrix manicorensis* são a metade anterior do corpo de cor branco ou branco-argênteo, incluindo os membros anteriores, as mãos, garganta, peito, manto, e nuca, e a presença de uma mancha cinza clara ou cinza-argêntea (não preta) no vértice. O dorso é cinzento ou marron-claro e transversalmente listrada ou mosqueado com branco ou branco-argênteo. O ventre e os lados interiores do corpo são amarelados ou alaranjados. As pernas e os pés são alaranjadas. A cauda é lisa, não anelada e preta. As diferenças mais notáveis da nova espécie *Callithrix acariensis* são a metade anterior do corpo quase branco neve inclusive os braços anteriores, peito, juba, nuca e vértice, sem uma mancha cinza ou preta no vértice. O dorso é cinzento. O ventre é branco. As pernas e os pés são claramente alaranjadas. A cauda é preta, proximalmente com uma mancha alaranjada. Esta espécie mostra uma mancha larga branca na coxa do joelho quase até o dorso. Apresenta-se uma filogenia que inclui as duas novas espécies, baseada em 902 pares de bases da região controle mitocondrial e 635 pares de bases do intron 2 do gene nuclear b$_2$-microglobulin. O arranjo cladístico sugere que *Callithrix manicorensis* seja um membro do grupo *C. argentata*, e que *C. acariensis* seja mais próxima a *C. mauesi* e *C. humeralifera* (baseada na análise da região controle mitocondrial). Discuta-se a filogeografia dos sagüis amazônicos tanto quanto cenários possíveis para os padrões históricos de dispersão e especiação. Com essas descobertas, acrescenta-se mais duas espécies ao gênero *Callithrix*, sendo agora um total de 21, com 20 endêmicas ao Brasil (considerando *Callithrix* aff. *emiliae* de Rondônia uma espécie válida, geográficamente isolada e separada de *Callithrix emiliae*). O número de espécies de primatas existentes no Brasil elevou-se para 79. Destas, 41 são endêmicas ao país.

Palavras-Chave - Primatas, Callitrichidae, sagüis, *Callithrix manicorensis* sp. n., *Callithrix acariensis* sp. n., filogenia, filogeografia, Brasil, Amazônia.

Introduction

All but one of the 19 marmosets, *Callithrix* Erxleben, 1777, recognized to date are endemic to Brazil. The black-tailed marmoset, *Callithrix melanura*, 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. emiliae*, and elevated all the forms to species status. Mittermeier *et al.* (1988) agreed with the taxonomy suggested by De Vivo, but also recognized a sixth eastern Brazilian species, *C. kuhlii*, which was considered a hybrid by Hershkovitz (1977) and as merely a pelage color variant of *C. penicillata* by De Vivo (see Rylands *et al.*, 1993). Mittermeier *et al.* (1992) followed De Vivos 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 callitrichid taxa to 59 (see Van Roosmalen *et al.*, 1998). Figure l (after Van Roosmalen *et al.*, 1998) shows the distribution of 14 species of the Amazonian *Callithrix argentata* group, including the two described here, *C. manicorensis* and *C. acariensis*, and also *Callithrix humilis* M. G. M. van Roosmalen, T. van Roosmalen, Mittermeier and Fonseca, 1998.

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

Callithrix manicorensis was first discovered by Marc G. M. and Tomas van Roosmalen on 5 July, 1996, during a field trip to the region in search of a new species of dwarf marmoset, *Callithrix humilis* (Van Roosmalen *et al.*, 1998). The animal was being kept as a pet and, as they were informed, had been collected on the Rio Mariepauá. *Callithrix acariensis* was first discovered by Marc G. M. van Roosmalen on 29 August, 1996, when he obtained a baby pet monkey from locals living along the right bank of the lower Rio Acarí.

Callithrix manicorensis sp. n.

Holotype: INPA 2511, juvenile female, one of two juveniles obtained alive by Marc G. M. van Roosmalen on 30 December 1996, from the vicinity of the town of Manicoré. The specimen INPA 2511 died soon after being acquired and is deposited in the mammal collection of the Instituto Nacional de Pesquisas da Amazônia (INPA) Museum, Manaus, Amazonas, Brazil.

Paratype: A juvenile male, obtained alive together with the holotype INPA 2511 by Marc G. M. van Roosmalen on 30 December, 1996, from the vicinity of the town of Manicoré. It is still alive in captivity at the time of this publication. It will eventually be placed in the mammal collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil.

Type locality: Seringal São Luis, east bank of the middle Rio Madeira, in the vicinity of the town of Manicoré, state of Amazonas, Brazil (Fig. 2). This region is located in south central Amazonia, Brazil, south of the Rio Amazonas, east of the Rio Madeira, and west of the lower Rio Aripuanã. Coordinates for the type locality are 05° 50' 28" S, 61° 18' 19" W. Altitude 45 m.

Other specimens examined: A specimen collected alive by Marc G. M. van Roosmalen on 5 July, 1996. It was reported to have been captured along the lower Rio Mariepauá. This specimen, an adult male, died a month later and only the skull and skeleton was preserved (see Table 3 for cranial measurements; Table 2 for intermembral, brachial and crural indices). It is deposited in the mammal collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil, under the number INPA 2512. It is depicted in Figure 5. Furthermore, a skull and a complete skeleton of an adult female that was kept for several years in the breeding center of the first author, has been preserved and is deposited in the mammal collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil, under the number INPA 3930. Figure 9 shows the skull of this specimen, and Table 4 gives the cranial and dental measurements.

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.

Hershkovitz (1977)	De Vivo (1988, 1991)	Mittermeier *et al.* (1988) Rylands *et al.* (1993)	Van Roosmalen *et al.* (1998)	This paper
Pygmy marmosets – *Cebuella*[1] (Amazonia in Colombia, Peru, Brazil, Bolivia)				
C. pygmaea[1]	*C. pygmaea*	*C. pygmaea*	*C. p. pygmaea*[2]	*C. p. pygmaea*
			C. p. niveiventris	*C. p. niveiventris*
Dwarf marmoset – *Callithrix humilis* group (Brazilian Amazonia)				
			C. humilis[3]	*C. humilis*
Marmosets - *Callithrix jacchus* clade (Eastern Brazil)				
C. jacchus jacchus	*C. jacchus*	*C. jacchus*	*C. jacchus*	*C. jacchus*
C. j. Penicillata	*C. penicillata*	*C. penicillata*	*C. penicillata*	*C. penicillata*
C. j. geoffroyi	*C. geoffroyi*	*C. geoffroyi*	*C. geoffroyi*	*C. geoffroyi*
C. j. aurita	*C. aurita*	*C. aurita*	*C. aurita*	*C. aurita*
C. j. flaviceps	*C. flaviceps*	*C. flaviceps*	*C. flaviceps*	*C. flaviceps*
		C. kuhlii[4]	*C. kuhlii*	*C. kuhlii*
Marmosets - *Callithrix argentata* clade (Brazilian Amazonia, Bolivia and Paraguay)				
C. argentata argentata	*C. argentata*	*C. a. argentata*	*C. argentata*	*C. argentata*
C. a. leucippe	*C. leucippe*	*C. a. leucippe*	*C. leucippe*	*C. leucippe*
C. a. melanura	*C. melanura*	*C. a. melanura*	*C. melanura*	*C. melanura*
	C. emiliae[5]	*C. emiliae*	*C.* aff. *emiliae*	*C.* aff. *emiliae*
			C. emiliae[5]	*C. emiliae*
		C. nigriceps[6]	*C. nigriceps*	*C. nigriceps*
			C. marcai[7]	*C. marcai*
			C. saterei[8]	*C. saterei*
				C. manicorensis
				C. acariensis
C. humeralifer humeralifer	*C. humeralifera*	*C. h. humeralifer*	*C. humeralifera*	*C. humeralifera*
C. h. intermedius[9]	*C. intermedia*	*C. h. intermedius*	*C. intermedia*	*C. intermedia*
C. h. chrysoleuca	*C. chrysoleuca*	*C. h. chrysoleuca*	*C. chrysoleuca*	*C. chrysoleuca*
			C. mauesi[10]	*C. mauesi*

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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.* (1992), Barroso (1995), Schneider *et al.* (1996), Barroso *et al.* (1997), Tagliaro (1997), and Tagliaro *et al.* (1997) have also argued for this arrangement on the basis of their karyotype and molecular genetics.

[2] Lönnberg (1940) argued for two subspecies of *Cebuella pygmaea*, *C. p. pygmaea* 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).

[4] Coimbra-Filho (1984, 1985, 1990), Rylands (1989), Mittermeier *et al.* (1988), Natori (1990), Rylands *et al.* (1993), and Groves (1993) recognize *Callithrix kuhlii* from southern Bahia as a valid form. Hershkovitz (1977) regarded it as a hybrid between *C. j. geoffroyi* and *C. j. penicillata*. De Vivo (1991) considered it to be indistinguishable from *C. penicillata*.

[5] *Callithrix emiliae* was first described by Thomas (1920) from the Rio Irirí, 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 Curuá (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 Irirí until further research is carried out on these marmosets.

[6] Described by Ferrari and Lopes (1992).

[7] *Callithrix marcai* 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), afluente 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.

[8] Described by Silva Jr. and Noronha (1998).

[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).

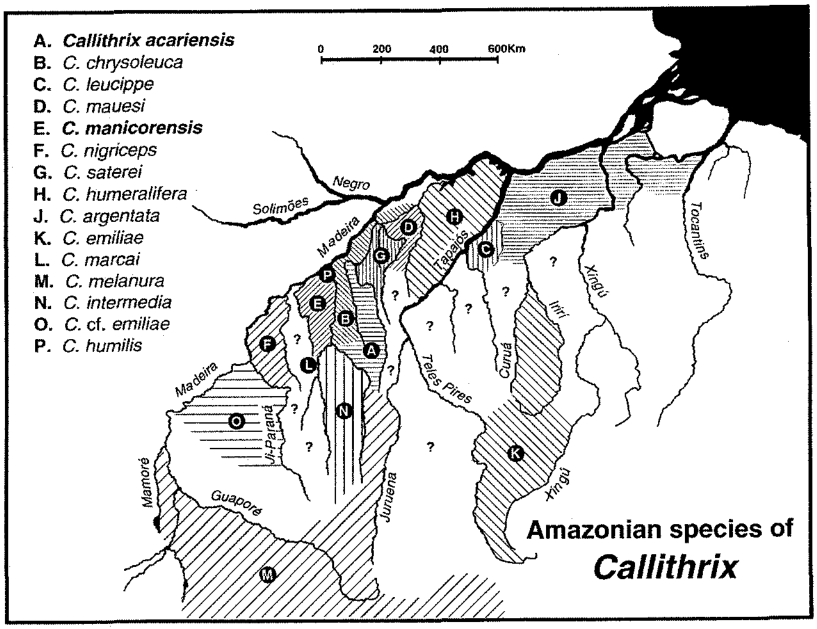

Figure 1. Distribution of 14 species of the Amazonian *Callithrix argentata* group, including *C. manicorensis* and *C. acariensis* described in this paper, and also of *Callithrix humilis* Van Roosmalen *et al.*, 1998. Map by Stephen D. Nash.

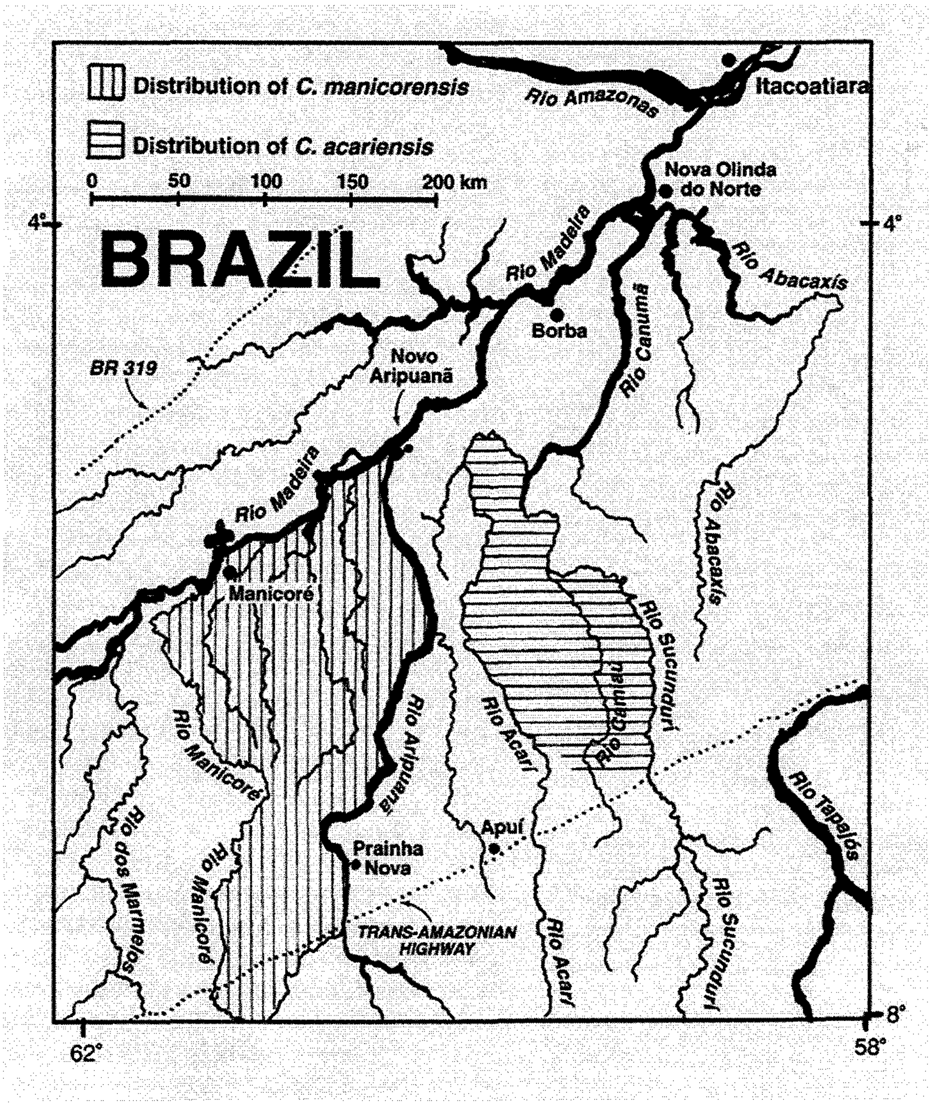

Figure 2. Distribution of *Callithrix manicorensis* and *Callithrix acariensis*. Map by Stephen D. Nash.

Table 2. The intermembral (humerus + radius)/(femur + tibia) x 100), brachial (radius/humerus) x 100) and crural (tibia/femur) x 100) indices of one adult *Callithrix manicorensis* compared with those of *Callithrix argentata, Callithrix humilis* and *Cebuella pygmaea* (measurements taken by Lesa A. Davis and Susan Ford).

Intermembral Index		Brachial Index		Crural Index	
C. argentata	76	*C. humilis*	88	*C. manicorensis*	99
C. manicorensis	78	*C. argentata*	89	*C. argentata*	100
C. humilis	79	*C. manicorensis*	89	*C. humilis*	102
Cebuella pygmaea	82	*Cebuella pygmaea*	90	*Cebuella pygmaea*	102

Table 3. Cranial measurements (mm) of the adult male (Registration number INPA 2512) of *Callithrix manicorensis* from the Rio Mariepauá.

Skull and mandible	mm
Greatest Skull Length (SL)	45.36
Condylobasal Length	36.92
Zygomatic Width (ZW)	30.31
Biorbital Width (BW)	27.71
Braincase Length	40.31
Braincase (Postorbital) Width (PW)	26.72
Across First Molars (AM)	15.55
Length of Mandible (ML)	30.45
Coronoidal Height	18.30
pm^2-m^2	9.27
i-m^2	15.62
c-m^2	11.72
pm_2-m_2	10.07
i-m_2	15.80
c-m_2	12.56

Geographic distribution: The species is known from the west bank of the lower Rio Aripuanã 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 Aripuanã, just south of the town of Novo Aripuanã, 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 *seringal*, 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*), 'orelha de macaco' (*Enterolobium schomburgkii*), wild cocoa (*Theobroma* spp.), 'bacurí' (*Rheedia* spp., *Platonia insignis*), 'ingá' (*Inga* spp.), 'taperebá' (*Spondias mombin*), 'biribá' (*Rollinia squamosa*), 'soursop' (*Annona* spp.), and a number of tree species belonging to the Sapotaceae and Arecaceae (palm) 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. marcai,* and *C.* aff. *emiliae.* The lightest of these four species and most advanced phaeomelanically (*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 subgroup, 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 manicorensis,* 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. manicorensis, Callithrix humilis* and *C. marcai*, 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 transversally 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 circumbuccal area naked, pink to flesh-colored, dark brown mottled around the nostrils, with a narrow dark brown vertical nose stripe, without moustache; auricle 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 with black 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 *sagüi, sauím* (*souím*), or 'branquinho' (= little white fellow, in Portuguese) by the local people. For an English name, we suggest the Rio Manicoré marmoset.

Callithrix acariensis 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 Acarí near its confluence with the Rios Sucundurí and Canumã. 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 Acarí close to the confluence with the Rios Sucundurí and Canumã, 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 Acarí, and assumed to occur in the entire interfluvium of the Rios Acarí and Sucundurí, south perhaps to a contact zone with *Callithrix melanura* somewhere between the Rio Aripuanã and the Rio Juruena.

Habitat: This new species has not been observed in the wild, but according to local settlers living along the right bank of the Rio Acarí 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, under parts, 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. melanura*, 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. melanura*, 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 of the nostrils, and on the lower lip and chin; nose and circumbuccal 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 Acarí. 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 *sagüi* or *sauím* (*souím*) by the local people. For an English name, we suggest the Rio Acarí marmoset.

Phylogenetic Placement of *Callithrix manicorensis* and *Callithrix acariensis* 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, Brazil. Sampled marmosets included three *Callithrix humilis*, one *Callithrix manicorensis*, one *Callithrix acariensis*, and one *Cebuella pygmaea niveiventris*. 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 proffered 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 b_2-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° (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. geoffroyi*, two *C. penicillata*, two *C. jacchus*, five *C. kuhli*, 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. kuhli*, one *C. penicillata*, one *Cebuella pygmaea*, one *Callimico goeldii*, one *Saguinus 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 specimen, 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-Açú, a minor tributary of the Rio Amazonas and contact zone with *C. humeralifera* between the headwaters of the Rio Maués and the Rio Abacaxís, 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.

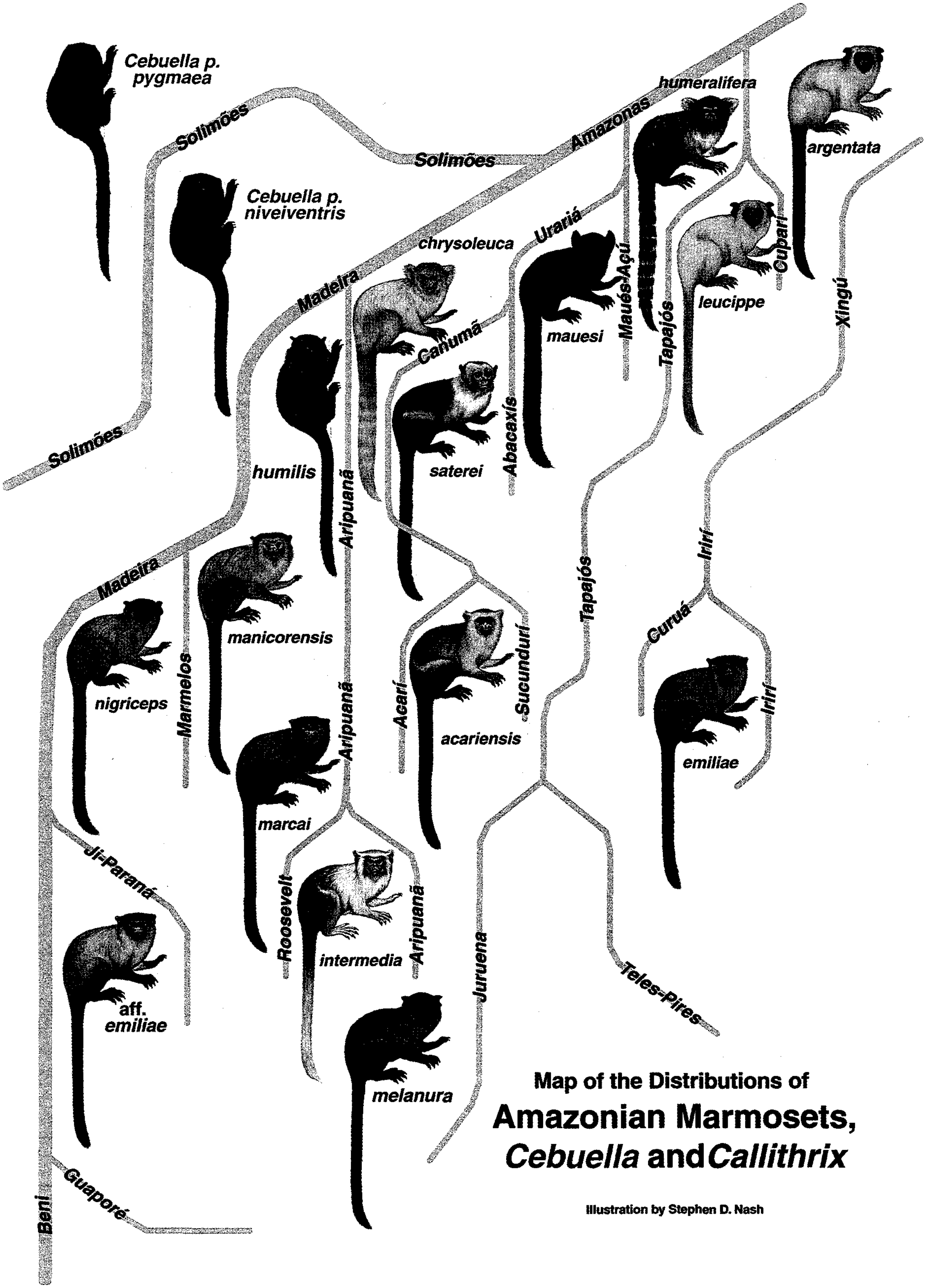

Figure 3. A schematic representation of the distributions of the Amazonian marmosets, *Callithrix*, delimited by rivers. Illustration by Stephen D. Nash.

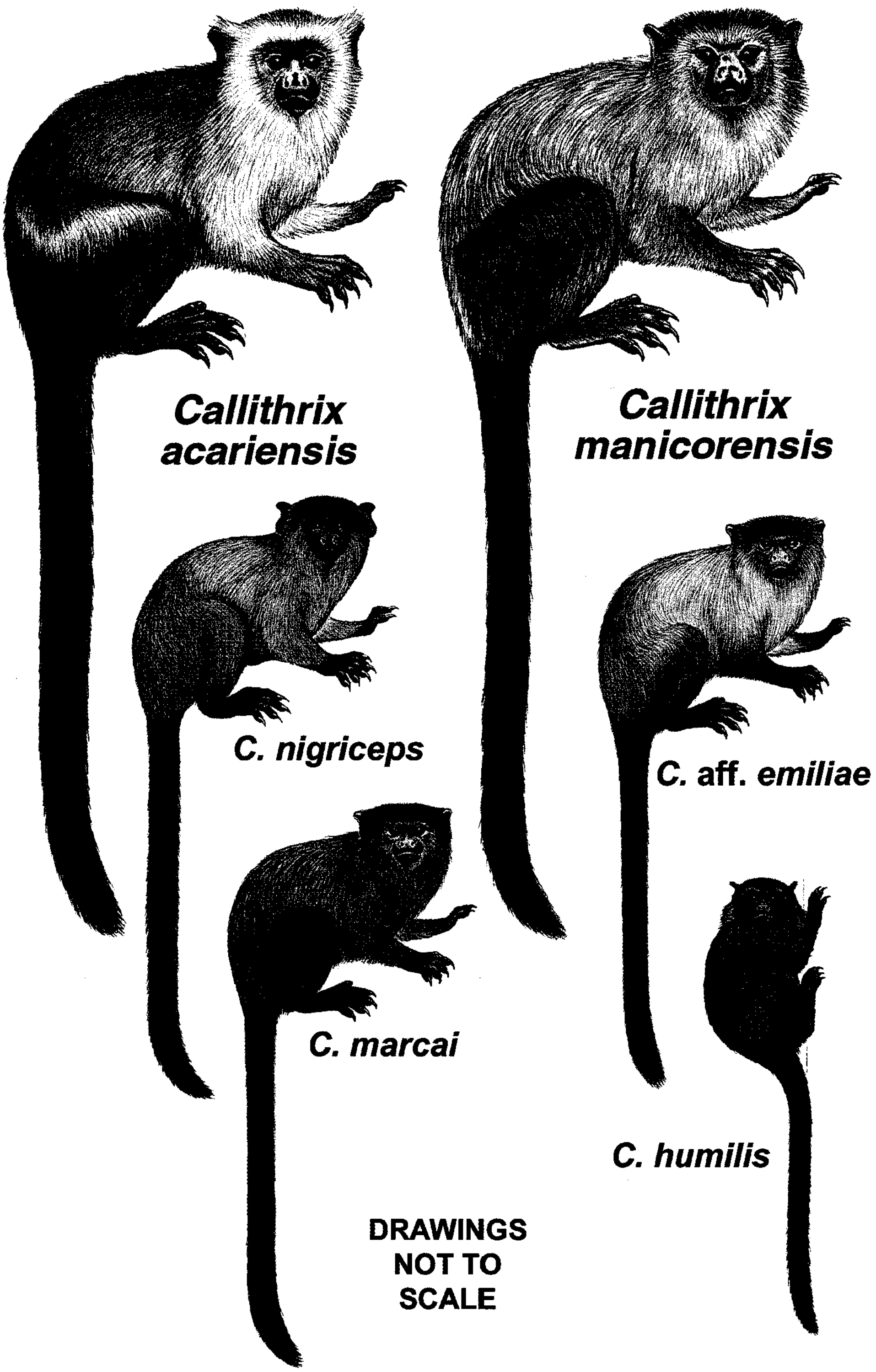

Figure 4. The Rio Acarí marmoset, *Callithrix acariensis* and the Rio Manicoré marmoset, *Callithrix manicorensis* compared with *Callithrix nigriceps* Ferrari and Lopes, 1992, *Callithrix* aff. *emiliae* (to be described as a new species), *Callithrix marcai* Alperin, 1993 (possibly parapatric in the 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 Mariepauá (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.

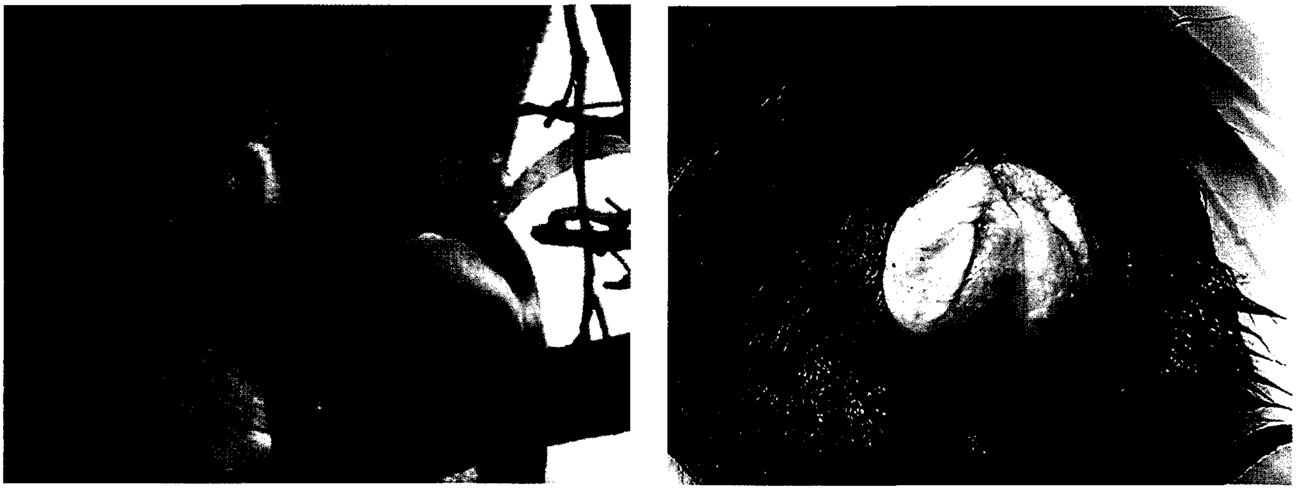

Figure 7. Adult female *Callithrix acariensis* (holotype INPA 3931), showing the distinct thigh stripe (left), and the hypertrophied pudenda (right). Photographs by Marc G.M. van Roosmalen.

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 acariensis* (INPA 3931) and the adult female of *Callithrix manicorensis* (INPA 3930) (mm).

Skull and mandible	**INPA 3930**	**INPA 3931**
Greatest Skull Length (SL)	45.7	47.6
Zygomatic Width (ZW)	31.3	30.8
Biorbital Width (BW)	26.2	27.3
Postorbital Width (PW)	22.4	23.3
Nasion-Basion	32.2	33.1
Basion-Prosthion	33.7	34.8
Biauricular Breadth	26.3	26.5
Height of Canine (CH)	4.3	5.2
Length of Mandible (ML)	28.8	31.1
Across First Molars (AM)	11.7°	13.5
Across Canines	8.4	8.9
Dental Field (P2-M2)	11.1°	10.8
Premaxilllary Height	8.3	8.3
Intradentale Superior to Premaxilla-Maxilla Junction at Alveolus (IS-P)	5.0	4.6
Intradentale Superior to Nasion (IS-NA)	15.1	15.8
Intradentale Superior to Posterior Nasal Spine (IS-PNS)	15.6	16.3
Bregma to Nasion (BR-NA)	23.6	23.3
Nasion to Fronto-Malar Junction at Orbit (NA-FM)	14.1	14.2
Fronto-Malar Junction to Pterion	6.7	8.3
Fronto-Malar Junction to Zygomaxillare Superior (FM-ZS)	4.9	6.8
Fronto-Malar Junction to Maxillary Tuberosity (FM-MT)	13.2	9.9
Zygomaxillare Inferior to Premaxilla-Maxilla Junction at Alveolus (ZI-PM)	12.0	12.1
Zygomaxillare Inferior to Zygomaxillare Superior (ZI-ZS)	7.5	6.8
Zygomaxillare Inferior to Maxillary Tuberosity (ZI-MT)	5.6	6.0
Anterior Teeth		
I^1 Length		2.1
I^1 Breadth		1.6
I^1 Height		2.7
I^2 Length		1.9
I^2 Breadth		1.6
i_1 Length		1.4
i_1 Breadth		1.6
i_1 Height		3.0
i_2 Length	1.3	1.4
i_2 Breadth	2.2	2.2
C_1Length	2.5	2.7
C_1Breadth	1.5	1.7
Cheek Teeth		
P_2 Length		2.4
P_2 Breadth		1.7
P_4Length		1.9
P_4 Breadth		1.8
M_1 Length		2.5
M_1 Width		2.0
M_2 Length		2.0
M_2 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 yielded 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.* (1997). *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. mauesi/humeralifera* clade concurs with these species' shared geographical location between the Rios Tapajós and Madeira/Aripuanã, 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 Aripuanã/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 archetypic *C. melanura* with its huge distribution in the headwaters of the Rios Madeira, Mamoré and Guaporé, and Aripuanã and Juruena, lacking major river barriers, this subclade speciated toward the north via *C. intermedia* confined to the Rios Roosevelt and Aripuanã interfluvium, *C. acariensis*, confined to the interfluvium of the Rios Acarí and Sucundurí, *C. humeralifera* in the interfluvium of the Rios Tapajós, Amazonas and Maués-Açú, finally speciating into *C. chrysoleuca*, occupying the Rios Amazonas, Madeira, Canumã, Aripuanã and Acarí interfluvium from north to south, while *C. saterei* branched off into the area between the Rios Canumã and Abacaxís, and *C. mauesi* between the

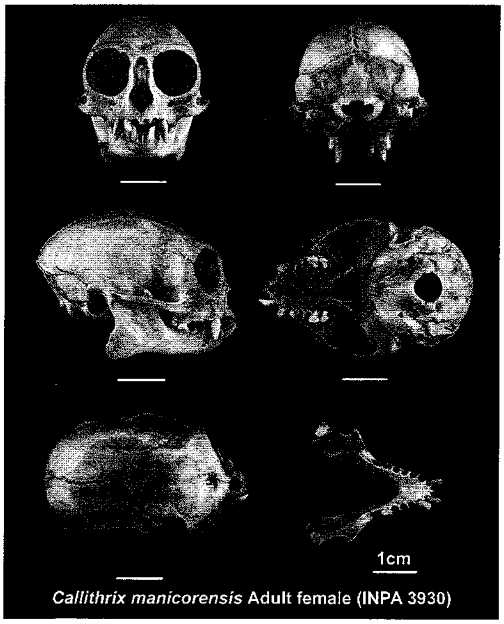

Figure 9. Skull of adult female *Callithrix manicorensis* (INPA 3930). Photograph by Stephen D. Nash.

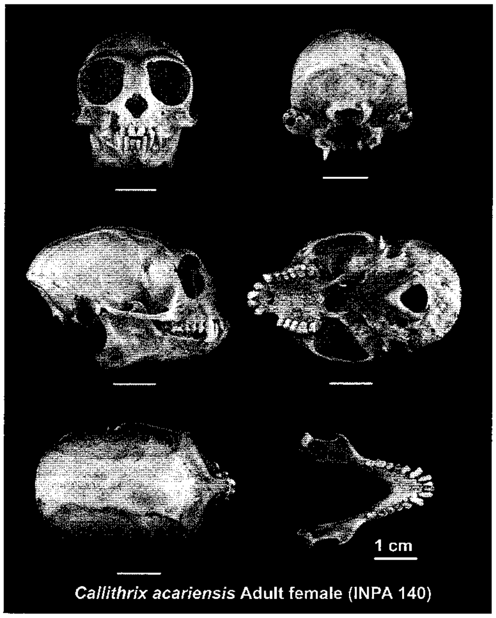

Figure 10. Skull of adult female *Callithrix acariensis* (INPA 3931). Photograph by Stephen D. Nash.

Paraná Urariá and Rio Maués-Açú. In this context it is interesting to note the strikingly white hip/thigh stripe consistent in all these species (rather inconspicuous only in *C. mauesi*), and the partially hairy auricles in especially juvenile *C. intermedia* and *C. acariensis*, culminating in the tufted ear *C. humeralifera, C. mauesi,* 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. marcai, C. nigriceps* 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. mauesi, C. humeralifera,* and *C. chrysoleuca* in one clade, and *C.* aff. *emiliae, C. nigriceps, C. manicorensis, C. marcai, C. emiliae, C. leucippe* and *C. argentata* in the other clade. *C. marcai* and *C. nigriceps* 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 subclade (*C. argentata/manicorensis*) is divided geographically by the other subclade (*C. acariensis/mauesi/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-Paraná interfluvium, *C. nigriceps* in the Rios Madeira and Marmelos interfluvium, *C. marcai* in the Rios Marmelos and Roosevelt interfluvium, and finally *C. manicorensis* 'trapped' in the interfluvium between the unsurpassable Rio Madeira and the lower Rio Aripuanã, *and* northeast passing the upper Rios Juruena and Tapajós filling the Rios Xingú and Tapajós interfluvium with *C. emiliae* in the Rios Curuá and Irirí interfluvium, *C. argentata* in the Rios Xingú, Amazonas and Cuparí interfluvium, and *C. leucippe* in the Rios Tapajós and Cuparí interfluvium. It is rather likely that new species will be found in the near future east of the Rios Juruena and Tapajós.

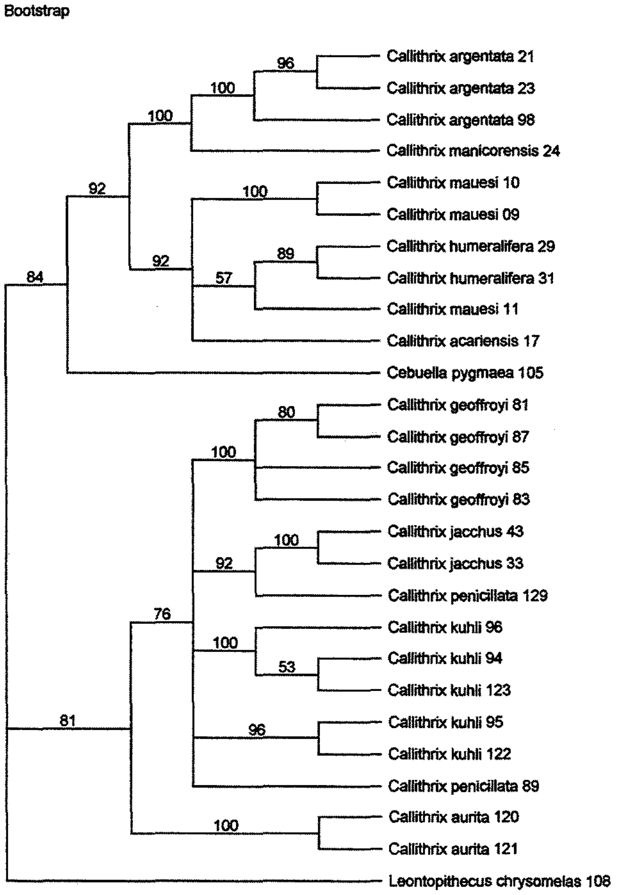

Figure 11. Callitrichid gene tree based on 902 base pairs (bp) of the mitochondrial control region and 635 bp of intron 2 of the nuclear β2-microglobulin gene, analyzed using maximum parsimony. Bootstrap values are given above branches. *Callithrix manicorensis* clearly belongs to the *C. argentata* clade, *Callithrix acariensis* is most closely related to *C.mauesi* and *C. humeralifera*, the tufted ear *Callithrix* clade.

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. humeralifera* and *C. mauesi*, 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 Amazon 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 manicorensis*. There is no way of knowing whether its initial divergence involved its isolation from the ancestral *Callithrix* in its present location in the northern part of the interfluvium 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 mauesi/humeralifera* 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 mauesi/humeralifera* subclade drove the *Callithrix argentata* subclade species from the region between the Rios Canumã and Aripuanã, and the Rio Tapajós. Alternately, the *Callithrix mauesi/humeralifera* 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 *mauesi/humeralifera* 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 *mauesi/humeralifera* 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 manicorensis* is threatened. However, the total area in which it has been confirmed to occur is *c.* 15,000 km^2 (*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 larger 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 *caboclos*) 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, Uruá, Maripauá, Arauá, 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 interfluvium of the Rios Acarí and Sucundurí, 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 Araras, a tributary of the Rio Acarí, or by boat entering the Rio Canumã via the Rio Madeira, all the way upriver to the confluence with the Rio Sucundurí and Rio Acarí. Since marmosets generally prefer edge habitats and secondary forest on high dry land (*terra firme*), *Callithrix acariensis* is assumed to be relatively rare, considering the fact that there is almost no human habitation in the interfluvium of the Rios Acarí and Sucundurí. No major deforestation or logging has been planned for the area, and therefore the monkey is not considered threatened.

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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 ecologica 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 contrast 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 Neotrópico. Tres especies de primates existen en estos hábitats: *Alouatta palliata*, *A. pigra* y *Ateles geoffroyi*. La primera y la última presentan una distribución amplia en el sur de México y en al área Mesoamerica. 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 Mesoamerica 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 (SEMARNAP, 1999).

En México, el estudio de la población, ecología y comportamiento de *A. palliata* ha sido investigado durante varios años en la región de Los Tuxtlas, Veracruz (Estrada y Coates-Estrada, 1996). Sin embargo, información sobre estos aspectos para *A. pigra* es inexistente. Hasta ahora sólo contamos con algunos reconocimientos breves (Horwich y Johnson, 1986; Watts y Rico-Gray, 1987; del Campo y Jorgenson, 1998) de los que sólo uno, llevado a cabo en Muchunuk, Quintana Roo, en la península de Yucatán, podría ser considerado como sistemático (Gonzales-Kirchner, 1998).

En el caso de Guatemala, estudios breves se han efectuado en Tikal (Coelho *et al.*, 1976; Schlichte, 1978). Los únicos estudios detalladas 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; Ostrum *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 que ahí se resguarda, y utilizando como modelo los estudios poblacionales y ecológicos que hemos realizado en las selvas de Los Tuxtlas con la especie *A. palliata*, hacia fines de 1999 iniciamos una investigación de las poblaciones del mono aullador negro, *Alouatta pigra*, 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. pigra* 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 de campo 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. pigra* 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 localiza 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.

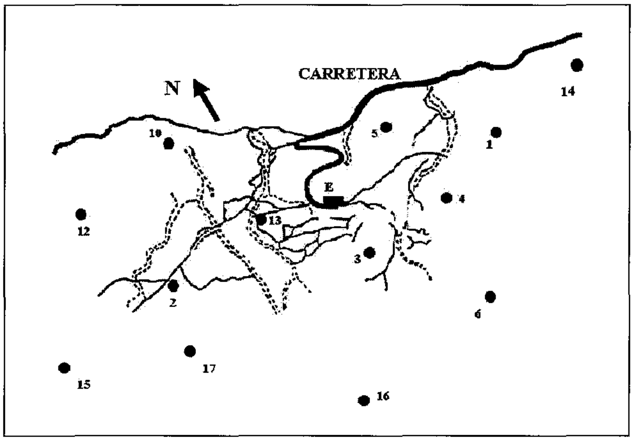

Figure 1. Localización del Parque Nacional Zona Arqueológica de Palenque en el estado de Chiapas, México. La zona sombreada representa vegetación selvática (597 ha), areas con rayas horizontales = a vegetación secundaria (300 ha). Areas en blanco son pastizales (874 ha). Línea punteada = terracería. ZA = zona arequeológica.

El clima del área donde está ubicado el sitio ha sido clasificado como cálido-húmedo (García, 1981). La precipitación media anual es de 2156 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 de los meses 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 esta 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 presentan 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 mejor representadas son Leguminosae 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 *Astrocaryum mexicanum*, mientras que en los estratos superiores por arriba de los 20 m predominan especies como *Vatirea lundelli, Guatteria anomala, Manilkara zapota, Brosimum alicastrum, Quararibea funebris* y *Ficus* spp. (Díaz Gallegos, 1996).

Censo de la población de monos aulladores: Registros acústicos

A través de sesiones matutinas (5-7 a.m.) y vespertinas (6-8 p.m.) equipos de 2-3 personas se ubicaron en puntos estratégicos en las estructuras arqueológicas más altas del sitio. A partir de estos puntos se registró el intercambio de coros entre tropas de monos aulladores, indicando la orientación de los aullidos en grados en relación a los cuatro puntos cardinales y se estimó la distancia a la que los bramidos fueron 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, infante) y sexos. La localización de las tropas de saraguatos 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/ó 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 observaron durante periodos fijos de tiempo. En las observaciones del comportamiento alimenticio se tomó nota de la parte de la planta consumida (hojas, frutos y/ó hojas jóvenes ó maduras, frutos jóvenes ó 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 conteos de 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% infantes. 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 infantes. La relación de machos a hembras entre los adultos fue de 1: 0.74 y la relación

Tabla 1. Tropas de mono aullador negro detectadas en el Parque Nacional Zona Arqueológica de Palenque, Chiapas, México.

Troop	Adultos		Juveniles		Infantes	Total
	M	F	M	F		
1	3	2			2	7
2	2	1			1	4
3	4	2	1	2	2	11
4	3	1	1	1	1	7
5	1	1				2
6	3	2	3		2	10
10	3	4			2	9
12	2	3			1	6
13	3	2			1	6
14A	3	2	2	1	2	10
15A	3	2	1	1	2	9
16A	2	2	2	2	2	10
17A	3	2	1	1	1	8
Total	35	26	11	8	19	99

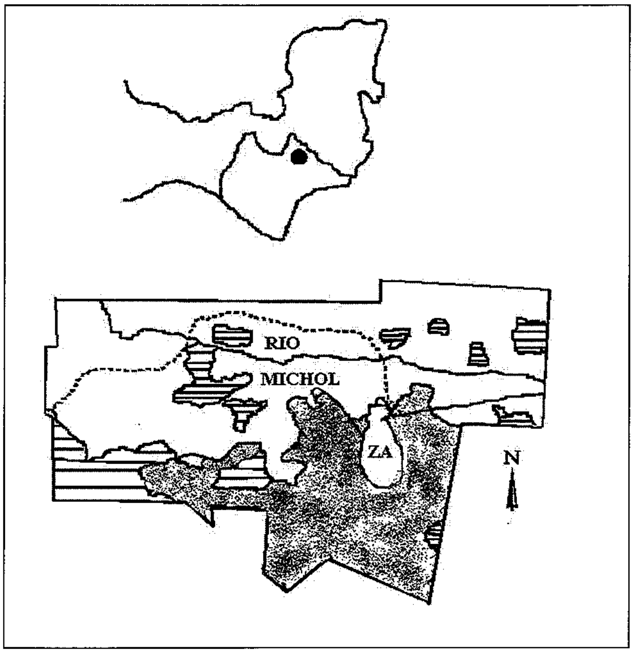

Figura 2. Localización aproximada de las tropas de monos aulladores detectadas en la zona selvática del Parque. El área mostrada está cubierta, a excepción de las estructuras arqueológicas principales en la vencindad del estacionamiento (E), por vegetación selvática. Lineas punteadas = arroyos, lineas negras delgadas = senderos. Area representada aprox. 500 ha. El gradiente altitudinal de Norte a Sur es de 100 – 500 m sobre el nivel del mar.

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 km^2 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 >1.3 m en d.a.p. y $\geq$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 esto en cuenta, la densidad estimada de la población de monos aulladores en el Parque Nacional Palenque de 33 individuos km^2 es más alta que aquella que ha sido reportada para la misma especies en Belice (8-22 individuos/km^2) (Bolin, 1981; Horwich y Gerhardt, 1983) y en Tikal en Guatemala (5-9 individuals/km^2) (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/km^2) (Gonzales-Kirchener, 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 saraguato en el país, *Alouatta palliata*, se presentan en densidades de 23 individuos/km^2 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 aseveración de que esta especie presenta las densidades más bajas reportadas para las especies del género *Alouatta* (Crockett y Eisenberg, 1987; Gonzales-Kirchener, 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 especies en Belice y Guatemala, donde el tamaño de las tropas varia de 4.4 a 6.3 individuos Coelho *et al.*, 1978; Bolin, 1981; Horwich y Gerhardt, 1983; Ostro *et al.*, 1999) y para el centro de Quintana Roo (3.16 individuos) (Gonzales-Kirchner, 1998).

Otro contraste 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 numero menor de hembras adultas. En Guatemala y Belice diferentes autores de manera consistente reportan tropas unimacho (un solo macho adulto y varias hembras adultas) (Coelho *et al.*, 1976; Schlichte, 1978; Horwich y Johnson, 1986).
Consideramos que estos contrastes podrían ser el resultado de la pobreza 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 llevados a cabo en el sitio (Díaz Gonzales, 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. *Nectandra* spp., *Ocotea* spp.) entre otras, reportadas como fuente importante de hojas y de 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

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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 Rios Blanco y Negro Wildlife Reserve (RBYNWR) covering 14,239 km^2 (Figure 1), was created in 1990, and forms part of the Bajo Paragua Forestry Reserve (BPFR) of 33,882 km^2. The reserve is divided into forestry concessions that reach areas of up to 3,113 km^2 (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 wildlife 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 Rios Blanco y Negro Wildlfe 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 Rios 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 Martin, San Luis, Oquiriquia, and El Tutumo. Three others were accessible by river and/or plane; Perseverancia, Pajaral, and Rio Negro de Caimanes (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

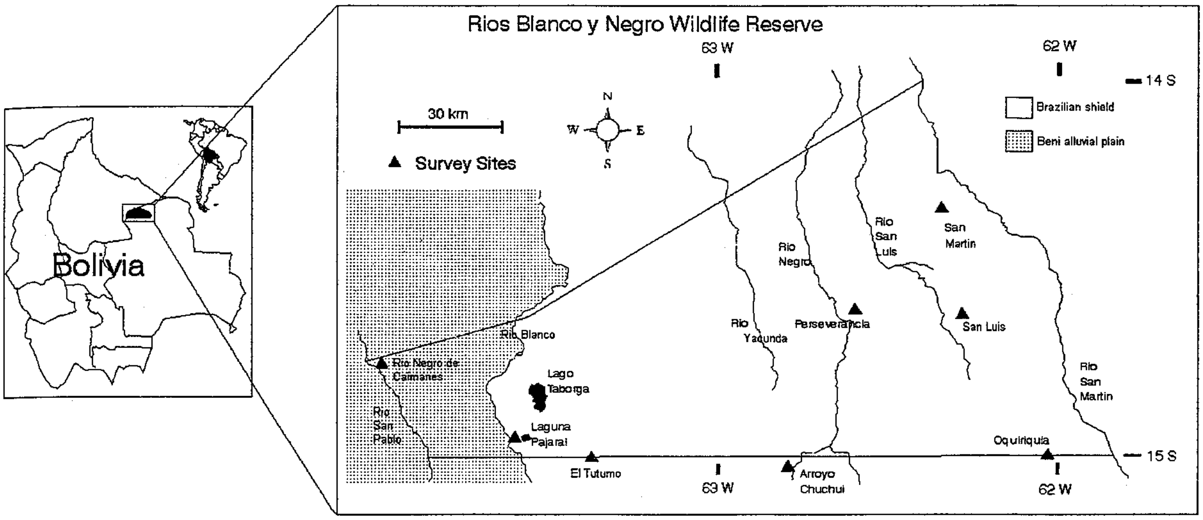

Figure 1. Location of the eight survey sites within the Rios Blanco y Negro Wildlife Reserve, Santa Cruz Department, Bolivia.

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 are expressed as relative abundances, calculated as the number of group encounters for each primate species per 10 km censused (groups/10 km). For *Ateles, Cebus,* and *Saimiri* the transect width was truncated at 40 m from the trail for all sites considered. *Alouatta, Aotus* and *Callithrix* sightings were truncated at 20 m from the trail due to the more cryptic nature of these species. These analytical norms were established to ensure that the transect width, and hence the area censused at each site, was similar. Individual encounter rates are expressed as the number of observed individuals of each species encountered per 10 km censused (inds/10 km). Primate biomass encounter rates for each site are expressed as the observed primate biomass per 10 km censused (kg/10 km). Primate body weights were taken from Ford (1994). Since data on group composition was difficult to obtain during censuses, and weights for other age/sex classes unknown, for the purposes of analysis all animals were assumed adult, and adult sex ratios were assumed 1:1 for all species at all sites. Statistical procedures follow Siegel and Castellan (1988), and significance was set at the 0.05 level.

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 1. Transect kilometres and location of the eight field sites within the Rios Blanco Y Negro Wildlife Reserve, Santa Cruz Department, Bolivia.

Survey Site	Diurnal (km)	Nocturnal (km)	Biophysical Region¹	Location	Survey Period
Perseverancia	165	27.5	BS	14, 38' S; 62, 37' W	June – July 1992
Pajaral	98	16	BS/BAP	14, 57' S; 63, 31' W	August 1992
Arroyo Chuchui	54.8	13.5	BS	15, 35' S; 62, 45' W	October 1992
San Martin	69	33.6	BS	14, 30' S; 62, 06' W	November 1992
Rio Negro Caimanes	101.6	20.9	BAP	14, 43' S; 63, 58' W	June 1993
San Luis	108.9	25	BS	See Figure 1	August 1993
Oquiriquia	93.2	16.2	BS	15, 03' S; 61, 48' W	September 1993
El Tutumo	99.7	21.5	BS/BAP	15, 03' S; 63, 19' W	October 1993

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

Four species were encountered at all of the sites visited within the reserve: *Callithrix melanura*, *Aotus azarae*, *Cebus apella*, and *Ateles 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, d.f.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 inds/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 inds/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 inds/10 km) was higher than that of Arroyo Chuchui (5.2 inds/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 inds/10 km.

Alouatta seniculus: Only observed on transects at three sites, individual encounter rates varied from 0.3-1.8 inds/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 inds/10km) were significantly different between sites (Chi-squared = 97.01, d.f.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.

Ateles chamek: Individual encounter rates were also significantly different between sites for spider monkeys (Chi-squared = 357.95, d.f.7, p<0.001). Both group (0.1 - 0.3 grps/10km) and individual (0.3-2.3 inds/10km) encounter rates were low for all sites considered except Arroyo Chuchui, where individual encounter rates reached 11.5 inds/10km 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 Oquiriquia (23.5 kg/10 km) were relatively low.

Discussion

Primate diversity within the Rios Blanco y Negro Wildlife Reserve, at seven species, appears typical of other protected areas in eastern lowland Bolivia (Braza and Garcia, 1988; Garcia 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 Garcia, 1988; Wallace *et al.*, 1998; this study). Nevertheless, in the Lago Caiman region *C. brunneus* is present on the Brazilian side of the Iteñez 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 forest where it is found at relatively low densities (Wallace

Table 2. Primate diversity, group (and individual) encounter rates (per 10km), and primate biomass encounter rates at eight sites within the Rios Blanco y Negro Wildlife Reserve, Santa Cruz Department, Bolivia.

Species	Perseverancia	Pajaral	Arroyo Chuchui	San Martin	Rio Negro de Caimanes	San Luis	Oquiriquia	El Tutumo
Callithrix melanura	0.2 (1.9)	*	0.2 (1.8)	0.1 (0.1)	0.2 (0.6)	0.1 (0.5)	0.5 (2.8)	0.1 (0.4)
Aotus azarae	1.1 (2.2)	0.6 (1.2)	3.0 (5.2)	0.9 (1.8)	*	0.4 (0.8)	*	1.4 (7.4)
Saimiri boliviensis	*	0.7 (9.8)	-	-	0.2 (4.9)	-	-	*
Cebus apella	0.7 (8.3)	1.6(14.7)	1.3 (14.0)	0.9 (6.2)	1.5 (9.0)	0.6 (4.4)	1.2 (7.4)	0.8 (6.3)
Alouatta caraya	-	*	-	-	-	-	-	-
Alouatta seniculus	*	0.1 (0.3)	0.4 (1.8)	-	0.3 (1.2)	-	-	-
Ateles paniscus	0.2 (1.6)	0.1 (0.7)	1.8 (11.5)	0.3 (2.3)	*	0.1 (0.3)	0.1 (0.3)	0.1 (1.6)
Total Species	5	7	5	4	6	4	4	5
PBER (Kgs/10km)	38.2	57.2	148.2	37.2	36.5	15.3	23.5	37.1

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

et al., 1998). The black howler monkey (*Alouatta caraya*) also appears to be restricted to certain habitats, mainly semideciduous forests. The restrictive use of habitats by this genus may be due to the floristic composition of the forests, and/or poor nutrient background of the soils, which may limit folivory as a dietary niche (Wallace *et al.*, 1998). These factors are certainly important in explaining variations in *Alouatta* abundance in lowland Brazilian Amazonia (Peres, 1997).

Apart from the presence or absence of *Saimiri* and *Alouatta* spp., primate community structure also varied in the relative abundances of the more widespread species: *Callithrix*, *Aotus*, *Cebus* and *Ateles*. Although encounter rates varied for *Callithrix*, they were rare at all sites, indicating low population densities for this region. The variations in *Aotus* encounter rates should be treated with some caution, as censuses were run during different phases of the moon at different sites. *Aotus* are more conspicuous around the full moon due to increased calling behavior (pers. obs.). *Cebus* encounter rates also varied and capuchins were the most commonly encountered diurnal primate at all visited sites. Previous studies have demonstrated a considerable adaptability in habitat use by *Cebus apella* and have suggested that this is linked to their generalist diet (Terborgh, 1983). This adaptability may account for their numerical dominance at the sites considered here.

Due to their superior body weight, spider monkey density variations account for much of the variation in overall primate biomass encounter rates. *Ateles* were infrequently encountered at most sites, suggesting that typically spider monkey population densities are relatively low for this region. Arroyo Chuchui features markedly high *Ateles* encounter rates and is characterized by the presence of rocky escarpments that result in a local diversity of forest habitats. Surveys conducted at Lago Caiman in Noel Kempff Mercado National Park (Wallace *et al.*, 1998) revealed a high primate biomass encounter rate (109.4 kg per 10 km censused) which was also due to increased *Ateles* encounter rates (see Table 3). Lago Caiman features a prominent quarzite escarpment, again resulting in local habitat diversity. We suggest that local habitat diversity provides an abundance of fruit resources at differing times of the year, resulting in increased *Ateles* densities. Phenology results and ranging patterns from a recent long-term autoecological study on *Ateles* at Lago Caiman support this hypothesis (Wallace, 1998).

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 many of the sites where logging activities were occurring (e.g., San Luis, Oquiriquia), 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*, *Spondias mombin*, *Ficus* sp., *Ampelocera ruizi* (Wallace and Painter, unpubl.). In the long term, significant reductions in the densities of important frugivore resources could prove limiting to wildlife populations.

Table 3. Diurnal primate encounter rates (per 10 km) for the Beni Biosphere Reserve, Bosque Chimanes, and Noel Kempff Mercado National Park.

	Beni Biosphere Reserve[1]		Bosque Chimanes[2]		Noel Kempff Mercado[3]	
Species	Group ER	Individual ER	Group ER	Individual ER	Group ER	Individual ER
Callithrix melanura	-	-	-	-	0.1	0.2
Saimiri boliviensis	0.6	20	1.7	36.4	-	-
Cebus apella	1.2	14.1	3.7	31.4	1.1	8.6
Alouatta seniculus	0.4	1.7	0.9	4.0	-	-
Ateles chamek	0.3	0.8	0.2	0.5	1.9	10.6
PBER		72.8		146.9		109.4

PBER = Primate Biomass Encounter Rate.

Source: Adapted from [1]Painter *et al.*, 1995, [2]Rumiz and Herrera, 1994 and [3]Wallace *et al.*, 1998

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 cracids (Townsend *et al.*, in prep.). Although primates are rarely hunted by logging crews in this region (Solar, 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.

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Short Articles

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

Patrícia G. Guedes
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Juliana A. G. da Silva
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Introdução

O gênero *Alouatta* Lacépède, 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 folívora-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 ao Ceará. 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, estes 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 (UFC M018) e Cinta da Boa Vista (UFC M019), no Município de Ibiapina, vizinho ao município de São Benedito. Estão localizados na Chapada da Ibiapaba, uma região caracterizada como um brejo-nordestino com floresta de mata-úmida relictual devido à altitude e posição geográfica próxima ao litoral. A região é considerada como um interessante remanescente de Mata Atlântica - no entanto, várias áreas vêm sendo, 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 sugeria 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 (Bonvicino *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 (UFC), foi doado por moradores da região e consta de dois crânios, suas respectivas mandíbulas e um hióide, sendo um indivíduo adulto (UFC M018) e um jovem (UFC M019). Os exemplares apresentam os caracteres diagnósticos e medidas cranianas semelhantes aos listados por Gregorin (1996) para a espécie *A. b. ululata*, principalmente no que diz respeito à morfologia do aparato hióide. Este autor apresenta uma proposta que eleva a subespécie *A. belzebul ululata* ao *status*

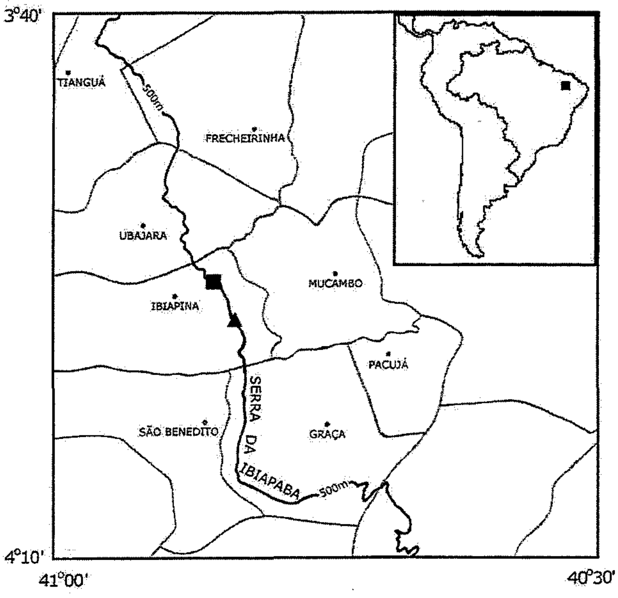

Figura 1. Mapa da região da Chapada da Ibiapaba, ilustrando os novos registros de *Alouatta*: Ladeira do Mucambo (UFC M018) e Cinta da Boa Vista (UFC M019), Município de Ibiapina (Ceará).

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. belzebul* 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. belzebul* e *A. discolor* habitam a floresta equatorial amazônica, *A. ululata* habita uma vegetação aberta de transição com uma alta freqüência 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 corrobora a hipótese da existência pretérita, 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 originalmente 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, atraindo a atenção para a alarmante escassez de informações sobre estes primatas e seu *status* de conservação.

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NOVA OCORRÊNCIA DE *BRACHYTELES ARACHNOIDES* NO PARQUE ESTADUAL DA SERRA DO MAR, SÃO PAULO, BRASIL

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Marco Aurélio Ferreira 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; Martuscelli *et al.*, 1994; Oliveira *et al.*, 1996; Auricchio, 1997). Em duas ocasiões em julho de 1999 pudemos observar um grupo de mono-carvoeiros, a apenas 300 metros da movimentada primeira pista da rodovia dos Imigrantes, no Núcleo Cubatão, Parque Estadual da Serra do Mar. Os avistamentos foram feitos na Subestação n.53 (estação de energia) em uma estrada vicinal desta rodovia, chamada pelos moradores locais como "Estrada de Serviço" a 250-300m de altitude.

O Parque Estadual da Serra do Mar estende-se do litoral norte do Estado de São Paulo, a partir da divisa com o Rio de Janeiro, até os municípios de Peruibe e Pedro de Toledo, no sul. Com 315.390 há, é o maior parque estadual 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 planalto, 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 entrecortada pelas rodovias que interligam as Regiões Metropolitanas de São Paulo e da Baixada Santista - Caminho do Mar, Anchieta e Imigrantes - 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 muriqui já foi avistado (Martuscelli, 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 a nordeste. No dia 16 de julho um grupo de cerca 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 nesta 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 aparecerem 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 freqüentemente, 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 segurarem-se uns nos outros para formar uma espécie de "ponte" entre uma árvore e outra mais afastada, para que os filhotes possam atravessar sobre eles. Um outro morador do local, diz que vê freqüentemente os muriquis, nas redondezas do "Cachoeirão", uma queda d'água formada pela descida do Rio Passariúva, a cerca de 2,8 km da subestação. Segundo os entrevistados, não há relatos de caçadores na região.

A presença desta espécie na região era 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 área, 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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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.*, in prep.) with relaxed or avoidant 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.*, 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 (Emlen and Oring, 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 (RCB) observed an adult female immigrant to the Baizar/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., Pope, 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 over limiting resources or infanticide). Tracing these evolutionary routes has significant implications for *Alouatta* 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 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. pigra.* Wrangham (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.,* 1998; 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 dispersion 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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UPDATE ON THE STATUS OF THE MARGARITA ISLAND CAPUCHIN, *CEBUS APELLA MARGARITAE*

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Eladio Márquez

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 Marquez (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, Tragaplata 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 effect 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 to have had a pet monkey. When we found a pet we recorded its age, sex, procedence 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 juvenile female, and one adult female (reported 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$270. 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 deam 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-

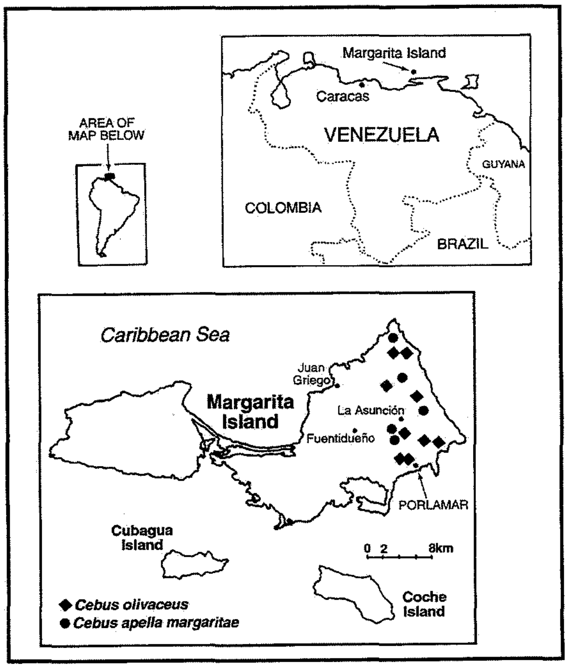

Figure 1. Margarita Island, Venezuela. Locations where *Cebus* monkeys were being kept as pets. Map by Stephen D. Nash.

larity of the *margaritae* monkey to *C. olivaceus* and the presence of the unknown blood parasite in all the samples requires further studies to evaluate the risks 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. margaritae* during our interview with the local officer from the Ministry of Environmental Resources, but if feral 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. margaritae*, 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, have resulted in widespread habitat fragmentation, the consequences of which have yet to be assessed (Ottocento *et al.*, 1989; Marquez and Sanz, 1992). There is an urgent need for effective protection and management of the Cerro El Copey and Matasiete 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. margaritae* 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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PRIMATE RECORDS FROM THE POTARO PLATEAU, WESTERN GUYANA, INCLUDING THE FIRST FOR *CEBUS ALBIFRONS* EAST OF THE RIO BRANCO, BRAZIL

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Shawn Lehman, Mireya Mayor
Everton Henry, Paul Benjamin
Michael McGarrill and Ruford Nagala

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 Potaro Plateau, Guyana, a 1,165 km^2 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; 1594 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 km^2 to 580.16 km^2; 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-falls 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°59N, 59°34W), Tappa airstrip (04°54 N, 59°45 W), Conrad's mining camp (04°59N, 59°39W), Menzie's 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

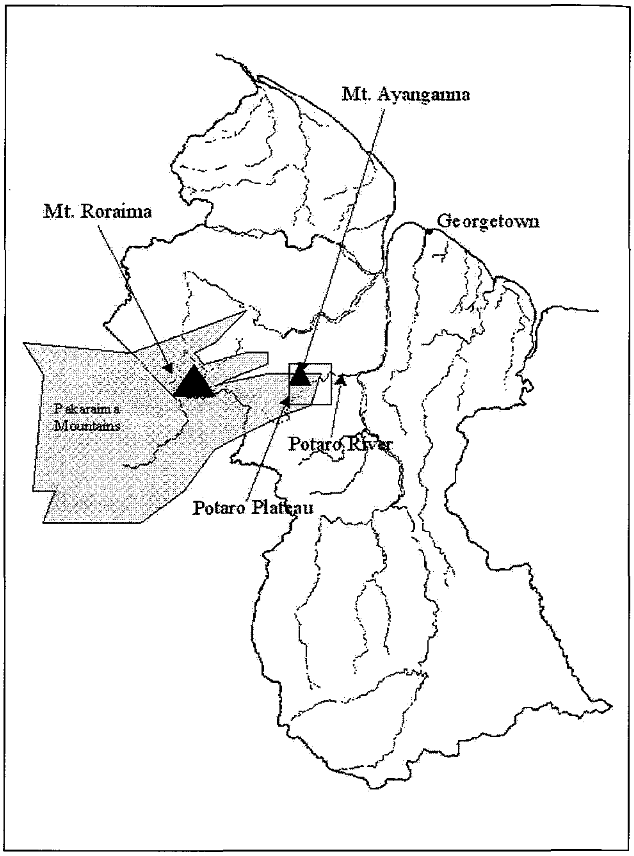

Figure 1. Location of the Potaro Plateau and other places mentioned in the text.

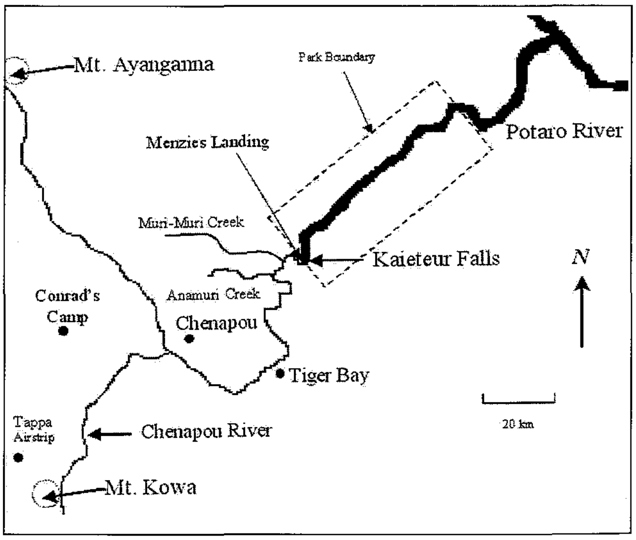

Figure 2. Location of study sites on the Potaro Plateau.

(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 (*Alouatta 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 60m, 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 Amamuri 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 Hershkovitz, 1949; Eisenberg, 1989; Kinzey, 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 people 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 informants 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 (*Potus flavus*) (see Roussillhon, 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 informants 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 Kaieteur 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 informants. 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 informants 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 neccasarily 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 (*Tayassu pecari* and *T. tajacu*) and tapir (*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 (Kinzey *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.

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

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 Kinzey *et al.* (1988) from neighbouring eastern Bolívar 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 *Saguinas 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; Kinzey, 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 Guyanese 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 very severe forest fires in the region in early 1998, see Hammond and ter Steege, 1998; Schulze, 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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SURVEY OF *ALOUATTA PALLIATA* AT THE BILSA BIOLOGICAL RESERVE, NORTH-WEST ECUADOR

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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 km^2 (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 (Wolfheim, 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 colour 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 Esmereldas, 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 (Brame, 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 fairly 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 10th September), the average temperature was 21.6°C. The maximum temperature recorded during that time was 27.5°C and the minimum

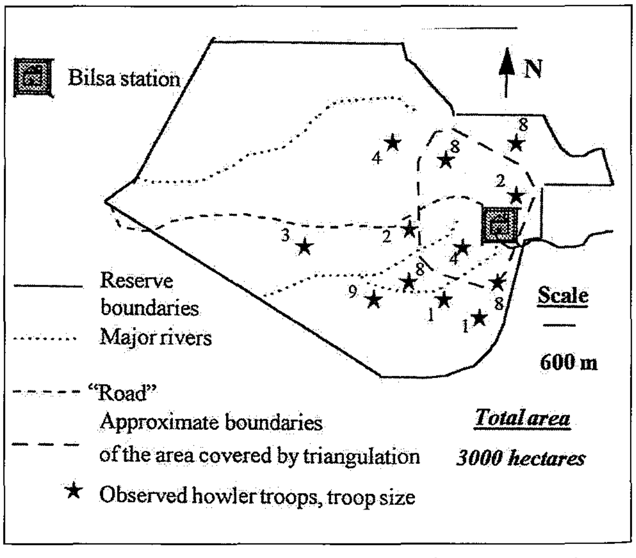

Figure 1. Map of the Bilsa Biological reserve, from Carlos Aulestia.

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 km^2. 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.

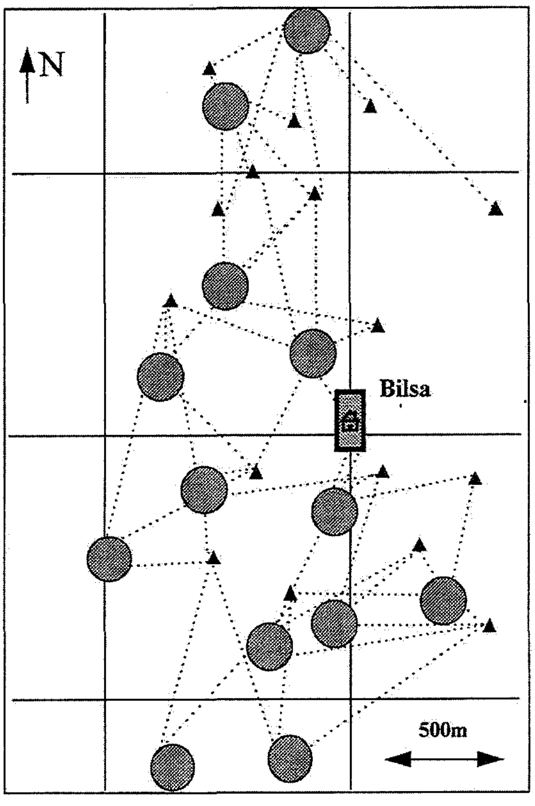

Figure 2. Results of the triangulation. Triangles represent listener pairs. Circles represent howler troops. Doted lines represent directions allowing to locate howler troops. As an example, the troop located at the top of this map as been heard by six listener pairs at the same time.

The Survey: Troop Size Estimation

Troop sizes were determined by direct observations. We looked for howler troops in different randomly chosen areas. We formed three groups of two and worked in shift. One team worked from 5 a.m. to 2 p.m., one from 5 a.m. to 5 p.m., and the third from 2 p.m. to 5 p.m. As a consequence there was at least one group of observers in the field at any time of the day, and two for most of the day. Each area was surveyed for three days. The researchers walked throughout the day, with occasional stops to listen for howler calls and cracking branches that indicated monkey troops. Using troop size and composition as well as GPS position allowed identification of the different troops encountered. All observations using this method between 4 August and 10 September,1998, were recorded. Troops were studied until all observers agreed on their size. Two major observations by park guards were added to the data.

Mapping of the area and the positions of the troops used a Global Positioning System (Garmin 12). Field notes were taken on AquaScribe waterproof notebooks.

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 km^2 (Fig. 2). Troop density is therefore estimated to be 3.25 troops/km^2 in the covered area. Using N = 4.8 (SD 3.1), we estimate the density to be 15.6 individuals/km^2 (± 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/km^2 (± 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 / km^2 are common.

Table 1. *Alouatta palliata* population densities from various sites.

Site	Densities ($/km^2$)	Source
Barro Colorado Island, Panama	16.2	Collias and Southwick, (1952)
Barro Colorado Island, Panama	27-52	Carpenter (1934, 1962)
Barro Colorado Island, Panama	62.7	Chivers (1969)
Barro Colorado Island, Panama	62.6	Mittermeier (1973)
Barro Colorado Island, Panama	75.8	Smith (1977)
Barro Colorado Island, Panama	82.2-91.7	Milton (1982)
Chirique, Panama	1050	Baldwin and Baldwin (1976)
La Pacifica, Costa Rica	74.3	Heltne *et al.* (1976)
La Pacifica, Costa Rica	77	Glander (1978)
La Pacifica, Costa Rica	74.3-103.3	Clarke and Zucker (1992)
La Selva, Cosra Rica	7-15	Stoner (1994)
La Selva, Costa Rica	12-19	Fishkind and Sussman (1988)
Los Tuxlas, Mexico	23.3	Estrada (1982)
Palo Verde, Costa Rica	89.7	Rodriguez (1985)
Rio Jesus, Costa Rica 1	4.9	Sanchez Porras (1991)
Rio Jesus, Costa Rica 2	169	Sanchez Porras (1991)
Santa Rosa, Costa Rica	1.2	Freese (1976)
Santa Rosa, Costa Rica	10.1	Chapman *et al.* (1989)
Santa Rosa, Costa Rica	4.9-7.9	Fedigan *et al.* (1998)

Thus, it seems that the howler density in Bilsa 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 Mittermeier, 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, discussion with park guards as well as personal observations suggest that hunting pressure is very low or non-existent at Bilsa.

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 Bilsa. 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 Bilsa.

The floristic composition can have a profound influence on the population structure of howler monkeys. The flora of Bilsa is remarkable by the fact that it contains low 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 Bilsa 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). Bilsa 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 Bilsa. 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* has 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 (Estrada 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 Mache-Chindul Mountains, hunting and pet trade do not seem to 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 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 alimentary 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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DEMOGRAPHY OF A GROUP OF TUFTED CAPUCHIN MONKEYS (*CEBUS APELLA NIGRITUS*) AT THE ESTAÇÃO BIOLÓGICA DE CARATINGA, MINAS GERAIS, BRAZIL

Jessica Ward Lynch
José Rímoli

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 important to monitor demography of abundant and widespread species, both for comparison to those which are threatened (Hubbell and Foster, 1986) and for understanding dynamics among species in primate 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* (Izawa, 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

Table 1. Age-sex composition of a group of *Cebus apella nigritus* at the Estação Biológica de Caratinga, Minas

	July 95	Jan 96	July 96	Jan 97	July 97	Jan 98
AM	4	4	3	4	5	4
AF	7	7	7	6	6	7
SAM	3	3	2	2	1	1
SAF	0	0	1	2	6	4
JUV	10	10	11	10	6	6
INF	2	5	3	2	2	6
Total	26	29	27	26	26	28

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

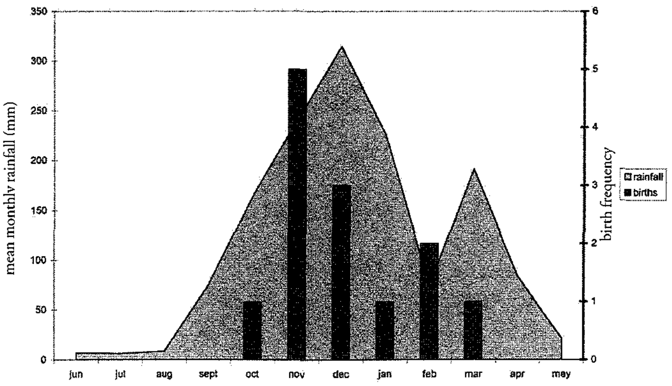

Figure 1. Capuchin births by month, compared to mean rainfall by month at EBC, from June 1995 to December 1997.

dynamics of a group of tufted capuchin monkeys (*Cebus apella nigritus*) in a fragment of Atlantic forest at the Estação Biológica de Caratinga (EBC), in Minas Gerais, Brazil.

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 aproximately 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 30-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 surriving 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 nigritus* extend the upper range of *Cebus apella* group size. *C. a. nigritus* 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 nigritus* at Iguazú, Argentina also have a birth season from October to February, during the

Table 2. Interbirth intervals for the genus *Cebus*.

Species	Mean IBI in months after infant survival (n of IBIs; range)	Mean IBI in months after infant loss (n of IBIs; range)	Source
C. apella	25 (n=1)	11.2 ±1.8 (n=5; 9-14)	Present study
C. apella	25.6 ± 3.8 (n=10; 21-35)	15.5 ±5.9 (n=4; 9-21)	Izawa, 1988, 1990, 1992, 1994a, 1994b, 1997
C. apella	22	Not reported	Robinson & Janson, 1987
C. albifrons	18	Not reported	Robinson & Janson, 1987
C. capucinus	26.9 (n=23)	16.0 (n=2)	Fedigan & Rose, 1995
C. capucinus	22 (n=7; 12.5-34)	10.7 (n=3; 9.8-11.3)	Perry, 1995
C. olivaceus	26	Not reported	Robinson & Janson, 1987

Note: IBIs reported in Robinson and Janson, 1987.

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 oerstedi*) have shown a similarly high rate of infant mortality, due to avian predation (Boinski, 1987).

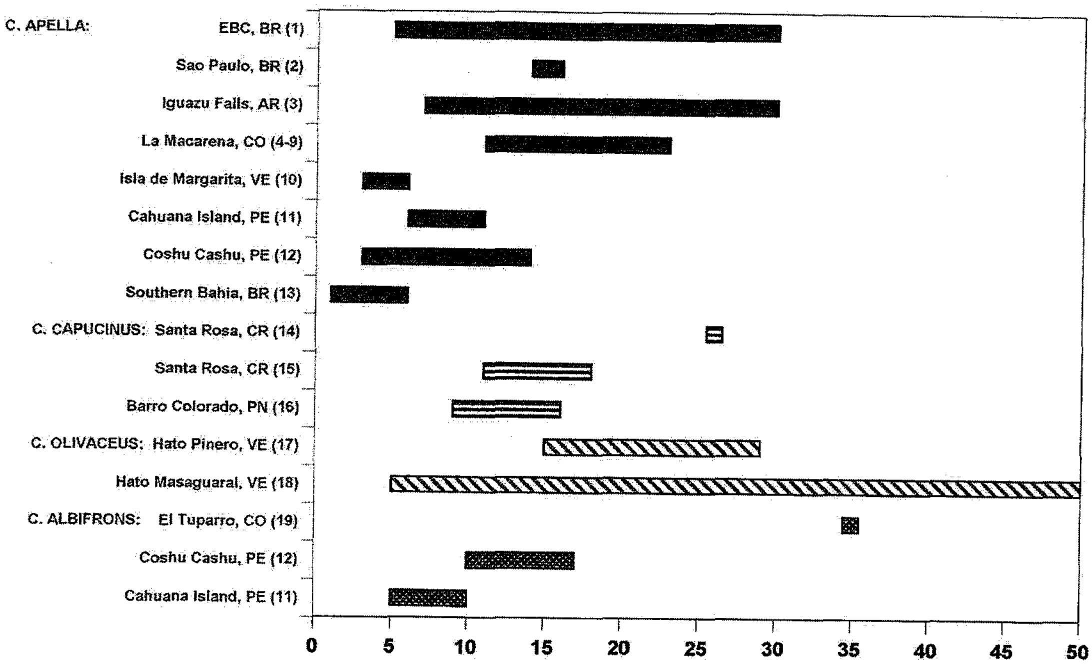

Figure 2. Group size within the genus *Cebus*.

BR=Brazil, AR=Argentina, CO=Colombia, VE=Venezuela, PE=Peru, CR=Costa Rica, PN=Panama
All bars are ranges in group size except 2, 14, and 19 which are mean group size. 14 understimates variation in group size as it is the range of MEAN group size for the population. (1) present study (2) Izar, 1999 (3) Janson, 1996 (4-9) Izawa, 1988, 1990, 1992, 1994a, 1994b, 1997 (10) Sanz and Marquez, 1994 (11) Soini, 1986 (12) Janson, 1985 (13) Pinto and Tavares, 1993 (14) Chapman, 1990 (15) Fedigan *et al.*, 1996 (16) Phillips, 1994 (17) Miller, 1996 (18) Robinson, 1998a (19) Defler, 1979. Early reports of capuchin group size are summarized in Freese and Oppenheimer, 1981.

Infant mortality in the EBC group may be the result of a combination of factors. Predators at EBC include tayras (*Eira barbara*), coatimundis (*Nasua nasua*), ocelots (*Felis pardalis*), hawks (*Buteo* spp.), caracarás (*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 (Rímoli 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 (Rímoli 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*, Valderrama *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 the other, 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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News

THE WORLD'S TOP 25 MOST ENDANGERED PRIMATES

A listing of the World's top 25 most endangered primates was published in the 17 January 2000 edition of *Time* magazine (pp.76-79). The list was prepared by Conservation International, Washington, DC, in collaboration with the IUCN/SSC Primate Specialist Group Chairman, Russell A Mittermeier, and Deputy Chairmen, William R. Konstant and Anthony B. Rylands, and released at a press conference at the National Press Building, Washington, DC, on 10 January. The press release was also attended by Primate Specialist Group members Devra G. Kleiman (National Zoological Park, Washington, DC), Karen B. Strier (University of Wisconsin, Madison) and Thomas T. Struhsaker (Duke University, Durham, North Carolina).

Of the 25 primates listed, 24 are endemic to seven of the 25 biodiversity hotspots identified for priority conservation action by Conservation International (see Mittermeier *et al.*, 1999; Myers *et al.*, 2000). The hotspots identified by Conservation 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. candidus*), 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 muriqui (*Brachyteles hypoxanthus*).

Tropical Andes: Yellow-tailed woolly monkey (*Lagothrix flavicauda*).

Guinean Forests of West Africa: Miss Waldron's red colobus (*Procolobus badius waldroni*), white-naped mangabey (*Cercocebus atys lunulatus*), Sclater's guenon (*Cercopithecus sclateri*), the drill (*Mandrillus leucophaeus*), and the Cross River gorilla (*Gorilla gorilla diehli*).

Eastern Arc Mountains and Coastal Forests of Tanzania and Kenya: Sanje mangabey (*Cercocebus galeritus sanjei*)

Indo-Burma: Delacour's langur (*Trachypithecus delacouri*), Cat Ba Island golden-headed langur (*T. poliocephalus*), grey-shanked douc langur (*Pygathrix nemaeus cinerea*), Tonkin snub-nosed monkey (*Rhinopithecus avunculus*) and Hainan gibbon (*Hylobates concolor hainanus*).

Sundaland: the Sumatran orangutan (*Pongo abelii*) and the Javan gibbon (*Hylobates moloch*).

Russell A. Mittermeier, William R. Konstant and **Anthony B. Rylands**, Conservation International, Suite 200, 2501 M Street NW, Washington, DC 20037, USA.

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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 accommodation.

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 Paraíba, 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 (Nocturnal Primate Research Group, Oxford Brookes University, Oxford, UK), Douglas Brandon-Jones (Natural History Museum, London), Thomas M. Butynski (PSG Vice Chair for Africa, Africa Biodiversity Conservation Program, Zoo Atlanta, Nairobi), Todd R. Disotell (New York University, New York), Ardith Eudey (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. Struhsaker (Duke University, Durham, North Carolina) and Ian 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 platyrrhines which resulted from the workshop will be published in the next issue of *Neotropical Primates* 8(2).

Ernesto Rodríguez-Luna, Director, Instituto de Neuroetología, 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.

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

Carla Castro 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 grasshopers (Orthoptera: Acrididae and Tettigoniidae), 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 availiable. 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. 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 strange 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 locatng mates and breeding opportunities outside of their group.

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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 subespécies recentes do gênero *Pithecia* (Primates, Atelidae) foi feita com base em caracteres de pelagem, pêlo, crânio, de pós-crânio e cariótipo. *P. aequatorialis* e *P. monachus milleri* não foram incluídos na análise devido à 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. chrysocephala*) (*P. albicans*) (*P. m. monachus, P. i. irrorata, P. i. vanzolinii*). Os resultados desta análise evidenciam o monofiletismo de *Pithecia* e que *Cacajao* é seu grupo-irmão. Os táxons setentrionais ao Rio Amazonas, *P. p. pithecia* e *P. p. chrysocephala*, 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 resolvida 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. aequatorialis* 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. chrysocephala*) (*P. albicans*) (*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. chrysocephala*), 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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COGNITIVE ASPECTS OF WITHIN-PATCH FORAGING DECISIONS IN WILD *SAGUINUS IMPERATOR*, *SAGUINUS FUSCICOLLIS*, *CALLICEBUS 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, *Callicebus 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 estimó en base a censos por transectas lineales la abundancia y densidad de *Ateles chamek* 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 innundable y bosque pie de monte en la base de la serranía de Huanchaca.

Se realizaron censos diurnos caminando un total de 289.51 km en una serie de 6 replicaciones, donde se registraron encuentros 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 centro del grupo (n = 84 encuentros) fue 6.18 grupos/km^2 o 18 individuos/km^2, que fue igual (18 individuos/km^2) a lo estimado usando las distancias individuales (n = 245). Los valores obtenidos por ambos métodos fueron muy similares de 18 a 20 individuos/km^2 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/km^2 y 11.4 individuos/km^2. 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 pie 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.

Norka Rocha, Museo de Historia Natural, Noel Kempff Mercado, Area de Mastozoología, Casilla 2489, Proyecto Bolfor, Santa Cruz, Bolivia, e-mail: < museo @museo .sczbo .com>.

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Wallace, R. 1998. The Behavioural Ecology of Black Spider Monkeys in North-eastern Bolivia, Tesis de PhD, University of Liverpool, Liverpool.

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 Febuary, 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 had 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 significnce 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 Kaemmerer, 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 availiable 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, Patrícia Vilarinho, 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* and 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 hydrids), 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 wildborn 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 Callithrichids EEP Primate TAG Husbandry 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 lanaguage - announcements, news, plans and summaries of the results of their investigations - in the section "Primates of the Americas - the Page" (see *Lab. Prim. Newsl.* 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 half a page. Please send all correspondence related to "Primates of the Americas - the Page" to: Juan Carlos Serio Silva, Department of Plant Ecology, Instituto de Ecología, 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: < serioju@ sun. ieco.conacyt.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 WEBSITE

An extensive website is now availiable on gibbons (Hylobatidae). Thomas Geissman offers an 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 reseach on the management, use, and conservation of biological resources and their enviornment, 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 Turegatan 19, 114 38 Stockholm, Sweden, Tel: (46) 8 545 818 00, e-mail: <info@ifs.se>.

FUNDAÇÃO BIODIVERSITAS – IUCN BRAZIL AND AN ADDRESS CHANGE

The Fundação Biodiversitas, President Aspásia 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 Natural Reserve in Paraná.

The Fundação has changed its address. The new address of the Fundação Biodiversitas is: Rua Ludgero Dolabela 1012, 7°. Andar, 30430-130 Belo Horizonte, Minas Gerais, Brasil, 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 to 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 primate conservation or conservation education 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.uk/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 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, Sao 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, failiures and lessons to be learned, new approaches and strategies); Tools and Techniques; Numbers in Context (graphs, charts and tables and other data with minimal text to give readers a quick accessible way to graps 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 (suggesstions) 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: <kkohm@u.washington.edu>. It is published quarterly, and subscription rates are as follows: US$30 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

Primate Communities, edited by J. G. Fleagle, C. H. Janson, and K. E. Reed, 1999, 329pp. Cambridge University Press, UK ISBN 0-521-62967-5. Price: £18.95. Comparing the communities of living non-human primates throughout the world, *Primate Communities* examines the underlying similarities and differences between the composition, behaviour and ecology of primate communities in Africa, Asia, Madagascar and South America. Focusing on the phylogenetic history, climate, rainfall, soil type, forest type, competition with other vertebrates, and human activities as it relates to primate communities, the text is an excellent source for researchers and students of anthropology, ecology and conservation. *Contents*: African primate communities: Determinants of structure and threats to survival - C. A. Chapman, A. Gautier-Hion, J. F. Oates & D. A. Onderdonk, pp.1-37; Biomass and use of resources in south and south-east Asian primate communities - A. K. Gupta & D. J. Chivers, pp.38-54; Species coexistence, distribution and environmental determinants of neotropical primate richness: A community-level zoogeographic analysis - C. A. Peres & C. H. Janson, pp.55-74; Primate communities: Madagascar - J. U. Ganzhorn, P. C. Wright & J. Ratsimbazafy, pp.75-89; Primate diversity - J. G. Fleagle, C. H. Janson and K. E. Reed, pp.90-91; Phylogenetic and temporal perspectives on primate ecology - J. G. Fleagle & K. E. Reed, pp.92-115; Population density of primates in communities: Differences in communitiy structure - K. E. Reed, pp.116-140; Body mass, competition and the structure of primate communities - J. U. Ganzhorn, pp.141-157, Convergence and divergence in primate social systems - P. M. Kappeler, pp.158-170; Of mice and monkeys: Primates as predictors of mammal community richness - L. H. Emmons, pp.171-188; Comparing communities - J. G. Fleagle, C. H. Janson and K.E. Reed, pp.189-190; Large-scale patterns of species richness and species range size in anthropoid primates - H. A. C. Eeley & M. J. Lawes, pp.191-219; The recent evolutionary past of primate communities: Likely environmental impacts during the past three millennia - C. Tutin & L. White, pp.220-236; Resources and primate community structure - C. H. Janson and C. A. Chapman, pp.237-267; Effects of subsistence hunting and forest types on the stucture of Amazonian primate communities - C. A. Peres, pp.268-283; Spatial and temporal scales in primate community structure - J. G. Fleagle, C. H. Janson & K. E. Reed, pp.284-288; Primate communities in Africa: The consequences of long-term evolution or the artifact of recent hunting? - T. T. Struhsaker, pp.289-294; The future of primate communities: A reflection of the present? - P. C. Wright & J. Jernvall, pp.295-309; Concluding remarks - J. G. Fleagle, C. H. Janson & K.E. Reed, pp.310-314. 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>.

Primate Encounters – Models of Science, Gender and Society, edited by Shirley C. Strum and Linda M. Fedigan, 2000, The University of Chicago Press. ISBN 0 226 77754 5. Price US$35. An attempt to answer the diversity of primatologies and on science in general by reflecting on the relations of both to cultural, historical and social issues. *Sections*: Introduction and History, What do the Pioneers say? The Advantages of Hindsight, A diversity of other Primatologies: Other National Traditions, Enlarging the Lens: Closely Related Disciplines, Models of Science and Society, Reformulating the Questions, Index. Includes chapters by Maria Emília Yamamoto and Anuska Irene Alencar (Some Characteristics of Scientific Literature in Brazilian Primatology) and Karen B. Strier (An American Primatologist Abroad in Brazil). *Available from:* The University of Chicago Press, 11030 S. Langley Avenue, Chicago, IL 60628, USA, Tel: (800) 621-2736, Fax: (800) 621-8476. e-mail: <kh@press.uchicago.edu>. Website: http://www. press. uchicago.edu.

Lista Vermelha das Espécies Ameaçadas de Extinção da Flora de Minas Gerais, edited by Fundação Biodiversitas, Belo Horizonte, June 2000. Fundação Biodiversitas and the Fundação Zoobotânica de Belo Horizonte, Belo Horizonte. A lista é uma ferramenta essencial para o planejamento e execução de atividades relacionadas à conservação da flora mineira, alem de alerta para a necessidade da atuação efetiva das entidades responsáveis pela conservação dessas espécies" explica Lívia Lins, bióloga e coordenadora de projetos da Biodiversitas. Das 537 espécies listadas, 221 (41%) são consideradas vulneráveis, 129 (24%) em perigo, 108 (20%) estão criticamente em perigo e 79 (15%) foram consideradas provavelmente extintas por não terem sido encontradas na natureza nos últimos 30 anos. A destruição da vegetação nativa e a coleta predatória, principalmente para fins ornamentais, são as principais causas da degradação da flora mineira. Quase todas as 27 espécies de bromélias, 31 de cactáceas e 20 de orquídeas presentes na lista possuem valor onramental e sofrem pressão de coleta indiscriminada. O mesmo ocorre com inúmeras espécies de sempre-vivas, que tem sua situação agravada por geralmente se distribuírem em uma área restrita, nos campos rupestres da Serra do Espinhaço, principalmente na região de Diamantina, maior pólo fornecedor de sempre vivas para o comércio. O pouco conhecimento existente sobre a flora mineira foi evidenciado no estudo para elaboração da lista. Um exemplo é o da pteridófita *Huperzia rubra*, incluida na lista como provavelmente extinta e que foi posteriormente encontrada no alto da Serra da Caraça. Antes de significar uma imprecisão do método, o fato indica necessidade premente de incremento dos inventários biológicas no estado. Essa preocupação já estava presente as durante a elaboração do *Atlas da Biodiversidade de Minas Gerais*, que incluiu as áreas onde ainda existem remanescentes significativas da vegetação nativa mas cujo conhecimento biológico é insuficiente. A indicação dessas áreas objetivou incentivar o direcionamento de pesquisas e prioridades aos pesquisadores e órgãos financiadores de fomento. Além de conter a lista das espécies ameaçadas, a publicação traz uma caracterização geral dos biomas e dos grandes grupos vegetais que ocorrem em Minas Gerais. O livro poderá ser adquirido na: Fundação Biodiversitas, Rua Ludgero Dolabela 1012, 7o. Andar, 30430-130 Belo Horizonte, Minas Gerais, Brasil, Tel: (0)31 292 8235, Fax: (0)31 291 7658, e-mail: < biodiversitas@ biodiversitas.org>. Home page: <www.biodiversitas.org>.

Conservation of Biological Resources, by E. J. Milner-Gulland and Ruth Mace (with contributors), 1998, 416pp, 114 illustrations. Blackwell Science, Oxford. Paperback ISBN 0 86554 2738 0. Price: £24.95. A student textbook presenting the issues surrounding the biological conservation of species and ecosystems used by humans. It is aimed at final year undergraduate and Master's level students as well conservation professionals, including managers, policy-makers and researchers. *Contents*: Part One. Introduction to Biological Conservation and Sustainable Use. Part Two. Theoretical Background. 1. The ecological and economic theory behind sustainable harvesting. 2. Harvesting and ecological realities. 3. Decision-making by users of natural resources. 4. Practical considerations when applying the theory. Part Three. Case Studies. Part Four. Making Conservation Work. Part 3 includes contributions by Kathy Mackinnon (Sustainable use as a conservation tool in the forests of South-east Asia), R. E. Gullison (Will bigleaf mahogany be conserved through sustainable use?), Vivienne Solis Rivera and Steven Edwards (Cosigüina, Nicaragua: A case study in community-based management of wildlife), Sophie des Clers (Sustainability of the Falkland Islands loligo squid fishery), Andrew Price, Callum Roberts and Julie Hawkins (Recreational use of coral reefs in the Maldives and Caribbean), Joel Freehling and Stuart A. Marks (A century of change in the Central Luangwa Valley of Zambia), M. Norton-Griffiths (The economics of wildlife conservation policy in Kenya), Tom Butynski and Jan Kalina (Gorilla tourism: A critical look), Anne Gunn (Caribou and muskox harvesting in the Northwest Territories), and Leonid Baskin (Hunting of game mammals in the Soviet Union). *Available from*: Anna Van Opstal, Blackwell Science Ltd., Osney Mead, Oxford OX2 0EL, UK, Tel: +44 (0)1865 206206, Fax: +44 (0)1865 721205. Website: http:// www.blackwell-science.com>.

Developing a Social Psychology of Monkeys and Apes, by John Chadwick-Jones, 1998. 208pp. Psychology Press, London. Hardback ISBN 0 86377 820 8. Price: £29.95. *Contents*: Introduction: social psychology and primates; Intentionality, deception and social intelligence; Primate communication and social psychology; Facial expressions; Gestures, postures and touch; Vocal signals: apes; Vocal signals: monkeys; Tactics and social devices; Social exchange and grooming partnerships; Sexuality in monkeys and apes; Dominance and social relationships; Primate studies and social psychology.

Appendices. *Available from*: Afterhurst Ltd. Mail Order Service, c/o The Book Ordering Dept., Taylor and Francis Ltd., Rankine Road, Basingstoke, Hants RG24 8PR, UK, Tel: +44 (0)1256 813000, Fax: +44 (0)1256 479438, e-mail: <book.orders@tandf.co.uk>.

Species Coexistence, by M. Tokeshi, 1998, 464pp. 159 illustrations. Blackwell Science, Oxford. Paperback ISBN 0 86542 744 5. Price: £37.50. *Contents*: Introduction: conceptual threads; Origination: the basis of coexistence; Origination and evolution of communities; Patterns in species richness: temporal dimension; Patterns in species richness: spatial dimension; The niche, resources and species assembly; Niche apportionment and relative abundances of coexisting species; Competition, co-operation and coexistence; Agent-mediated coexistence: predation and disturbance; Patchiness, heterogeneity and stochasticity; Traits and coexistence; Stability and conservation of coexisting species; Concluding remarks. *Available from*: Anna Van Opstal, Blackwell Science Ltd., Osney Mead, Oxford OX2 0EL, UK, Tel: +44 (0)1865 206206, Fax: +44 (0)1865 721205. Website: http:// www.blackwell-science.com>.

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, Cercopithecoidea, 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 primatology. *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 and or www.cup.org>.

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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@hq.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 on Nonhuman Primate 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: <ausborne@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: Professor Silvana Borgognini Tarli, Dipartimento di Etologia, Ecologia, Evoluzione, Via Volta, 4-56126 Pisa, Italy, Tel: (050) 24613 or (050) 44484, Fax: (050) 24653, e-mail: <borgognini@discau.unipi.it>. Home Page: <http://www.unipv.it/webbio/api/cong14/14con.htm

II Congresso Brasileiro de Unidades de Conservação, 5-9 de November 2000, Centro de Convenções de Campo Grande, Mato Grosso do Sul, Brazil. Commemorating 60 years after the creation of the Brazils 1st National Park. For more information contact: Fundação O Boticário de Proteção à Natureza, Av. Rui Barbosa 3450, Afonso Pena, 83065-260 São José dos Pinhais, Paraná, Brazil, Tel: (041) 382 3456, Fax: (041) 382 4179, E-mail: fundacao@fbpn.org.br. Home Page: <http://www.fbpn.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 Rossbach, Department of Veterinary Medicine, Deutsches Primatenzentrum, 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 3330.

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/management 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>

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British Ecological Society '2000' Winter Meeting, 3-5 January 2001, University of Birmingham, England, UK. For more information: British Ecological Society, 26 Blades Court, Deodar Road, Putney, London SW15 2NU, England, UK.

XVIIIth Congress of the International Primatological Society, 7-12 January 2001, Adelaide, Australia. Hosted by the Australasian Primate Society, President Mr. John Lemon, Western Plains Zoo, Dubbo, NSW. Theme: "Primates in the New Millenium". 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: <satconv@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 disharmonic floras and faunas; 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, P.O. Box 600, Wellington, New Zealand. The complete scientific program will be available on the conference website by 15 November 2000.

14th Annual Meeting of the Society for Tropical Ecology, 14-16 February 2001, Zentrum für Marine Tropenökologie (Center for Marine Tropical Ecology), Bremen, Germany. Topics: Aquatic ecosystems, Neotropics, Interdisciplinary research. Free topics in tropical ecology. Contact: Zentrum für Marine Tropenökologie, Fahrenheitstr. 1, D-28359 Bremen, Germany, Tel: +49 421-2380-029, Fax: +49 421-2208-330, e-mail:< gtoe2001@zmt.uni-bremen.de>. Homepages: <http://www.gtoe.de>, <http://www.uni-bremen.de>.

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: "Interfacing Behaviour with Other Disciplines". For more information: Prof. F. A. Huntingford, Division of Environmental and Evolutionary Biology, Graham Kerr Building, Glasgow University, Glasgow G12 8QQ, Scotland, UK, Tel: +44 (0)141 330 5968, Fax: +44 (0)141 330 5971, e-mail: <f.huntingford@bio.gla.ac.uk>.

The First International Conference on Distance Sampling, 30 July-3 August, 2001. St. Andrews School, Scotland. Organized by Rhona Rodger. Theme: Estimating Wildlife Abundance Ecology, Management and Conservation Tel: +44 (0)133 446 3228, e-mail:<rhona@dcs.st-and.ac.uk>, Homepage:<http://www.ruwpa.st-and.ac.uk/icods/>.

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 Rodríguez-Luna**, Instituto de Neuroetología, Universidad Veracruzana, Apartado Postal 566, Xalapa 91000 Veracruz, México. Tel: 281 8-77-30, Fax: 281 8-77-30, 8-63-52, e-mail: <saraguat@speedy.coacade.uv.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.uv.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 platyrrhines. 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:

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

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