ISSN 1413-4703

NEOTROPICAL PRIMATES

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

Volume 13
Number 3
December 2005

CONSERVATION INTERNATIONAL

SPECIES SURVIVAL COMMISSION

CENTER FOR APPLIED BIODIVERSITY SCIENCE AT CONSERVATION INTERNATIONAL

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

Center for Applied Biodiversity Science
Conservation International
2011 Crystal Drive, Suite 500, Arlington, VA 22202, USA

ISSN 1413-4703 Abbreviation: *Neotrop. Primates*
DOI: 10.1896/ci.cabs.2005.np.13.3

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Front cover: A juvenile *Ateles belzebuth* from the Peruvian Andes. Photo by Russell A. Mittermeier.

This issue of *Neotropical Primates* was kindly sponsored by the Margot Marsh Biodiversity Foundation, 432 Walker Road, Great Falls, Virginia 22066, USA, and the Los Angeles Zoo, Director John R. Lewis, 5333 Zoo Drive, Los Angeles, California 90027, USA.

SHORT ARTICLES

POPULATION SURVEY OF THE AZUERO HOWLER MONKEY (*ALOUATTA PALLIATA TRABEATA*) IN HERRERA PROVINCE, REPUBLIC OF PANAMA

Pedro G. Méndez-Carvajal

Introduction

The taxonomic identity of the Azuero howler monkey has been controversial. Lawrence (1933) initially described this taxon as a subspecies of *A. palliata*. In 1987, Froehlich and Froehlich analyzed the fingerprint pattern of different species of howler monkeys as a proxy to infer genetic distance. They concluded that *A. p. coibensis* should be considered a distinct species, *A. coibensis*. In this analysis they also found *A. p. trabeata* to be closer to the *coibensis* form than to other *A. palliata* forms, and suggested that this taxon be a subspecies of *A. coibensis*. Cortés-Ortiz *et al.* (2003) carried out genetic studies (mitochondrial DNA) of howler monkeys along their entire geographic range and, inferring the phylogenetic relationships among the species, they concluded that both *trabeata* and *coibensis* share mitochondrial haplotypes with other forms of howler monkeys in Central America (*coibensis* with *mexicana* and *palliata*, and *trabeata* with *aequatorialis*), supporting the initial classification of Lawrence, and suggesting that they are at best subspecies of *A. palliata*.

The original distribution of the Azuero howler monkey covered most of the Azuero peninsula in Panama, including portions of the provinces of Veraguas, Herrera and Los Santos (Méndez, 1970; Froehlich and Froehlich, 1986, 1987; Arauz, 1998; Méndez, 1999). This subspecies is an endemic taxon under high risk of extinction if the present trends of forest destruction continue (Rodríguez-Luna *et al.*, 1996; Rylands *et al.*, 2000; Méndez, 2002).

In order to better understand the current status of the Azuero howler monkey, I conducted a survey in the northern part of its range in the province of Herrera (Fig. 1). Demographic and behavioral data were recorded, as well as the quality of the habitat in the area. I also used the information collected on these howler monkeys to initiate an education program with local people aiming at the conservation of this primate in Azuero.

Study site

The Azuero peninsula is in southwestern Panama. The annual average temperature is 28.1°C (22.5°C to 33.7°C) and annual rainfall averages 1,410 mm/year (Contraloría General de la República, 2001). The dry season is from December to April and the rainy season from May to December (Suárez, 1981). The area surveyed was quite flat with small hills of 90 to 150 m (Méndez, 2001). Remnant forest can be found on the hilltops and along the rivers. The tallest trees are about 15 to 20 m high (Méndez, 2001). There is only one patch of forest that the farmers have left more or less untouched. The landscape in the region is mostly grassland and cattle pasture, with a few fragments of forest, some of them connected by narrow strips of trees and sparse riparian forest.

Methods

I first traveled through the region (15 towns) asking local people about the presence of monkeys in order to get some understanding of the location of the howler populations. Fieldwork was subsequently conducted for five consecutive days each month, from April to December 2001. I surveyed all the trails and roads between the towns of Ocú and Parita (Fig. 1), from 6:00 am to about 2:00 pm. On finding a group of monkeys, I recorded their location, the number of individuals and the composition (following Milton, 1982), and also noted aspects of their behavior and the quality of the habitat. I spent as much time as I could observing the behavior of the group and whenever possible following and recording the activities of particular individuals I was able to identify. Remaining with the group until the howlers vocalized made it possible to detect other groups in the vicinity. When hearing other groups, I recorded the compass bearing, inferred the distance, and went in search of them. Care was taken not to double-count groups or individuals.

Results

Three hundred and sixty hours were spent in fieldwork. Thirty percent of this time was devoted to searching for the howler monkeys and the remaining 70% was dedicated to accompanying the groups, identifying sex-age composition, and conducting direct observations on behavior. In total I visited 15 towns and their surrounding areas, along 24 linear kilometers (Fig. 1, Table 1). Howler monkeys were found around only three of the towns: Santa Mónica, Llano Grande, and Llano Hato. Eleven howler monkey groups were located. In Santa Mónica I also found captive monkeys of two other species, *Cebus capucinus* and *Saguinus geoffroyi,* that were taken from Eastern Panama (Cerro Azul and Darien respectively). In the town of Camaron (Fig. 1) I was told of an introduction of a male howler monkey that was brought from La Chorrera, in the Panama Canal area, and therefore *A. p. aequatorialis.* However, I was unable to find any howler monkeys in that area. Local people also reported a case when a howler monkey was hunted and eaten in the town of Pedregosito (Fig. 1).

I counted 119 howler monkeys in five groups by direct observations. The average size of the groups was 23.8 (range 15–39) individuals. Six more groups were heard but never found in a forest of approximately 400 ha between the towns of Llano Grande and Llano Hato. The forest around Santa Mónica totaled approximately 245 ha in two patches of forest and a riparian forest corridor. All these forest fragments are surrounded by grassland. In total I estimated 262 howler monkeys in the area between Ocú and Parita towns, in the central part of Herrera Province. Population density in the area was calculated to be 40.6 individuals/km² and 1.7 troops/km². The average sex-age composition of the groups was 6.0 adult males, 7.8 adult females, 6.6 juveniles and 3.4 infants. Female/male and immature/female ratios were 1:1.3 and 1:1.39 respectively (Table 2).

Habitat use

At least in this part of the Azuero peninsula, the howler monkeys showed no strong preference for any particular types of forest. Our observation did, however, demonstrate their attachment to certain trees. On some occasions we watched them spend up to 60% of the day in the same group of trees (*Enterolobium cyclocarpum*, *Bursera simaruba*, *Ficus yoponensis* and *Spondias mombin*) in the middle of the thin lines of trees that separate cattle ranching properties. According to local people, the monkeys sometimes use wire fences to travel from one tree to another, and even run through the grassland to reach other trees. They evidently have a taste for mango fruits (*Mangifera indica*), a very common introduced tree in Panama. Table 3 gives a list of trees that were used by howler monkeys (as food or to rest in) during the survey. The majority of the tree species reported in this survey have also been reported by other authors as sources of food for howler monkeys in different localities (e.g., Milton, 1982; Terborgh, 1983).

Discussion

I estimated 262 individual howler monkeys in 11 troops living in highly fragmented forest and along the sparse corridors of trees which customarily delineate properties in central Herrera Province. In general, the land use in the area is a fine-grained mosaic, with small forested areas interspersed with crops and enormous areas of grassland and cattle pasture. People take wood from the forest patches and hunt deer, rabbit, and armadillo in them. Although local people did not admit to hunting howlers, I did witness one

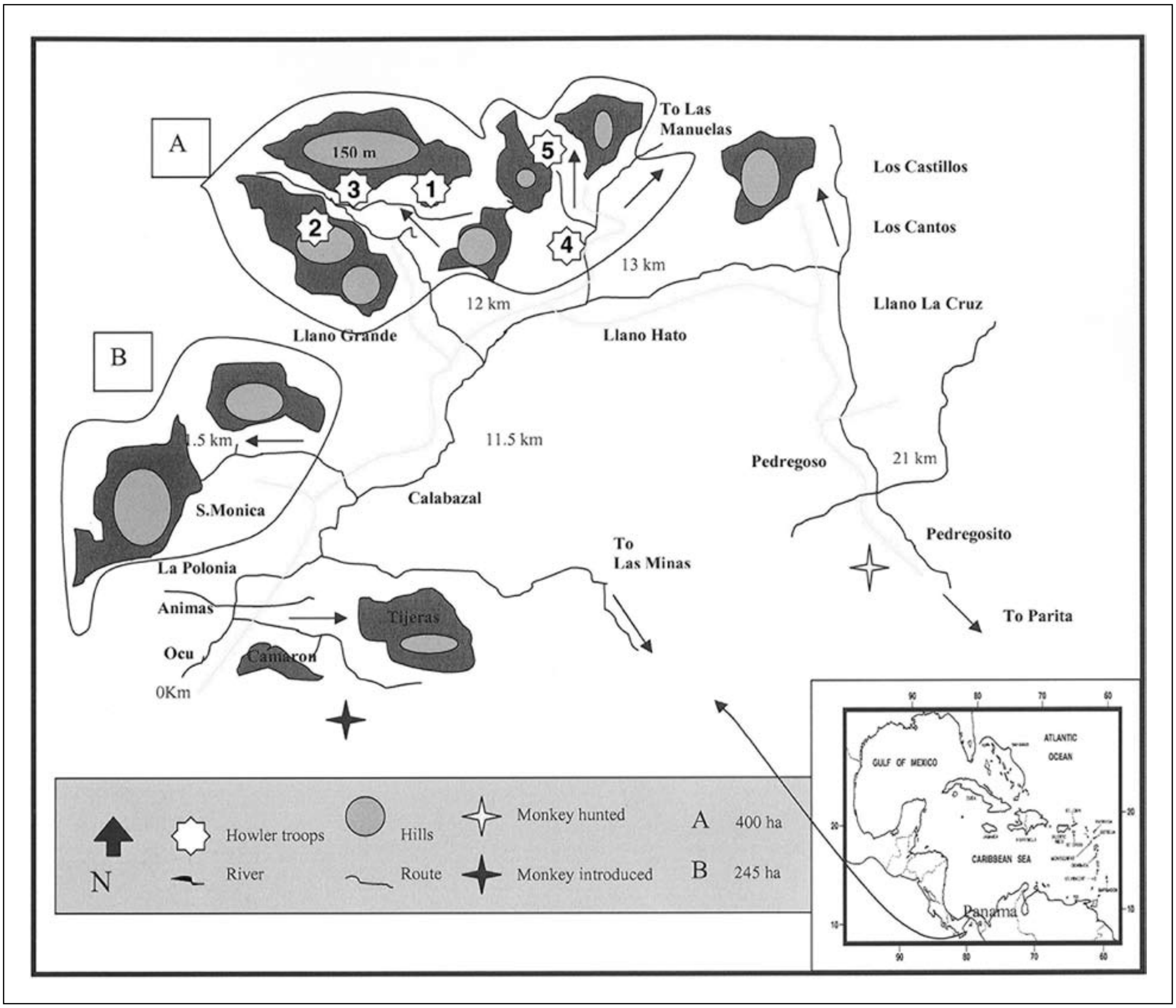

Figure 1. Location of the towns between Ocú and Parita, Azuero, Herrera Province, Republic of Panama.

case where an individual was hunted and eaten. This part of the range of the Azuero howler monkey is not protected in any way by the National Environmental Authority (*Autoridad Nacional del Ambiente* – ANAM) and yet is one of the few lowland areas in the region that still has forest patches large enough (645 ha in total) to hold small numbers of groups of howler monkeys.

Despite the fragmentation of their habitat, the howler monkeys in the region have a robust and healthy appearance, suggesting that they are not lacking in food. There is a good variety of trees in the patches of forest that the howlers can exploit as food sources (Table 3), and some of the trees left standing to delineate properties are mature and evidently appear to be providing sufficient food and shelter. Furthermore, the howlers are able to eat fruits from species such as mango trees that have been introduced, likely an important supplement to their diet, or even a mainstay at certain times of the year.

The presence of juveniles and infants suggests that the population is growing. Average group size for *A. p. trabeata* in this region of Herrera was similar to that of other populations of howler monkeys studied in Azuero (Brandaris, 1983) and in Barro Colorado Island, Panama (Carpenter, 1934; Milton, 1982). The large number of individuals per group may be a consequence of the impossibility of dispersal among fragments. When howler monkeys cross

Table 1. Localities, distance and the presence of Azuero howler monkeys during the survey in Herrera Province. *We found *Saguinus geoffroyi* and *Cebus capucinus* in captivity. (h) = hearing; (o) = observed.

Town	Linear distance from Ocú (km)	Habitat	No. of monkeys estimated by local people	Number of troops identified
Ocú	0	Human settlements	0	0
Las Animas	1.5	Human settlements	0	0
La Polonia	10	Human settlements, riparian forest	0	0
El Calabazal	11	Human settlements, riparian forest	?	0
Santa Mónica	11.5	Human settlements, riparian forest, forest fragment	30–35	2(h)
Llano Grande	12	Human settlements, riparian forest, forest fragment, grassland	20	5(h) 3(o)
La Chavarría-Pesé	12.5	Human settlements, riparian forest, forest fragment, grassland	1	0
Llano Hato	12.5	Human settlements, riparian forest, forest fragment, grassland	40	4(h) 2(o)
Llano de la Cruz	14	Human settlements, riparian forest.	3	0
Los Cantos-Parita	22.4	Human settlements, riparian forest, forest fragment on a hill	2	0
Los Castillos-Parita	24.9	Human settlements, riparian forest, grassland	12	0
Pedregoso-Pesé	21	Human settlements, riparian forest, forest fragment	0	0
Pedregosito-Pesé	23	Human settlements, riparian forest, grassland	1	0
Camaron	5	Human settlements, Forest Reserve	-	
Tijeras	8	Hill	-	11(h) 5(o)

Table 2. Social structure of Azuero howler monkey troops observed in Santa Mónica, Llano Grande and Llano Hato, Herrera Province. Classification according to Milton (1982).

Troops	Male	Female	J3	J2	J1	I3	I2	I1	Total
T-1	5	6	1	1	0	0	1	1	15
T-2	4	5	3	3	2	0	0	1	18
T-3	10	10	8	5	1	1	1	3	39
T-4	7	11	3	1	1	1	1	1	26
T-5	4	7	3	1	0	0	1	5	21
Totals	30	39	18	11	4	2	4	11	119
Average	6.0	7.8	3.6	2.2	0.8	0.4	0.8	2.2	23.80
%	25.2	32.8	15.1	9.2	3.4	1.7	3.4	9.2	100

Table 3. List of tree species used by Azuero howler monkeys and collected in Herrera Province. * = monkeys eating from these trees during the survey.

Common name	Scientific name	Family
Espavé*	*Anacardium excelsum*	Anacardiaceae
Mango	*Mangifera indica*	Anacardiaceae
Malagueto hembra	*Xylopia aromatica*	Annonaceae
Malagueto macho	*Xylopia frutescens*	Annonaceae
Caracucha	*Plumeria* sp.	Apocynaceae
Lagartillo	*Sciadodendron excelsum*	Araliaceae
Palma negra	*Astrocaryum standleyanum*	Arecaceae
Uvito	*Bactris major*	Arecaceae
Barrigón*	*Pseudobombax septenatum*	Bombacaceae
Indio desnudo*	*Bursera simaruba*	Burseraceae
Guarumo	*Cecropia peltata*	Cecropiaceae
Camaroncillo	*Hirtella racemosa*	Chrysobalanaceae
Sastra	*Rheedia* sp.	Clusiaceae
Guachapali	*Albizia guachapele*	Fabaceae
Harino	*Andira inermis*	Fabaceae
Corotú*	*Enterolobium cyclocarpum*	Fabaceae
Bobo	*Erythrina fusca*	Fabaceae
Liana	*Erythrina* sp.	Fabaceae
Sigua	*Ocotea dendrodaphne*	Lauraceae
Nance	*Byrsonima crassifolia*	Malpighiaceae
Pasmo hediondo	*Siparuna guianensis*	Monimiaceae
Higuerón*	*Ficus insipida*	Moraceae
Higuerón*	*Ficus yoponensis*	Moraceae
Guayabo de montaña	*Eugenia* sp.	Myrtaceae
Arbol carne	*Roupala montana*	Proteaceae
Jagua	*Genipa americana*	Rubiaceae
Naranjo	*Citrus sinensis*	Rutaceae
Mamón*	*Melicoccus bijugatus*	Sapindaceae
Guázimo*	*Guazuma ulmifolia*	Sterculiaceae
Peine de mono	*Apeiba membranacea*	Tiliaceae

grassland to reach other fragments there is a high risk of predation by dogs — a situation reported by local people, confirmed by direct observations, and reported elsewhere in Azuero (Brandaris, 1983). Another potential predator that has been reported in Azuero is the coyote (*Canis latrans*), which reached the peninsula at least five years ago (2000), and is currently considered a serious problem for howler monkeys and other populations of wild animals in Azuero. The natural predators of howler monkeys, such as harpy eagles (Eason, 1989; Sherman, 1991) and jaguars (Kinzey, 1997), are no longer believed to occur in the region.

Age-sex composition of *A. p. trabeata* troops is similar to other *A. palliata* populations studied in different locations (Carpenter, 1934; Chivers, 1969; Milton, 1982). The social system observed in the Azuero howler monkey troops is multi-male/multi-female, similar to what has been reported for *A. p. mexicana* (Cortés-Ortiz, 1998; Dias and Rodríguez-Luna, 2003) and for other species of the genus (Crockett and Eisenberg, 1987). It is interesting to note that the unimale social system reported by Milton and Mittermeier (1977) for *A. p. coibensis* (always considered as the same species as *A. p. trabeata* but then believed to be a different species of *Alouatta*) differs from the one observed in the population of Azuero howler monkeys.

I recorded only one case of aggression among the howlers, but I did note that many males had scars on their bodies. The dominant male in group T3, for example, had lost an eye. Another male in group T4 had a recent cut on his left leg and was unable to use it when I first saw him, although he was fully recovered when I returned a year later. Other males had easily visible scars from old wounds and fractured tails. The one aggressive event occurred between two males evidently fighting over a female. The male that was guarding the female chased and fought off an approaching male. The presence of scars, injuries and fractures in the males of these groups suggest that there are sporadic but serious fights.

Although howler monkeys suffer botfly (*Alouattamyia baeri*) parasitism in most of their range (Milton, 1982, 1996 for Barro Colorado Island; Cowlishaw and Dunbar, 2000 for Brazil; Cortés-Ortiz, pers. comm. for Mexico) I was unable to find signs of botflies in the population I observed in Azuero. Special conditions of soil humidity are necessary for botflies to complete their pupal phase (K. Milton, pers. comm.). The more arid conditions of the Azuero peninsula may be responsible for the absence of this parasite. Nonetheless, the cattle surrounding the howler monkeys undoubtedly increase the probabilities of infection by screw worm larvae (*Cochliomyia hominivorax*), another parasite reported for *A. palliata* in Panama (Milton, 1982). The risk of infection by this type of larvae increases with open wounds, such as those observed in the males of this population.

The Azuero howler monkeys in the central part of Herrera Province, Panama, are highly endangered for the reasons already mentioned above, including forest clearance and fragmentation, as well as hunting for food or pets. The isolation of this population of howler monkeys is jeopardizing its long-term genetic viability. As a consequence of this survey, and in order to help with the conservation of the Azuero howler monkeys, the Mammal Society of Panama (SOMASPA) has initiated a conservation campaign and environmental education project in the region. Furthermore, we will continue monitoring this population to understand the population dynamics and social behavior of this highly threatened primate.

Acknowledgements: I thank the Rafael Quintero Villarreal secondary school from Ocú, and their teachers, especially Nidia Aguirre. Thanks also to Mr. Didio Gonzalez and the Gonzalez family, owners of the pasturelands from Llano Hato and Llano Grande respectively, and to Mr. Luis Carrasco and the people from Ocú and Parita for their hospitality and help in finding and protecting the howler monkeys in the area. I greatly appreciate the enthusiasm of the students Emigdio Mitre, Wedlis Gonzalez and Donald Osorio who helped with observations in the field. Thanks to Ivelisse Ruiz-Bernard, Alonso Santos and Ricardo Moreno for supporting this research, and Agustin Somosa for the plant identifications. My sincere gratitude to Liliana Cortés-Ortiz for her advice and assistance on this manuscript.

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ESTUDOS PRELIMINARES DA PRESENÇA DE SAGÜIS NO MUNICÍPIO DE BAURU, SÃO PAULO, BRASIL

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Graziela Valença da Silva, Rosângela Lopes Zaganini
Anderson Lucindo

Introdução

O município de Bauru localiza-se na região centro-oeste do Estado de São Paulo (Fig. 1, painel superior) e apresenta 67.937 hectares de área, sendo 5,54% da superfície coberta por vegetação nativa. A maioria dessa vegetação está concentrada numa unidade de conservação chamada Área de Proteção Ambiental (APA) Vargem Limpa – Campo Novo, localizada na região leste do município (22°20'S, 49°01'W), e rodeada pelo Jardim Botânico e Zoológico Municipal de Bauru e por áreas de ocupação rural e urbana (Fig. 1, painel inferior). A vegetação da APA foi extensivamente estudada por Cavassan e colaboradores (1984), que descreveram-na como sendo típica de cerradão, com manchas de cerrado senso restrito e de floresta subtropical semi-decídua (Cavassan, 1990). O clima é predominantemente tropical, com uma estação seca entre março e outubro (na qual a umidade relativa do ar pode chegar a 15%) e um período quente e úmido estendendo-se pelos meses de novembro a fevereiro.

Figura 1. Ilustrações relativas à área de estudo. Painel superior: localização do município de Bauru no Estado de São Paulo, Brasil. Painel inferior: área de proteção ambiental (APA) municipal Vargem Limpa – Campo Novo.

Ao longo dos últimos anos, surgiram numerosos relatos sobre a presença de sagüis nas proximidades da área em questão. Vale destacar que pouquíssimos levantamentos sobre a fauna do local foram realizados, sendo inexistente qualquer menção na literatura sobre a presença de sagüis na área. Por esse motivo, o objetivo do presente trabalho foi realizar um levantamento preliminar da presença de calitriquídeos na APA e suas adjacências, com vistas a contribuir para o mapeamento das espécies de primatas no território sul-americano pelo projeto BDGEOPRIM (Hirsch *et al.*, 2002). Além disso, foram estudados alguns aspectos das interações dos calitriquídeos com diversos fatores locais, entre eles com as populações humanas que habitam a área. Por fim, foi feita a dissecação de três indivíduos encontrados mortos, com a finalidade de extrair informações biológicas sobre os animais viventes no local.

Metodologia

Estudo 1: Levantamento preliminar dos grupos
Como primeira abordagem, 16 entrevistas foram realizadas no mês de abril de 2002 com pessoas residentes ou que trabalham em bairros distribuídos ao longo da Rodovia SP/225 Comandante João Ribeiro de Barros, a qual delimita a parte norte da APA (ver Fig. 1). A escolha dos indivíduos a serem entrevistados seguiu uma amostragem oportunística, no sentido de que se buscou incluir indivíduos que, por alguma indicação, teriam avistado sagüis. Os questionários utilizados foram preparados de tal forma a requisitar uma certa descrição dos animais, com a finalidade de se evitar falsos relatos. Em seguida, ocorreu uma etapa de busca de registros *in loco* da presença dos animais, com base nos dados levantados pelos questionários. Observações diretas dos sagüis, bem como registros indiretos (detecção de marcas de gomivoria e a identificação de vocalizações típicas das espécies), foram recursos utilizados nessa etapa. Entre março e junho de 2004, realizamos 18 novas entrevistas na mesma região com a finalidade de atualizar informações quanto ao número, composição e distribuição de cada grupo. Os dados de todas as etapas foram reunidos e, com a ajuda de mapas e fotos aéreas da região, foi feita uma plotagem dos bandos identificados no presente estudo.

Estudo 2: Aspectos ecológicos e comportamentais de um grupo local de Callithrix jacchus
Apenas um grupo de sagüis da espécie *Callithrix jacchus* foi escolhido para ser estudado quanto a aspectos ecológicos e comportamentais, tais como área de vivência, hábitos alimentares e períodos de atividade. Esse grupo se situava na periferia da área de Reserva Legal da UNESP, próxima ao Jardim Zoológico Municipal e margeando a Rodovia SP/225 (Fig. 2). A região apresenta pouco declive e terreno de latossolo textura arenosa, com vegetação característica de cerradão, sendo que no lado oposto ao da rodovia há um pequeno alagadiço com a nascente do córrego Vargem Limpa. Tal área foi dividida em seis quadrantes, de 50 x 50 metros cada, totalizando uma área de aproximadamente 1,42 hectares (Fig. 2, painel inferior). Foi realizado o levantamento florístico dentro dos quadrantes utilizando-se o método de parcelas, no qual as árvores amostradas deveriam conter mais de 0,3 metros de diâmetro na altura de 1,5 metros (Müller-Dombois e Ellemberg, 1974). Os exemplares selecionados tiveram seus ramos coletados, marcados e herborizados para confirmação em chave específica da região e comparação com exemplares existentes no herbário do Departamento de Ciências Biológicas da UNESP de Bauru. A presença de marcas de mordidas de sagüis era anotada para cada exemplar identificado. Durante o período de atividade dos animais, das 06:00 às 18:00 horas, os quadrantes eram visitados para registros cursivos *ad libitum* de comportamentos obtidos por observação direta.

Estudo 3: Relações entre calitriquídeos e seres humanos
Os questionários aplicados no Estudo 1 continham perguntas sobre como os humanos que habitavam as áreas exploradas pelos sagüis se relacionavam com estes animais. Foram feitas questões sobre o oferecimento de comida e sobre possíveis incômodos causados pela presença dos animais. Também foi perguntado quais os períodos (tanto do dia como do ano) em que a presença dos sagüis nas proximidades das áreas urbanas era mais freqüente, e sobre possíveis ameaças aos sagüis.

Estudo 4: Análise post-mortem *de três sagüis*
Entre 2001 e 2004, três sagüis foram encontrados mortos nas imediações da APA e encaminhados ao Departamento de Ciências Biológicas da UNESP / Bauru, onde foram mantidos congelados para posterior análise *post-mortem.* Nas dissecações, inicialmente foram investigadas as possíveis causas de morte, por procura de lesões externas e internas. O trato digestório foi também dissecado para fornecer informações sobre o conteúdo alimentar e presença de parasitas. A determinação do estágio de desenvolvimento dos indivíduos foi feita pela pesagem e medição do corpo, bem como pela análise macroscópica dos órgãos genitais.

Resultados

Estudo 1: Levantamento preliminar dos grupos
Identificou-se a presença de 13 grupos de calitriquídeos, distribuídos na APA Municipal e em suas adjacências, abrangendo uma área total de aproximadamente 1.600 hectares e totalizando 150 indivíduos. Sobre os grupos, não foi possível determinar com certeza se todos eram constituídos por núcleos familiares, ou se seriam meros agrupamentos de animais na área sem uma organização verdadeiramente grupal e/ou familiar. De qualquer forma, cada grupo foi nomeado por uma letra, indo de A a M, como está mostrado na Tabela 1. Essa tabela também expõe a composição e o número de indivíduos de cada grupo. Cinco grupos (B, D, E, F e G) foram compostos por exemplares de duas espécies: *Callithrix jacchus* e *Callithrix penicillata*, e por isso foram designados como grupos mistos. Outros grupos considerados mistos, aparentemente, foram compostos por subgrupos monoespecíficos distintos. Foi o caso de grupo A, composto por um casal de adultos *C. penicillata* e por um subgrupo de *C. jacchus* que eram observados na mesma área de vivência. O grupo M foi um caso semelhante, em que dois pequenos grupos de *C. penicillata* viviam no mesmo território de um grupo de *C. jacchus.* Os demais grupos foram monoespecíficos e, com exceção do grupo J, eram formados por núcleos familiares, isto é, compostos por um casal de adultos reprodutivos e seus descendentes jovens e filhotes. O grupo J pareceu reunir mais de um núcleo familiar devido ao elevado número de indivíduos.

A localização de cada grupo está plotada na Fig. 2 (painel superior), mostrando que os grupos de sagüis se concentram nas áreas de vegetação nativa, mas também ocupam manchas de vegetação incrustradas em áreas urbanas.

Estudo 2: Aspectos ecológicos e comportamentais de um grupo local de Callithrix jacchus

O subgrupo de *C. jacchus* pertencente ao grupo M, e constituído por seis adultos, dois subadultos, dois juvenis e um infante, foi observado por um período de tempo mais prolongado (15 horas acumuladas de observação direta ao longo de três meses) com o objetivo de permitir a caracterização de seus aspectos comportamentais e ecológicos. Considerando todos os locais em que os animais foram avistados, chegou-se à área de vivência do grupo correspondente a 2,4 hectares, representada na Fig. 2 (painel inferior).

Os resultados relativos à presença dos animais em cada quadrante estão mostrados na Tabela 2. A árvore-dormitório está localizada no quadrante 1 (QI), onde os animais foram avistados às 06:00 horas deixando esse local e se locomovendo silenciosamente para o quadrante QII, onde era muito comum vê-los perfurando árvores por volta das 07:00 horas. Em seguida, os animais locomoviam-se rapidamente pelos quadrantes QIII, IV e V emitindo vocalizações do tipo *long phee* tais como as descritas por Epple (1968). Por volta das 11:00 horas, os sagüis permaneciam no quadrante QVI tomando sol ou engajados em comportamentos

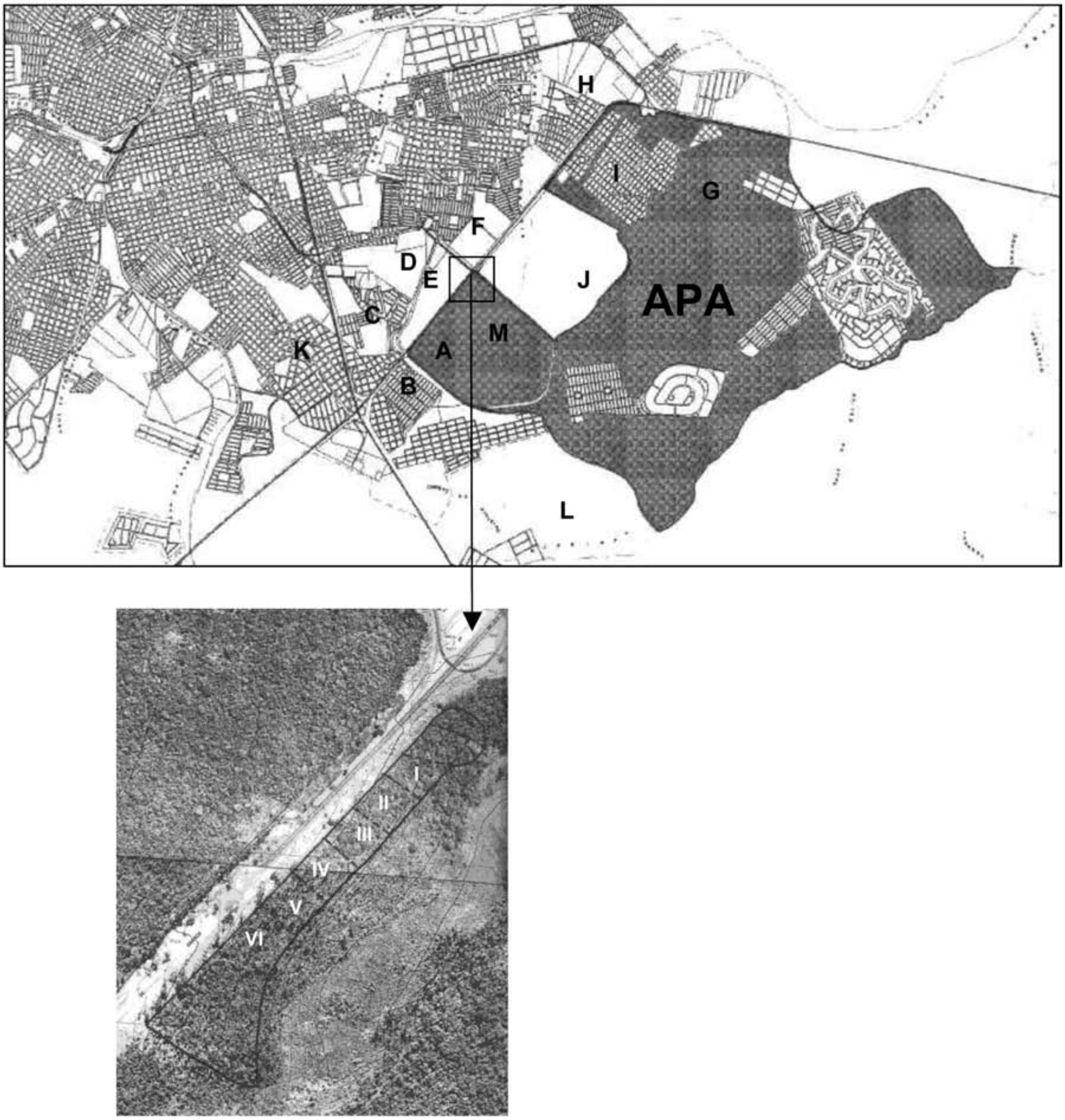

Figura 2. Mapas localizando as áreas de vivência dos sagüis na APA Vargem Limpa – Campo Novo e seus arredores. Painel superior: As letras "A" a "M" indicam os locais de permanência de cada grupo descrito na Tabela 1. Painel inferior: Fotografia aérea mostrando os limites da area de vivência do grupo de *Callithrix jacchus* descrito no Estudo 2. Os números I a VI indicam os quadrantes utilizados na divisão da área.

sociais do tipo brincadeira e catação. Na parte da tarde, eles foram mais freqüentemente avistados nos quadrantes QVI, IV e II, quando então retornavam para a árvore-dormitório ao pôr-do-sol.

As espécies arbóreas mais comumente amostradas foram *Vochysia tucanorum, Qualea multiflora* e *Qualea grandiflora*, possuindo abundâncias variáveis por quadrante. Em toda a área de vivência, 76 árvores apresentaram marcas de dentadas dos sagüis nos troncos e nos galhos, sendo que as três espécies supracitadas foram acometidas pela gomivoria.

Tabela 1. Número estimado de indivíduos de *Callithrix penicillata* e *Callithrix jacchus* em cada grupo (de "A" a "M") localizado na Figura 2.

Referência no mapa	Espécie	Número de indivíduos (n)
A	*Callithrix penicillata* *Callithrix jacchus*	2 3 – 4
B	*C. penicillata* *C. jacchus*	12 – 20
C	*C. penicillata*	4 – 6
D	*C. penicillata* *C. jacchus*	6 – 10
E	*C. penicillata* *C. jacchus*	~ 20
F	*C. penicillata* *C. jacchus*	~ 10
G	*C. penicillata* *C. jacchus*	~ 16
H	*C. jacchus*	~ 5
I	*C. jacchus*	6
J	*C. penicillata*	24
K	*C. jacchus*	~ 7
L	*C. jacchus*	~ 8
M	*C. penicillata* *C. jacchus*	9 11

Estudo 3: Relações entre calitriquídeos e seres humanos

Como a aplicação dos questionários seguiu uma amostragem que visava reunir o máximo de relatos sobre a presença dos sagüis na área, todas as pessoas entrevistadas afirmaram ver os animais com certa freqüência. A maioria (55%) declarou avistar os sagüis próximos a áreas residenciais e o restante (45%) relatou avistá-los apenas em locais de mata fechada e distante de áreas urbanas. Não houve um período preferencial de aparecimento dos sagüis, sendo que 50% dos entrevistados visualizaram esses animais tanto nos períodos da manhã como da tarde, enquanto que 27,8% avistaram apenas no período da manhã, e 22,2% somente durante a tarde. Não houve também alguma época do ano mais propícia à visualização dos animais, já que cerca de 50% dos entrevistados afirmam ver os sagüis ao longo de todo o ano. Vale mencionar, entretanto, que apenas 5,5% dos entrevistados relataram avistar os animais durante dias mais frios de outono e de inverno.

A grande maioria dos entrevistados (94,5%) relatou gostar da presença destes animais nas proximidades das regiões urbanas. Cerca de metade das pessoas (53,8%) declararam que fornecem algum tipo de alimento aos sagüis, como bananas e mamão, colocadas em comedouros improvisados, ou em outros locais elevados do chão. O restante, relativo a 46,2% dos entrevistados, não oferece nenhum tipo de alimentação. Apesar da percepção favorável em relação à existência dos calitriquídeos nas imediações de suas habitações, 11,1% chegou a notar algum tipo de ameaça humana aos sagüis, principalmente em relação à caça, já que a presença de predadores naturais não foi identificada por nenhuma das pessoas que vivem no local.

Estudo 4: Análise post-mortem *de três sagüis*

O primeiro indivíduo submetido à necropsia foi uma fêmea de *Callithrix penicillata* pesando 260 gramas e com idade estimada de 10 a 12 meses. Ela apresentava lesões na região inguinal da pele, costelas quebradas do lado direito e pulmão dilacerado. Juntamente com o fato de que o animal

Tabela 2. Dados de permanência e de gomivoria relativos às observações de um grupo de *Callithrix jacchus* (descrito no Estudo 2) discriminado por quadrantes da área de vivência.

Quadrantes	Número de avistamentos	Período do dia	Total de árvores com marcas de gomivoria	Árvores mais comuns por quadrante
I	1	6h – 7h	25	*Vochysia tucanorum* *Qualea grandiflora*
II	10	6h – 9h 14h – 17h	14	*Vochysia tucanorum* *Qualea grandiflora* *Qualea multiflora*
III	5	6h – 9h	8	*Vochysia tucanorum* *Qualea grandiflora* *Qualea multiflora*
IV	6	7h – 11h 14h – 17h	12	*Vochysia tucanorum* *Qualea grandiflora*
V	1	8h – 9h	5	*Vochysia tucanorum* *Qualea grandiflora*
VI	10	8h – 12h 14h – 17h	12	*Vochysia tucanorum* *Qualea grandiflora*

fora encontrado ao lado de uma estrada, esses achados sugerem que o sagüi tenha morrido atropelado. O segundo indivíduo era um *Callithrix jacchus* macho, que pesava 240 gramas e apresentava idade estimada de 6 a 10 meses, já que os testículos ainda não haviam migrado para a bolsa escrotal. Este animal foi encontrado num bosque dentro do Campus da UNESP de Bauru sem lesões aparentes, e a causa da morte não foi determinada. O terceiro sagüi era um *Callithrix jacchus* fêmea adulto (com mais de 12 meses de idade), e que pesava 280 gramas. Ele apresentava crânio fraturado e provavelmente também morreu por atropelamento.

O conteúdo estomacal dos animais apresentava uma grande massa esbranquiçada, que foi identificada como goma vegetal diluída. Outros materiais vegetais também foram encontrados, como pedaços de folhas, gravetos e sementes. Havia ainda partes corporais de artrópodes, como patas, asas e antenas. Essas partes foram identificadas como pertencentes a aracnídeos, coleópteros, ortópteros, himenópteros, homópteros e lepidópteros. No intestino, o conteúdo era demasiadamente modificado para ser analisado, mas o que merece destaque na análise desse compartimento digestório foi a presença de endoparasitas: uma média de 80 nematóides encontrada em cada indivíduo, principalmente na porção do ceco intestinal.

Discussão

Nas condições do presente trabalho, que correspondeu à primeira tentativa de se estudar a presença de sagüis na região de Bauru, São Paulo, foi contabilizada a presença de 13 grupos de *Callithrix jacchus* e *Callithrix penicillata* na região da APA Vargem Limpa – Campo Novo. Admite-se a possibilidade de que esse número seja maior se for considerado que vários grupos familiares podem estar incluídos num único grupo avistado pelos observadores. Parece pouco provável, contudo, que esse número esteja superestimado, dado a amplidão da área estudada e o tamanho da área de vivência dos grupos, que num caso particular mostrou-se relativamente pequena: 2,4 hectares para o grupo de 11 indivíduos descrito no Estudo 2. Áreas de vivências desse porte já foram relatadas anteriormente na literatura (Digby e Barreto, 1993).

A maioria dos grupos de *C. jacchus* e *C. penicillata* possui distribuição marcadamente associada com a APA, o que pode ser explicado pela abundância de recursos alimentares oferecida pela vegetação local, como a presença das árvores gomíferas *Vochysia* sp. e *Qualea* sp. (Cavassan, 1990). Segundo Vilela e Faria (2002), o exsudato vegetal na forma de goma constitui o principal recurso alimentar dessas espécies de sagüis em qualquer época do ano ou mesmo em ambientes ricos em outros itens alimentares. No caso dos sagüis de Bauru, corrobora para essa idéia o resultado da análise do conteúdo alimentar que revelou que a goma vegetal é intensamente ingerida pelos animais. Contudo, a mesma análise mostrou também o consumo de outros itens de origem vegetal e animal. Devido a esses dados, é possível interpretar que do ponto de vista alimentar, os sagüis encontram condições propícias para sua proliferação na área da APA e imediações. Soma-se a isso o fato dos animais se concentrarem em locais relativamente protegidos da ocupação humana e com baixo nível de exposição a predadores naturais, sendo ameaçados apenas por serpentes e gaviões pouco presentes no local. Dessa forma, é possível concluir que a população de calitriquídeos da área deve aumentar rapidamente. As conseqüências desse crescimento constituem matéria a ser investigada, uma vez que esses animais podem ameaçar o equilíbrio de espécies vegetais e animais nativos.

Outro achado interessante foi a presença de sagüis nas proximidades de áreas urbanas. Observou-se que esses grupos de calitriquídeos aproximam-se de residências à procura de comida, que na maioria dos casos é oferecida pelas pessoas em comedouros. Desse tipo de interação surge a questão da dependência que estes animais podem desenvolver pelos alimentos oferecidos pelos humanos, uma vez que as frutas constituem fontes atrativas e facilmente acessíveis e podem perturbar padrões naturais de forrageamento. Outra questão é a proximidade contínua, que pode levar os sagüis a se habituarem aos humanos, tornando-os mais vulneráveis à caça (como relatado por alguns entrevistados). Por fim, a presença em áreas urbanizadas aumenta o risco desses primatas sofrerem atropelamentos, como já documentado no presente trabalho.

Considerando a outra parte da interação, ou seja, a parte humana, sabe-se que os sagüis podem transmitir inúmeras doenças infecciosas, como raiva, através do contato físico (Favoretto *et al.*, 2001). Sendo assim, torna-se necessário avaliar o risco de acidentes envolvendo humanos e sagüis. A possibilidade de transmissão de doenças, como parasitoses intestinais, constitui mais um ponto a merecer atenção, especialmente porque as áreas urbanizadas freqüentadas pelos sagüis na região apresentam precária infra-estrutura sanitária e crianças foram comumente observadas brincando no local.

A ocorrência de *C. jacchus* e *C. penicillata* na região se deve provavelmente à introdução antrópica. Já há vários anos, estes animais têm sido repetidamente introduzidos na Região Sudeste do Brasil, com ênfase para os estados do Rio de Janeiro e de São Paulo (Mittermeier *et al.*, 1982). Conhecidas por apresentarem grande adaptabilidade e capacidade de explorar áreas perturbadas (Stevenson e Rylands, 1988; Faria, 1989), estas espécies têm se espalhado por diferentes regiões do território brasileiro, chegando até o extremo sul (Alexandre de Menezes, comunicação pessoal). Finalmente, o presente trabalho consiste em mais um relato de ocorrência de primatas que visa contribuir com o projeto BDGEOPRIM de localização de primatas neotropicais (Hirsch *et al.*, 2002).

Agradecimentos: Agradecemos ao Prof. Dr. Osmar Cavassan por estimular os estudos na área da Reserva da UNESP, e ao

botânico Luiz Carlos de Almeida Neto por incentivar os estudos na área do Jardim Botânico de Bauru. Agradecemos ao DAE pelo fornecimento dos mapas.

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BOA CONSTRICTOR PREDATION ON A TITI MONKEY, *CALLICEBUS DISCOLOR*

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Although it is thought that predation has played a major role in the evolution of primate sociality, actual predation events involving primates are rarely documented (Van Schaik, 1983; Boinski *et al.*, 2000). Birds of prey, felids, mustelids, and snakes are known predators of Neotropical primates. Most reported attacks by Neotropical snakes on monkeys are attributed to *Boa constrictor*, which feeds on callitrichids (*Saguinus*) and cebids (*Saimiri*, *Cebus*, *Alouatta* and *Chiropotes*), as well as a wide variety of small- and medium-sized mammals (didelphids, dasypodids, vespertilionids, molossids, procyonids, agoutids, dasyproctids, echimyids, murids and sciurids), birds (falconids, cotingids and formicarids), and reptiles (teiids) (Janzen, 1970; Greene, 1983; Chapman, 1986; Trail, 1987; Henderson *et al.*, 1995; Martins and Oliveira, 1998; Thorstrom and Morales, 2000; Shahuano Tello *et al.*, 2002; Perry *et al.*, 2003; Urbani, 2003; Ferrari *et al.*, 2004; pers. obs.).

Here we report an instance of predation by *Boa constrictor* on *Callicebus discolor*, observed during fieldwork at the Tiputini Biodiversity Station (TBS), a field station located in the Ecuadorian Amazon (00°37'05"S, 76°10'19"W, elev. 215 m; see Cisneros-Heredia, 2003). A total of 12 primate species have been recorded at TBS: *Cebuella pygmaea*, *Saguinus tripartitus*, *Aotus vociferans*, *Callicebus discolor*, *Pithecia monachus*, *Pithecia aequatorialis*, *Saimiri sciureus*, *Cebus albifrons*, *Cebus apella*, *Alouatta seniculus*, *Lagothrix lagotricha* and *Ateles belzebuth.* This is the first report of boa predation on monkeys of the genus *Callicebus.*

On 28 September 2003, at 11:30 am, we heard the calls of at least two *Callicebus discolor.* Following the calls, we discovered an adult *Boa constrictor* (total length ca. four meters) constricting a *Callicebus discolor* in a tree, approximately five meters above ground. The boa was coiled around the monkey, still shifting and squeezing. A second monkey was about four meters from the boa at the same height and called out once. No physical interactions were observed between the second monkey and the boa. The boa remained coiled around the carcass for some 45 minutes and then took approximately one hour to swallow it.

Reducing the risk of predation has been hypothesized to be one of the benefits of group living, and group behaviours such as alarm calls, mobbing and counter-attacks have been reported as primate responses to predation attempts by snakes (Chapman, 1986; Bartecki and Heymann, 1987; Shahuano Tello *et al.*, 2002). During this predation event, the only response behaviour we recorded was the calling from the second individual (rather short, classified into the second group of Robinson, 1979). The absence of other response behaviours cannot be assumed, however, because we arrived when the boa was already constricting the monkey. It is unknown how predation events may have functioned in the evolution of sociality in *Callicebus*, but this observation, together with similar reports (Chapman, 1986; Bartecki and Heymann, 1987; Martins and Oliveira, 1998; Shahuano Tello *et al.*, 2002; Perry *et al.*, 2003; Ferrari *et al.*, 2004), suggests that snakes play a major role as predators of Neotropical primates.

Acknowledgements: We are grateful to Eckhard W. Heymann, Stella de la Torre and Kelly Swing for their critical reading of the manuscript. Susan Perry, Eckhard W. Heymann and Stella de la Torre provided relevant literature. Maria Elena Heredia, Laura Heredia and Hector León provided financial and moral support. Tiputini Biodiversity Station / Universidad San Francisco de Quito provided institutional and logistical support. Video files of this event are deposited in the archives of the Tiputini Biodiversity Station, Universidad San Francisco de Quito. This is a publication of the project "Study of the Herpetofauna of the Tiputini Biodiversity Station" (D. F. Cisneros-Heredia, investigator).

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UMA AVALIAÇÃO DA DIETA, DA ÁREA DE VIDA E DAS ESTIMATIVAS POPULACIONAIS DE *CEBUS NIGRITUS* (GOLDFUSS, 1809) EM UM FRAGMENTO FLORESTAL NO NORTE DO ESTADO DO PARANÁ

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Introdução

Na porção sul e parte da porção sudeste do Brasil, *Cebus nigritus* (Goldfuss, 1809) é a espécie de macaco-prego característica da Mata Atlântica. Ao norte, sua distribuição limita-se à margem esquerda do Rio Doce (Silva Júnior, 2001; Vilanova *et al.*, 2005) e ao sul limita-se às municipalidades de São Lourenço do Sul, Rio Grande do Sul (Printes *et al.*, 2001). A leste, a distribuição é limitada pelo oceano Atlântico e a oeste pelo Rio Paraná (Silva Júnior, 2001; Vilanova *et al.*, 2005).

Esta espécie de macaco-prego está entre os mamíferos mais facilmente encontrados em fragmentos florestais do norte do estado do Paraná (Rocha, 2001), cujo patrimônio natural vem sofrendo intensa devastação por atividades agrícolas e agropecuárias que dizimaram a mata nativa dessa região, reduzindo a floresta original a valores próximos de 1% a 2% (Paraná, 1987). *Cebus nigritus* é uma espécie onívora com grande adaptabilidade aos ambientes alterados pelo homem e pode sobreviver em áreas de florestas fragmentadas e degradadas, desde que tenham acesso a outras fontes alimentares, como as plantações ao redor de seu ambiente (Rocha, 2000). É justamente nessa situação que a espécie é vista como uma praga florestal por produtores rurais, pois invadem plantações e passam a consumir pomares, milharais, canaviais, plantios de mandioca e até mesmo plantações de *Pinus* (Rocha, 2000; Ludwig *et al.*, no prelo). Assim, esse lamentável conflito pode futuramente alterar o status de conservação desses primatas em estados agrícolas como o Paraná.

Os poucos trabalhos que abordaram o comportamento e a ecologia dessa espécie em ambiente natural na região mostraram flexibilidade comportamental e estratégias ecológicas oportunistas para que os animais conseguissem sobreviver ao confinamento de fragmentos pequenos e isolados (Rocha, 1995, 2001; Rocha *et al.,* 1998, no prelo; Ludwig *et al.*, no prelo). Portanto, visando a futura conservação da espécie e um melhor entendimento da adaptabilidade desses animais frente aos efeitos antrópicos, surgiu o propósito deste trabalho que objetivou verificar e analisar a dieta, a área de vida, os percursos diários e as estimativas populacionais de *C. nigritus* no fragmento florestal Mata Doralice, Ibiporã, Paraná.

Material e Métodos

Área de estudo

A Mata Doralice (23°16'S, 51°03'W) situa-se no município de Ibiporã, norte do estado do Paraná, na porção baixa da bacia do Rio Tibagi, a 484 m de altitude. É um fragmento florestal de 170 ha, coberto em sua maior parte por uma vegetação primária alterada do tipo Floresta Estacional Semidecidual. O fragmento limita-se ao sul com o Rio Tibagi e está circundado por plantios de monoculturas, pomares e pastagens (Fig. 1). O solo da região é classificado segundo o Sistema Brasileiro de Classificação de Solos (EMBRAPA, 1999) como Nitossolo Vermelho Eutrófico (terra roxa) e caracteriza-se por ter alta fertilidade natural. O clima é subtropical úmido, apresentando as quatro estações bem definidas. As médias anuais para temperatura e precipitação são 21,8°C e 1558 mm, respectivamente (dados obtidos em Soares-Silva *et al.*, 1992; Carmo, 1995). Estudos fitossociológicos na área apontaram densidade absoluta de 1396 indivíduos/ha, diversidade específica de H' = 3,6 (I = 0,786), e as famílias mais representativas sendo Meliaceae, Myrtaceae, Fabaceae, Euphorbiaceae, Moraceae e Mimosaceae. A floresta é constituída por um estrato arbustivo e dois arbóreos, além de árvores emergentes com alturas superiores a 20 m (Soares-Silva *et al.*, 1992; Carmo, 1995).

Metodologia

Os dados foram coletados entre outubro de 2001 e setembro de 2002, através de quatro visitas mensais a campo divididas igualmente entre o período matutino e vespertino. Foram acompanhados dois grupos focais (GA: 35 indivíduos e GB: 25 indivíduos; 155 e 25 h de acompanhamento, respectivamente); os dados de dieta foram coletados através do método de freqüências de observação (através de observação direta dos animais) e freqüência de ocorrências dos itens alimentares em fezes. Para padronizar as amostras fecais e as visuais na somatória final, considerou-se uma ocorrência tanto uma espécie encontrada nas fezes como cada espécie ingerida pelo animal na observação direta do grupo (Rocha, 2001). Itens vegetais não identificados foram mencionados como indeterminados (sp. 1, sp. 2, etc.). Fragmentos de partes animais (artrópodos) encontrados nas fezes foram identificados pelo laboratório de entomologia da Universidade Estadual de Londrina, Londrina, Paraná.

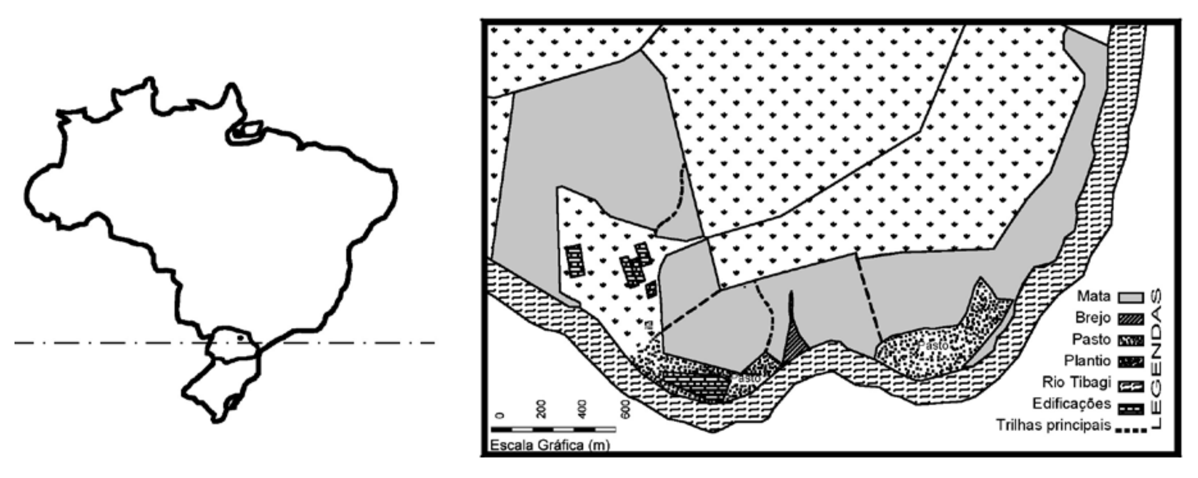

Figura 1. Mapa do fragmento florestal Mata Doralice (170 ha), Ibiporã, Paraná.

Todas as porcentagens finais obtidas dos itens que fazem parte da dieta foram obtidos através da somatória do total de itens vegetais (descritos na Tabela 1) e do total de itens animais (Tabela 2), totalizando em 100% (*e. g.*, 769 + 226 = 100%). Assim como as análises sazonais: ∑ itens vegetais + ∑ itens animais de cada estação = 100%. (*P. ex.*, a porcentagem de *Maclura tinctoria* na primavera é de: (18 + 23) × 100% / (29 + 61 + 108) + (4 + 27 + 13) = 16,9%.)

Para o estudo da área de vida, GA foi acompanhado por 180 h. O mapeamento da área de vida foi feito através da plotagem dos pontos de GPS (Garmin, modelo eTrex Venture®). Os pontos e rotas foram marcados pelo aparelho conforme a atividade dos animais, mudanças de direções do grupo e possibilidade de contato com satélites dentro da mata (Aguiar *et al.*, 2002). A área foi calculada através do programa AutoCAD 2000 (Autodesk, 1999). Alguns percursos diários foram possíveis de serem mensurados pelo próprio GPS.

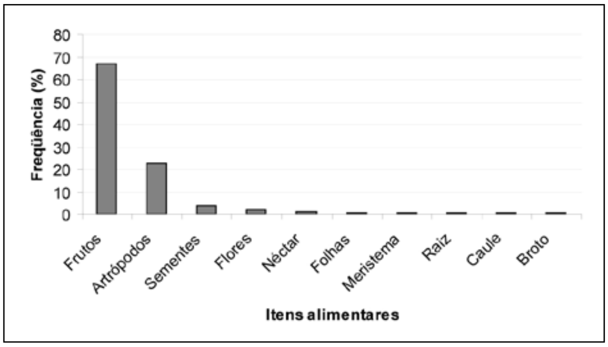

Figura 2. Freqüência total (%) dos itens alimentares (espécies vegetais e artrópodos) consumidos por *Cebus nigritus*.

Para estimar a densidade da espécie no fragmento foi empregado o método da área de vida (adaptado de Brockelman e Ali, 1987), levando-se em conta o número médio de indivíduos encontrados por grupo ao longo do estudo e tanto a dimensão total da área de vida quanto a de uso exclusivo do grupo.

Resultados

Dieta

A dieta constituiu de itens vegetais e animais, registrados em 995 ocorrências sendo a porcentagem de frutos (67,4%) substancialmente mais elevada que as dos demais itens vegetais (sementes, 3,6%; flores, 2,1%; néctar, 1,1%; folhas, 0,8%; meristema, 0,7%; raiz, 0,7%; caule, 0,5%; brotos, 0,4%) e animais (22,7%) (Fig. 2).

Quanto aos itens vegetais (77,3%) foram registradas 73 espécies (além do gênero *Ficus*), incluindo seis exóticas (*Zea mays*, *Citrus* sp. 1, *Citrus* sp. 2, *Hovenia dulcis, Caryota urens* e *Musa paradisiaca*), totalizando 32 famílias identificadas (Tabela 1). A família Meliaceae foi a que obteve maior

Tabela 1. Espécies vegetais, item consumido, número de vezes que o item foi consumido sazonalmente e porcentagem total que apareceu na dieta de *Cebus nigritus*. IC = Item Consumido; ∑ itens vegetais + ∑ itens animais = 100%. Uma tabela aumentada, com informações detalhadas sobre os itens menos comuns, pode ser encontrada no sítio de internet do *Neotropical Primates* em <http://www.primate-sg.org/np/LudwigTabela1a.pdf>.

Espécie	IC	Primavera			Verão			Outono			Inverno			∑	%
		O	N	D	J	F	M	A	M	J	J	A	S		
Sorocea bonplandii	Frutos	7	1							9	37	57	6	117	**11,8**
Euterpe edulis	Frutos			1	8	7	7	21	20	14				78	**7,8**
Zea mays	Frutos	2	4	2	5	10	5	4	2			8	13	55	**5,5**
Pereskia aculeata	Frutos							3	2	16	23	5	3	52	**5,2**
Guarea kunthiana	Frutos			1	3	1	2	1	1		13	23	4	49	**4,9**
Maclura tinctoria	Frutos		18	23		1	1	1						44	**4,4**
Syagrus romanzoffianum	Frutos				8	6		7	4	3	4			32	**3,2**
Miconia pusilliflora	Frutos	5	20	5										30	**3,0**
Piper amalago	Frutos			5	6	3	3					1		18	**1,8**
Ficus spp.	Frutos		3	4		2		5		2		1		17	**1,7**
Piper aduncum	Frutos		1	8	4									13	**1,3**
Nectandra megapotamica	Frutos			12										12	**1,2**
Psidium guayava	Frutos				11			1						12	**1,2**
Cabralea canjerana	Sementes		3	9										12	**1,2**
Piper crassinervium	Frutos				9		1	1						11	**1,1**
Jacaratia spinosa	Frutos				3	6	2							11	**1,1**
Macfadyena dentata	Sementes							10	1					11	**1,1**
Indeterminada sp. 3	Frutos		1	9										10	**1,0**
Euterpe edulis	Flores	4	1	5										10	**1,0**
Outros (67 itens)															**17,5**
Total		29	61	108	75	61	37	66	35	62	99	107	29	769	77,3

número de espécies consumidas, seis no total. A família Moraceae (17,9%) destacou-se na dieta principalmente pela utilização dos frutos de *Sorocea bonplandii* (11,8%). A Arecaceae e a Poaceae foram freqüentes na dieta, representadas pelo consumo de *Euterpe edulis*, palmito (9,5%, sendo 7,8% de fruto; 1,0% de flor; 0,7% de meristema) e *Zea mays*, milho (5,5%), respectivamente. Espécies como *Guarea kunthiana*, *Ficus* spp. e *Z. mays* estiveram presentes em todas as estações do ano (Tabela 1). Esta última espécie foi coletada, juntamente com *Manihot esculenta* (mandioca), pelos animais nas plantações localizadas ao redor da mata.

Pôde-se constatar que durante a primavera e o verão ocorreu maior riqueza de espécies vegetais quando comparada ao outono e ao inverno. Na primavera, os itens vegetais mais consumidos foram frutos de *Maclura tinctoria* (16,9%) e *Miconia pusilliflora* (12,4%); no verão, foram os frutos de *Euterpe edulis* (10,8%) e de *Zea mays* (9,8%). No outono, novamente prevaleceram os frutos do palmito (28,2%), seguidos dos frutos de *Pereskia aculeata* (10,7%). Ressalta-se que nessas duas últimas estações os animais foram registrados consumindo o meristema de palmito (0,7%). No inverno, predominaram os frutos de *Sorocea bonplandii* (28,2%) e *Guarea kunthiana* (11,3%). Nas duas últimas estações, observou-se indivíduos visitando os plantios de *Manihot esculenta* para desenterrarem os tubérculos e posteriormente consumi-los dentro da mata.

Em relação aos itens de origem animal (22,7% da dieta total), foram registrados aracnídeos (0,2%) e seis ordens de insetos (Hemiptera: 3,4%; Hymenoptera: 3,4%; Coleoptera: 1,3%; Orthoptera: 1,1%; Diptera: 0,3%; Lepidoptera: 0,2%) além de invertebrados não identificados (12,8%) (Tabela 2). O consumo de itens animais foi mais elevado no inverno (34%) do que nas outras estações do ano.

Área de vida e percursos diários

O grupo de estudo, GA, totalizou 56 ha de área de vida, resultando uma exigência espacial de 1,6 ha/indivíduo. A área nuclear (a área com maior concentração de pontos marcados pelo GPS e de uso exclusivo do grupo) foi de 14 ha e correspondeu a 25% do total de sua área. Duas outras sub-áreas utilizadas pelo grupo foram constatadas, uma ao noroeste e outra à sudeste da área de vida (Fig. 3). Foram mensurados sete percursos diários que variaram entre 900 e 2000 m (média de 1083 m).

Cerca de 90% da área de vida dos animais abrangeu floresta primária alterada e somente 10% abrangeu floresta secundária. Foi marcante o uso da borda da mata (4000 m de borda de mata utilizada) para forrageio, descanso e para acesso aos plantios de milho, mandioca e pomares. O grupo adentrou de 15 a 25 m nos plantios dessas culturas.

O grupo focal sobrepôs a periferia de sua área de vida com mais dois outros grupos vizinhos, verificando-se 14 ha (25%) de área sobreposta com GB (grupo que habita a porção leste da mata) e 10 ha (18%) com GC (grupo que habita a porção norte da mata). GA obteve uma área de uso exclusiva de 32 ha (57%), na qual estava contida a área

Tabela 2. Itens artrópodos, fragmentos encontrados, número de vezes que o item foi consumido sazonalmente e porcentagem total em que apareceram na dieta de *Cebus nigritus*. CT = Categoria taxonômica; ME = modo encontrado: fragmentos em fezes (Frag.) ou observação direta (Obs.); NI = Não Identificado; ∑ itens vegetais + ∑ itens animais = 100%.

CT	ME / Animal	Primavera			Verão			Outono			Inverno			∑	%
		O	N	D	J	F	M	A	M	J	J	A	S		
Coleoptera	Fragm. / Besouros	2	4		1		1				2	2	1	13	1,3
Arachnida	Fragm. / Aranhas		2											2	0,2
Lepidoptera	Fragm. / Indeterminados		1	1										2	0,2
Orthoptera	Fragm. / Gafanhoto			2		1				1	4		2	10	1,0
Orthoptera	Obs. / Gafanhoto										1			1	0,1
Hemiptera	Ninfa de percevejo	1												1	0,1
Hemiptera	Ninfa de cigarrinha		1											1	0,1
Hemiptera	Fragm. / Cigarrinha						1							1	0,1
Hemiptera	Fragm. / Percevejo		5	3	2	1		2	2	4	8	1	2	30	3,0
Hemiptera	Obs. / Percevejo									1				1	0,1
Hymenoptera	Fragm. / Formiga	1	5	1	1	1	2		1	1	4	3	1	21	2,1
Hymenoptera	Fragm. / Indeterminados		2	2			1							5	0,5
Hymenoptera	Fragm. / Vespa		1				1					1	3	6	0,6
Hymenoptera	Obs. / Formiga						1							1	0,1
Hymenoptera	Obs. / Vespa				1									1	0,1
Diptera	Fragm. / Indeterminados		1								1			2	0,2
Diptera	Pupa		1											1	0,1
Artrópodo (NI)	Fragmentos		1							1				2	0,2
Artrópodo (NI)	Observação direta		3	4	6	7	2	7	3	9	40	31	13	125	12,6
Total		4	27	13	11	10	9	9	6	17	60	38	22	226	22,7

nuclear. Foram observados dois encontros intergrupais: no primeiro, GA estava próximo a sua área nuclear e expulsou GB. Em outro, quando GA estava em porção periférica da área de vida, foi o grupo expulso por GC. Na primeira ocasião, verificou-se que o grupo residente formou um subgrupo de machos adultos e sub-adultos em linha de frente e emitiram gritos de alarme, quebravam galhos e exibiam os caninos em direção ao outro grupo, enquanto as fêmeas com infantes e os juvenis afastaram-se.

Estimativas populacionais

Foram levantados três grupos de *C. nigritus* no fragmento. O tamanho dos grupos GA e GB foi de 35 e 25 indivíduos, respectivamente (média: 30 indivíduos/grupo). As estimativas indicaram de três a cinco grupos no local e densidade populacional de 0,54 a 0,94 indivíduos/ha.

Discussão

Dieta

O predomínio de algumas espécies vegetais na dieta dos animais pôde ter sido reflexo do tipo do ambiente utilizado, seja porque as espécies foram abundantes dentro da floresta ou abundantes em plantações (Galetti e Pedroni, 1994). A família Meliaceae – família de maior riqueza florística, e de maior densidade e freqüência nos estudos fitossociológicos da Mata Doralice – foi justamente a família de maior riqueza de espécies na dieta de *C. nigritus. Sorocea bonplandii*, espécie vegetal que apresentou o maior índice de valor de importância para o fragmento, se destacou entre as demais pelo consumo de frutos. *Euterpe edulis* (palmito), quinta espécie com maior índice de valor de importância e *Zea mays*, abundante nos plantios durante todo o ano, também foram bastante utilizadas no consumo de frutos pelos animais deste fragmento. Essas espécies também foram bastante consumidas por *C. nigritus* em outros fragmentos da região do baixo Tibagi (Rocha, 1995, 2001), sendo consideradas altamente importantes para esses animais no contexto regional.

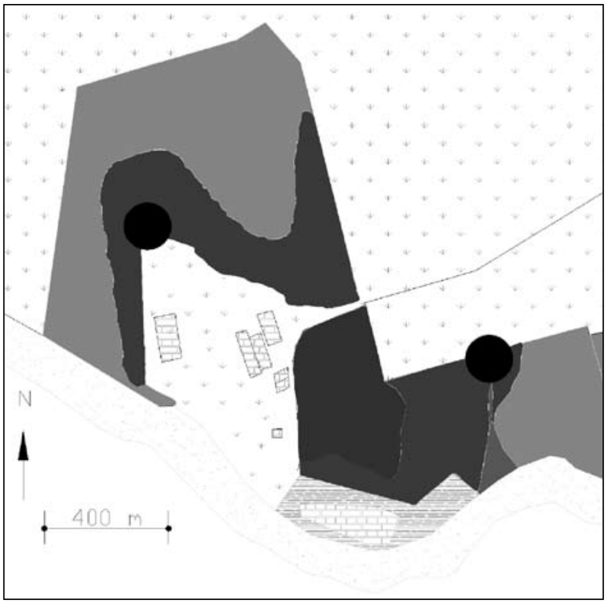

Figura 3. Área de vida de *Cebus nigritus*, GA, com 56 ha. Área nuclear com 14 ha (cinza escuro) e sub-áreas noroeste e sudeste (círculos em preto). Observe os plantios de milho (*Zea mays*) ao redor do fragmento.

Sazonalmente, a maior riqueza de espécies vegetais consumidas durante a primavera e verão pode ter refletido a maior disponibilidade de frutos durante estes períodos. Por outro lado, durante o outono e o inverno, foram poucas as espécies que produziram frutos que foram consumidos pelos primatas (e.g. *Sorocea bonplandii, Guarea kunthiana, Pereskia aculeata*), o que pôde refletir a menor riqueza de espécies vegetais na dieta. Nesses mesmos períodos, o consumo dessas espécies foi tão elevado que as três se destacaram na freqüência total obtida. Além disso, o consumo de tubérculos de *Manihot esculenta* pôde refletir a adaptação alimentar dos animais em períodos de escassez (Ludwig *et al.*, no prelo). Durante o inverno também pôde-se perceber um consumo mais elevado de itens animais, o que superou até mesmo a freqüência observada em relação aos frutos mais consumidos nessas épocas. Itens animais, principalmente insetos, também foram mais procurados durante as estações mais secas – como foi mostrado em outros trabalhos com várias espécies de *Cebus* (Robinson, 1986; Rodrigues, 1992; Izar, 1999; Rocha, 2001; Spironello, 2001) – demonstrando uma estratégia em resposta a menor disponibilidade de frutos.

Área de vida e percursos diários

O grupo de estudo apresentou uma área de vida pequena e bem definida, bastante inferior em relação aos trabalhos com outras espécies de *Cebus* em áreas de mata contínua: 80–125 ha (*C. apella* e *C. albifrons*; Terborgh, 1983), 275 ha (*C. olivaceus*; Robinson, 1986), 108 ha (*C. capucinus*; Chapman, 1988), 240 ha (*C. nigritus*; Izar, 1999), 81–293 ha (*C. nigritus*; Di Bitetti, 2001) e 900 ha (*C. apella*; Spironello, 2001). Porém, está mais próximo aos valores encontrados em estudos de fragmentação na região norte do estado do Paraná: 50–75 ha para grupos que também utilizaram plantios e pomares (Rocha, 1995). Os efeitos de fragmentação na diminuição da área de vida podem estar relacionados tanto às próprias restrições de tamanho impostas pelos fragmentos, quanto também à capacidade de "forrageio extra" vista para o gênero ao aproveitarem recursos externos à mata, como por exemplo, os plantios e os pomares. Estas fontes extras de recursos podem aumentar a densidade populacional nessas respectivas áreas e conseqüentemente reduzir as dimensões do espaço utilizado pelos animais em ambientes confinados. Isso ajudaria explicar a baixa exigência espacial encontrada neste trabalho quando comparada aos trabalhos citados acima.

Nos casos aqui verificados, a oferta de recursos relativamente freqüentes como os plantios poderiam estar funcionando como abundantes agregados de alimento. Estes por sua vez, reduziriam o tamanho da área de vida do grupo, já que áreas de vida deveriam ser menores se os

Tabela 3. Tabela comparativa das densidades de *Cebus nigritus* encontradas por diversos autores ao longo da distribuição geográfica da espécie.

Densidade (ind/ha)	Método	Localidade	Fonte
0,54 - 0,94	Área de vida e tamanho de grupos	Mata Doralice, Brasil	este trabalho
0,29 - 0,36	Área de vida e tamanho de grupos	PE Mata dos Godoy, Brasil	Rocha (2001)
0,66 - 0,76	Transecto linear	PE Vila Rica do ES, Brasil	Vidolin e Mikich (2004)
0,19 - 0,32	Transecto linear	Mata São José, Brasil	Bernardo e Galetti (2005)
0,057	Transecto linear	PN Iguazú, Argentina	Brown e Zunino (1994)
0,474	Transecto linear	RB Augusto Ruschi, Brasil	Pinto *et al.* (1993)
0,07	Transecto linear	Reserva Puriti, Brasil	Chiarello (2000)
0,01	Transecto linear	Reserva M7/317, Brasil	Chiarello (2000)
0,035 - 0,053	Transecto linear	Serra Paranapiacaba, Brasil	González-Solís *et al.* (2001)
0,16	Área de vida e tamanho de grupos	PN Iguazú, Argentina	Di Bitetti (2001)
0,51	Transecto linear	Mata ciliar (PR)/Rio Paraná/Brasil	L. M. Aguiar, dados não publicados

aglomerados de alimentos fossem abundantes (Pough *et al.*, 1999). Di Bitetti (2001) também verificou o efeito dos agregados alimentares na redução da área de vida em um grupo de *C. nigritus* no Parque Nacional do Iguazú, ao fornecer de modo freqüente, alimentos em plataformas para os animais.

Além do uso característico e freqüente de uma área nuclear (Terborgh, 1983), a utilização de outras duas sub-áreas pôde estar associada ao fácil acesso destas áreas aos plantios de *Zea mays* em frutificação. Além disso, estas sub-áreas de acesso também pareciam ser estratégicas contra a possibilidade de ataque de cães domésticos, pois eram localizadas distantes dos canis. Deste modo, essas áreas propiciavam ao grupo adentrar aos plantios com maior segurança.

Estimativas populacionais
As estimativas populacionais partiram da hipótese de a Mata Doralice ser homogênea. Todavia, é salutar ressaltar que esta densidade pode sofrer alterações se for considerada a heterogeneidade da mata. A estimativa de três a cinco grupos pareceu estar plausível, pois ao longo do estudo foram identificados três grupos sem a possibilidade de existência de outros. Ainda, a quantidade de grupos aqui encontrada é muito semelhante à verificada por Siemers (2000) em um fragmento de tamanho também semelhante ao da Mata Doralice. Em relação às densidades populacionais, os resultados apresentaram-se elevados em comparação às densidades estimadas por outros autores ao longo da distribuição geográfica da espécie (Tabela 3). Isso ilustra a flexibilidade de *C. nigritus* em prosperar uma população relativamente grande em um fragmento pequeno e estreito, frente às imposições de um mosaico ambiental constituído por fragmentos isolados, entremeados por monoculturas e pastagens.

Agradecimentos: Ao Pedro Favoreto, Bidú e Ivonete pelo apoio pessoal em campo. Ao José Marcelo D. Torezan, Manoel R. C. Paiva, Edmilson Bianchini e José Lopes pelo auxílio na identificação dos itens alimentares, e aos comentários de Nélio Roberto dos Reis, Isaac P. Lima, Fernando C. Passos e José H. F. Mariño.

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COPROPHAGY IN CAPTIVE BROWN CAPUCHIN MONKEYS (*CEBUS APELLA*)

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Introduction

Coprophagy, or the behavior of eating feces, is classified as autocoprophagy when the individual eats its own feces, or allocoprophagy when it eats the feces of others (Hirakawa, 2001; Graczyk and Cranfield, 2003). This habit is observed in lagomorphs, rodents, marsupials, and primates. Among leporids, coprophagy occurs in the form of caecotrophy (the reingestion of soft feces or caecotrophs) and serves to improve the absorption of vitamins and microbial proteins (Hirakawa, 2001). Caecotrophy has also been observed in a prosimian, the sportive lemur *Lepilemur leucopus* (Hladik, 1978). Among anthropoid primates, coprophagy has been observed in captive and wild apes (chimpanzees, gorillas, orangutans and gibbons: Hill, 1966; Gilloux *et al.*, 1992; Warniment and Brent, 1997; Nash *et al.*, 1999; Faraldo and Taylor, 2003; Graczyk and Cranfield, 2003; Krief *et al.*, 2004), Old World monkeys (baboons and rhesus macaques: Brent *et al.*, 2002; see also Graczyk and Cranfield, 2003), and New World monkeys (marmosets, tamarins and capuchin monkeys: Anderson *et al.*, 1991; Clark, 1994; Wissman, 1999; Taylor, 2002).

Krief *et al.* (2004) discussed a number of hypotheses to explain coprophagy by captive primates: (a) food deficiency, (b) boredom, (c) social stress, and (d) medical problems. The only report of coprophagy in capuchin monkeys (Anderson *et al.*, 1991) was of an occurrence during the integration of a tame adult female into a captive group. Anderson *et al.* argued that this abnormal behavior may have been related to food deficiency and/or social stress, since the human-raised female used to eat feces before adjusting to the standard primate food pellets offered in captivity. She was also frequently involved in agonistic interactions with other group members soon after her integration.

In this paper we report cases of coprophagy by captive brown capuchin monkeys and examine whether they fit the "food deficiency" and "social stress" hypotheses cited above. We predict that if food limitation is the primary stimulus for this behavior, coprophagy will be more frequent during those periods in which the monkeys have no food available in the cage. On the other hand, if social pressure can explain this behavior, we can expect to find an inverse relationship between social rank and individual frequency of coprophagy. In addition, we would expect that a given individual will be more likely to eat feces after being harassed by other groupmates.

Methods

The social behavior of a group of 10 brown capuchin monkeys (Table 1) was studied over 219.5 observation hours, from 8 April to 24 October 2003 at the Parque Farroupilha in Porto Alegre, Rio Grande do Sul, Brazil. This urban park has many visitors and is close to busy city streets. The study group was kept in a wired hexagonal cage with a cement floor, measuring approximately 5.5 m on each side with a height of 3.5 m. For behavioral enrichment the cage was equipped with a wheel, two tires and one movable ladder. The monkeys were fed only once a day, at about 09:00 h, with fruits, vegetables and sometimes peanuts. The cage was washed with water once a week on Thursday afternoons, so the monkeys had no food available until Friday morning.

We recorded all occurrences of coprophagy following the behavior sampling rule with continuous recording (Martin and Bateson, 1993). We determined the dominance status of each individual based on the frequency and distribution of agonistic interactions within dyads (see Janson, 1985). An individual was considered to have high social rank if it was the initiator of aggression more frequently than a recipient of aggression. In contrast, low social rank was indicated by a higher frequency of aggression received than performed.

Table 1. Age-sex composition of the study group, social rank, and recorded cases of autocoprophagy and allocoprophagy by each individual.

Age-sex class	Individual	Social rank	Auto-coprophagy	Allo-coprophagy
Adult male	Roger	1st	-	-
Adult male	Chico	2nd	-	-
Adult male	Tiburcio	4th	-	-
Adult male	Barba	6th	2	9
Adult male	Assis	10th	-	-
Adult female	Amelia	3rd	3	23
Adult female	Fabi	9th	-	15
Juvenile male	Dali	5th	1	8
Juvenile male	Guri	7th	4	4
Infant male	Fiba	8th	-	4
Total			10	63

Results

We recorded a total of 73 events of coprophagy (0.33 events per hour of observation). Six individuals (Amelia, Fabi, Barba, Dali, Guri and Fiba) were observed to eat feces. The remaining four (Roger, Chico, Tiburcio and Assis) never demonstrated this behavior (Table 1), but were occasionally seen to drink urine from the floor. Coprophagy was more prevalent than expected in females than in males (41 events vs. 32 events; $\chi^2 = 59.671$, d.f. = 1, $p < 0.001$). Allocoprophagy was more frequent than autocoprophagy.

Coprophagy was more common in the afternoon than in the morning (47 events or 0.47 events per hour of observation vs. 26 events or 0.22 events per hour; $\chi^2 = 11.000$, d.f. = 1, $p < 0.001$), suggesting that food availability may play an important role in the occurrence of this behavior. However, we recorded only nine instances of coprophagy (12%) in which there was no food on the cage floor. The frequency of coprophagy on Thursdays (when the cage was cleaned and devoid of food) was 0.21 events per hour, not above the expected level based on sampling effort (14 events; $\chi^2 = 1.785$, d.f. = 1, NS).

We observed a total of 326 cases of agonistic interactions during the study (1.49 events per hour of observation). Social rank did not explain inter-individual differences in coprophagy ($r^2 = 0.002$, n = 10, F-ratio = 0.016, $p = 0.901$). For example, the two highest-ranking individuals (Roger and Chico) and the lowest-ranking individual (Assis) never ate feces, whereas Amelia and Fabi (ranked third and ninth, respectively) showed the highest frequencies of coprophagy (Table 1). In addition, only rarely had the individual observed eating feces been harassed earlier in the day (Barba: two cases; Fabi: three cases; and Guri: two cases). Therefore, the "social stress" hypothesis was not supported.

Discussion

We observed a high frequency of coprophagy in this group of captive brown capuchin monkeys, a behavior reported only once before in this species (Anderson *et al.*, 1991). In a similar study on the social behavior of a captive group of nine capuchin monkeys at the Parque Zoológico de Sapucaia do Sul, Rio Grande do Sul, Brazil, Daniel B. Montano did not observe a single case of coprophagy during 208 hours of observation over 16 months (pers. comm.).

Its prevalence in adult females and immature individuals may be related to a diet insufficient in protein, as described for marmosets by Flurer and Zucker (1988). The tendency of females and immatures to exploit diets richer in protein has been described for a number of primates, and is related to the nutritional demands of gestation, lactation, and growth (see Bicca-Marques and Calegaro-Marques, 1994). This tendency, coupled with the fact that coprophagy was more frequent in the afternoon, supports the "food deficiency" hypothesis. However, most cases of coprophagy were observed when there was still food available in the cage, and its frequency on Thursdays (when the cage is cleaned) was not greater than that expected by chance.

Although social rank may interfere with food access, and may contribute to within-group differences in food deficiency, we found no relationship between this variable and the frequency of coprophagy. Thus, if the individual's degree of social pressure (reflected here by frequency of harrassment) is inversely related to social rank, the "social stress" hypothesis may also be rejected to explain the occurrence and distribution of coprophagy in this group.

We did not test the "boredom" and "medical problem" hypotheses for coprophagy, both of which would have required detailed information on individual differences in personality and health status. Therefore, it is not possible to evaluate whether the observed distribution of coprophagy among group members was caused by a single factor or by an interplay between food deficiency, boredom, and medical problems. Finally, it is possible that this uncommon behavior has been transmitted culturally among group members, as proposed for captive chimpanzees by Nash *et al.* (1999). The observations of Roger, Chico, Tiburcio and Assis (the only four individuals not involved in coprophagy) drinking urine is compatible with Stemmler-Morath's (1937, *apud* Hill, 1966) findings that apes began coprophagy by drinking their urine. To better understand the causes and significance of coprophagy for capuchin monkeys, it is important that researchers report all observations of this behavior both in captivity and in the wild.

Acknowledgements: We thank the personnel of the Parque Farroupilha, especially the zookeepers, for their support during this study.

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REHABILITACIÓN Y REPRODUCCIÓN DE *ALOUATTA CARAYA* FUERA DE SU ÁREA DE DISTRIBUCIÓN NATURAL

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Introducción

Alouatta caraya posee una amplia distribución en Sudamérica ocupando distintos tipos de bosques hasta los 29°56'S, en los cuales muestra una plasticidad comportamental destacada entre los primates del Neotrópico (Neville *et al.*, 1988). En condiciones de cautividad los aulladores negros no sobreviven largos períodos de tiempo, sugiriéndose la incapacidad de sustituir su dieta en estas condiciones, o bien la elevada susceptibilidad a situaciones generadoras de estrés entre las razones de esta baja viabilidad (Benton, 1976; Colillas y Coppo, 1978; Giudice *et al.*, 1995). Resulta paradójico que sólo se reproduzca excepcionalmente en cautiverio, bajo condiciones de cuidado intensivo; mientras logra reproducirse exitosamente en condiciones de libertad, en ambientes forestales exóticos con presión antrópica y más al sur de su límite austral natural de distribución. Estas condiciones no parecerían ser las más apropiadas para su supervivencia, ya sea por el rigor climático, la extrema fragmentación del hábitat en cercanía del hombre o por la pobre calidad y cantidad de la oferta de recursos alimentarios (Giudice y Ascunce, 1998). En esta oportunidad se presentan las primeras observaciones sobre hábitat, supervivencia, dieta y nacimientos, de *A. caraya* en condiciones de semilibertad, en bosques serranos, fuera del límite natural de su distribución marginal sur.

Sitio de Estudio

La población de *A. caraya* que es objeto de este reporte es parte de un estudio ecológico y comportamental en una tesis doctoral de la Universidad de Buenos Aires. Esta población habita dentro de los límites de una estancia privada de 300 ha en la que se encuentra el Centro de Reeducación del Mono Aullador Negro (CRMAN), surgido hace 10 años como una respuesta a la problemática relacionada con la rehabilitación y mantenimiento de ejemplares de aulladores negros extraídos de su entorno natural para su venta en el mercado ilegal de mascotas y que posteriormente son retenidos por diversas organizaciones de la provincia de Córdoba (Bruno *et al.*, 2004).

El CRMAN se encuentra ubicado a 1409 m.s.n.m., en el paraje Tiu Mayu (30°58'S, 64°25'O), Córdoba, Argentina. El clima templado serrano tiene temperaturas que oscilan entre -8.8°C y 32°C en invierno y 0.8°C y 38.4°C en verano, con una precipitación anual de aproximadamente 700 mm (Demaio y Medina, 1999). El área citada está inserta en la provincia fitogeográfica chaqueña, distrito serrano, caracterizado por sectores de bosque y pastizal de altura (Cabrera, 1976). Esta zona está notablemente alterada por las actividades humanas; las especies características del bosque nativo han sido paulatinamente eliminadas, siendo este bosque reemplazado casi en su totalidad por especies exóticas.

Sujetos de Estudio y Manejo

El CRMAN se caracteriza por recibir ejemplares procedentes de donaciones de particulares, así como de incautaciones/decomisos y derivados por el Departamento de Fauna Provincial (Córdoba, Argentina). Los ejemplares derivados al centro pasan un período de atención intensiva, en el cual son sujetos a los procedimientos clínicos y terapéuticos que los casos demanden. Posteriormente, se forman grupos para introducir en parches de monte exótico de aproximadamente 0.18 ha cada uno. En estos fragmentos de vegetación se han colocado travesaños para mejorar el desplazamiento en el dosel, tarimas para la colocación de los alimentos aportados por el centro y tambores metálicos de 0.60 x 1.00 m acondicionados para funcionar como refugios.

Una vez que los monos están en libertad se les aporta agua y alimentos en una razón diaria de 3 kg por grupo aproximadamente. La dieta suministrada está compuesta por verduras de hoja, frutas, pan, huevos, suplementándose además con té y leche. Todo ejemplar enfermo o que muestre signos de incompatibilidad social, es recapturado, reiniciándose la primera etapa de rehabilitación. Hasta la fecha, se han formando cuatro grupos, cuyo tamaño y composición sexo/edad se detallan en la Tabla 1.

Datos Preliminares

El CRMAN ha trabajado sobre un total de 89 aulladores desde 1994 hasta la fecha. Actualmente se mantienen 54 ejemplares, de los cuales 20 están bajo la etapa de cuidados intensivos y el resto, 34 ejemplares, están formando cuatro grupos, en distintos parches de monte exótico principalmente caducifolio (Tabla 1). Aún cuando en el área del CRMAN subsiste escasa vegetación arbórea nativa como *Fagara coco* y *Lithraea ternifolia* (representando al bosque serrano) y la presencia de gramíneas como *Stipa* sp. y *Festuca* sp. en el pastizal de altura (obs. pers., G. Bruno, 2004), hay una alteración en la composición florística por la introducción de especies de árboles exóticos, tal como *Ulmus procera, U. laevis, Robinia pseudoacacia, Populus nigra, Malus sylvestris, Thuja occidentalis, Cupressus macrocarpa* y *Salix fragilis*, entre otros. La reproducción con éxito comenzó a partir de 1998, totalizando 26 nacimientos hasta 2005, los cuales se producen a razón de cuatro ejemplares al año. El intervalo promedio entre nacimientos para las hembras multíparas

Tabla 1. Composición de grupos de *A. caraya* en semilibertad en el Centro de Rehabilitación del Mono Aullador Negro.

Grupo	Número total de individuos	Machos	Hembras	Adultos	Juveniles	Crías
1	9	6	3	4	2	3
2	9	3	4	5	1	3 (2 sin sexar)
3	8	4	3	3	4	1(sin sexar)
4	8	4	4	6	1	1

es de 14.62 ± 7.93 meses. Es importante destacar que los grupos formados permanecen en los parches, observándose cohesión con establecimiento de jerarquías. También se han registrado interacciones vocales entre grupos vecinos y comportamientos especie-específicos, muchos de ellos relacionados con el manejo del ambiente que habitan. Como ejemplos se puede mencionar el cuidado maternal, asistencia a las crías por parte de tías, juego entre las crías y juveniles, acicalamiento entre los distintos integrantes de la tropa, grupos térmicos, y alimentación espontánea de hojas y frutos de distintas especies del estrato arbóreo y herbáceo. Los monos consumieron espontáneamente hojas nuevas y maduras de *Robinia pseudoacacia, Salix fragilis*, brotes de *Populus nigra*, hojas y brotes de *Ulmus* spp., y hojas y frutos de *Rubus ulmifolius.* Estos recursos están disponibles sólo una parte del año, en las estaciones de primavera y verano, siendo suplementados con mayor intensidad con una dieta artificial en el resto del año, cuando los parches de bosque pierden su follaje casi por completo.

Los datos preliminares parecen avalar un proceso de rehabilitación integral de estos ejemplares extraídos de su entorno natural. Si comparamos la elevada tasa de reproducción en el CRMAN con los escasos eventos que se registran en cautividad (Fitchner Gomes y Bicca-Marques, 2003), estas observaciones preliminares permiten interpretar que *A. caraya* proveniente del mercado ilegal de mascotas puede sobrevivir en estado de semilibertad, adaptándose a un ambiente natural antropogénico que permite expresar un repertorio de conductas compatibles con las especie-específicas descriptas en el extremo austral de su distribución geográfica natural.

Si bien los estudios de ecología de *A. caraya* en este ambiente serrano antropogenizado están en una fase inicial de análisis, ante los hallazgos y el posible seguimiento de las tropas en el lugar y en el tiempo, el CRMAN se constituiría en una posible alternativa para la protección y conservación de *A. caraya*, una especie de difícil mantenimiento en el cautiverio tradicional de los zoológicos, quedando aún para su consideración, si estos ejemplares rehabilitados pueden ser reintroducidos con éxito en áreas particulares de su hábitat natural.

Agradecimientos: Este trabajo no sería posible sin el apoyo e interés institucionales junto a la información brindada por la Directora del CRMAN, Prof. M. A. Juárez. Se contó con la participación en los subsidios MDM-UBACyT X-031, X-107; CONICET PIP 2450/01.

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MALE TENURE AND REPRODUCTIVE SUCCESS IN SINGLE-MALE VS. MULTI-MALE GROUPS OF FREE-RANGING HOWLING MONKEYS IN COSTA RICA

Margaret R. Clarke
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Introduction

Male reproductive success in nonhuman primates has traditionally been measured by access to estrous females, and successful matings/inseminations are attributed either to high-ranking males in multi-male groups or to the one male in a single-male group (e.g., Fedigan, 1983; Smuts, 1987; Dixson *et al.*, 1993; Paul *et al.*, 1993). Paternity exclusion techniques and the testing of potential fathers and infants, however, have demonstrated that access, including copulation, does not always correlate with success. As group size increases, there are more females for the highest-ranking male to inseminate, and if the females are seasonal or synchronous breeders, the male is less able monopolize estrous females (Nunn, 1999; Takahashi, 2001). The discrepancy between dominance rank and mating success involves more than female availability, however. In single-male patas monkey groups, the resident male did not sire all offspring (Ohsawa *et al.*, 1993), and alternate male strategies in multi-male groups are known from rhesus monkeys (Berard *et al.*, 1993, 1994, 1999; Smith, 1993, 1994) and savannah baboons (Alberts *et al.*, 2003) which allow for reproductive success in lower-ranking males.

True reproductive success is defined as the total number of surviving offspring, which can only be measured over the lifetime of an individual male. Given the practical difficulties, this may be reduced to a pair of simple proxies: the length of time a male is fertile and has access to fertile females, and the number of other males competing for those same females. These two measures may serve as useful predictors of potential reproductive success.

Mantled howlers (*Alouatta palliata*) may form both single-male and multi-male groups within the same population. Since howler groups often experience takeovers by an outside male, there could be an advantage to living in a multi-male group, as low-ranking males would have the "protection" of the high-ranking males' competitive ability to repel newcomers (Nunn, 2000). Although all males would compete for access to estrous females, occasional reproductive synchrony could benefit low-ranking males; the dominant male can only monopolize one female at a time, which allows other males access to other fertile females. Conversely, the lone male in the single-male group would be expected to have access to all estrous females and father all offspring born in that group (Ridley, 1986), but would be at higher risk for predation or a takeover by an outside male (van Schaik and Horstermann, 1994).

To evaluate the effects of male tenure on reproductive success in both single-male and multi-male groups, we examined our records for group membership and infant survival in seven groups of howlers at Hacienda La Pacifica between 1970 and 2002. These included one group that had always had only one male, two groups that were always multi-male, and four groups that fluctuated between single- and multi-male status. As resource availability could have affected reproductive success, we carried out a similar analysis for males in riparian habitats (three groups), which could be considered richer in resources (Glander and Nisbett, 1996), vs. males in upland habitats (four groups).

We have made two important assumptions in this analysis. First, we assume that the male in a single-male group sires all offspring; and second, we assume that over a male's lifetime, males in multi-male groups have equal reproductive success. Takeovers by young males result in a reverse age-graded dominance hierarchy in this population (Glander, 1980; Jones, 1980). A young, dominant male would be expected to have high reproductive success, which would presumably decrease as the male aged and lost his status.

Methods

Study site

La Pacifica is a working cattle ranch / rice farm / tilapia farm in the dry tropical forest zone of Guanacaste Province, Costa Rica (Holdridge, 1967). Three rivers border the farm with associated riparian habitat. The farm was deforested in a comparatively conservative manner in the 1950s for cattle ranching The upland habitat was converted to pastureland, leaving strips of forest as windbreaks between pastures, and large areas of forest were left in hilly, rocky areas deemed unsuitable for grazing. Forested areas along the three rivers were untouched. The farm was originally irrigated through a low-maintenance, low-impact system operated by gravity, pulling water from the river on the north side of the farm. In 1986 the farm was sold and irrigation patterns changed: large machinery was used to clear larger ditches which increased waterflow and caused extensive soil erosion. In 1991 a substantial section was deforested for a major government irrigation canal, and in 1998 a major shift in land use occurred as pastures were converted to wet rice agriculture or tilapia tanks. Many of the forest areas were disturbed, but many others remain, and the size of the monkey population remained essentially unchanged from the 1970s to 1998 (Clarke *et al.*, 2002).

Study subjects

Animals from seven different social groups have been tracked for various periods from 1970 to the present. Thirty-three males were included in this analysis, eight in single-male groups and 30 in multi-male groups. Five of these males spent time in each type of group.

Data collection

This analysis is based on data collected during population surveys from 1974–76, 1984, 1991, and 1998 (Clarke *et al.*, 1986; Clarke and Zucker, 1994; Clarke *et al.*, 2001), yearly counts of groups by MRC, and repeated capture and mark sessions from 1970 to 2002. Behavioral studies carried out by M. R. Clarke, K. E. Glander, R. A. Nisbett and E. L. Zucker during the past thirty years have characterized group composition in detail.

Analysis

To analyze male tenure, we compared the number of years for each male in a multi-male group (n = 30) to the number of years for each male in a single-male group (n = 8) using an independent t-test. We also tested the number of years spent in a single- vs. a multi-male group for the same males in the same groups (n = 5), using a repeated measures t-test. We compared the number of years in single-male (n = 3), multi-male (n = 25), or both group types (n = 5) using an independent one-way ANOVA. We used an independent t-test to compare the number of years spent in a riparian habitat group vs. an upland habitat group. For the habitat comparison, total time for each male in the group was used regardless of male composition.

To calculate male reproductive success, we divided group history for all groups into time blocks of single- or multi-male tenure (seven blocks of multi-male, eight blocks of single-male). For each time block, the total number of "male years" was calculated and divided by the years in that time block to yield an average number of males per year. (E.g., in a four-year time block, if there were two males in the group for all four years and a third in the last year, there were 4 + 4 + 1 = 9 male-years divided by the four years of that time block, yielding an average of 2.25 males/year.) We used the same approach to calculate the mean number of females per year. We also tabulated the mean number of infants born per year and surviving per year. We calculated the potential number of infants per male (*potential infant/male*) by dividing the mean number of females by the mean for males. *Realized reproductive effort* was calculated by dividing the mean number of infants born to the mean number of males, and dividing that by *potential infant/male*, while *relative infant loss* was calculated by subtracting the mean number of infant survivors from the mean of all infants born. Each of these measures was tested by habitat (riparian vs. upland) and by male composition (single-male vs. multi-male) using independent t-tests.

Results

Male tenure

We found no significant differences in time spent in a single-male group or in a multi-male group (Table 1). For the five males which spent time in both group types, we also found no statistical differences between the length of time they spent in a single-male vs. a multi-male group (Table 1). However, when total time for specific males that alternated between group types is compared to males living exclusively in a single-male or multi-male group, males with the alternating strategy were in social groups significantly longer overall (Table 1). As before, however, we found no differences between animals living only in a single-male or in a multi-male group (Tukey post hoc test, $p < 0.05$, critical diff. = 6.0: single/multi = 0.45; single/both = 6.7; multi/both = 7.1). There were no differences in length of time in social groups by habitat type (Table 1).

Reproductive success

We found no difference in realized reproductive effort per male between single- and multi-male groups (see Table 2), but the potential for infant production was significantly greater in the single-male groups. Infant survivorship, when expressed as a ratio of infants born minus infants surviving, was greater in a single-male group, although it only approached statistical significance (see Table 2). More infants per female per male were born in riparian habitats, but neither the number of potential infants per male nor infant survivorship were associated with habitat type (see Table 2).

Discussion

We expected that males would reside in multi-male groups longer than in single-male groups, but this was not borne out. Residence in a larger group would presumably buffer an individual male's reproductive success against the likelihood of a male takeover, ensuring that the resident male shared group membership rather than having no membership at all. In theory, the shared group membership would be balanced by increased competition for access to fertile females, as opposed to the presumably sole access in the much smaller single-male group. The true situation, however, is apparently much more complex.

We found no differences in the mean number of infants born per male between single- or multi-male groups, but there were significantly more females available per male in the single-male group (almost double) than in the multi-male groups. Thus, males in single-male groups are not achieving all possible pregnancies, which raises several questions. Are they spending their time defending their females rather than copulating? In the absence of male-male competition, do they monitor female receptivity less carefully? Even considering the approximately two-year interbirth interval documented in this population (Glander, 1980), half of the females should give birth every year regardless of the number of available males. As reproductive success involves infant survivorship as well as number of offspring, it should be noted that infant survivorship is somewhat greater in single-male groups. Thus, a female might be less likely to conceive in a single-male group, but once she is pregnant, it would appear that her infant has a better chance of surviving its first year in a single-male group.

Table 1. Group tenure. Comparison of time in years which males spent in single-male groups, multi-male groups or both group types, and for groups in riparian vs. upland habitat.

	Mean	SD	Mean	SD	Mean	SD	t / F	df	Significance
	Single-male		**Multi-male**		**Both**				
Sample Type:									
One-multi (all)	5.6	3.0	6.2	3.6	-	-	t = 0.41	36	n.s.
Repeated	5.2	2.6	7.8	4.5	-	-	t = -1.34	4	n.s.
One/multi/both	6.3	4.0	5.9	3.4	13.0	6.0	F = 6.9	32	p < 0.01
	Riparian		**Upland**						
All males	8.1	5.4	6.1	3.7			t = 1.23	31	n.s.

Table 2. Reproductive success. Realized and potential reproductive success by year for males in single-male and multi-male groups, and by riparian vs. upland habitat type, including infant loss.

	Mean	SD	Mean	SD	t	df	Significance
	Single-male		**Multi-male**				
Sample (mean per year)							
Realized reproduction/male	0.4	0.2	0.5	0.1	-1.16	13	n.s.
Potential infant/male	4.3	1.2	2.6	0.8	3.17	13	p < 0.01
Relative infant loss	0.4	0.6	0.9	0.5	-2.05	13	p = 0.06
	Riparian		**Upland**				
Realized reproduction/male	0.5	0.1	0.3	0.1	2.68	13	p < 0.02
Potential infant/male	3.3	1.0	3.7	1.5	-0.54	13	n.s.
Relative infant loss	0.7	0.6	0.6	0.6	0.50	13	n.s.

Single-male groups are generally smaller (range = 4–12) than multi-male groups (range = 8–42), and while single-male groups occur in both habitat types, they are more common in upland habitat (Clarke *et al.*, 2002). Upland habitat is more affected by the distinct seasonality of the dry tropical forest, and upland habitat females are lighter than their riparian counterparts (Teaford and Glander, 1997; Glander, in press). These are factors which could contribute to females not conceiving, but they would not explain higher infant survivorship in single-male groups. As high-ranking females often attack the infants of lower-ranking females (Clarke *et al.*, 1998), it is possible that having fewer females in a single-male group may improve infant survivorship, an important factor unrelated to the number of males.

From the male standpoint, it might seem that the best strategy for long-term access to females is to maintain group membership, regardless of whether it is in a single-male or a multi-male group. This flexible strategy is not common, however, as only five of the 33 males in this sample were able to pursue it successfully. While males can stay in a multi-male group after a new male takes over, the sex-ratio becomes less favorable thereafter, with fewer females in proportion to males. Older males have two alternative strategies: leave a multi-male group and take over a single-male group, or form a new group with peripheral females. There is evidence that both patterns exist (Clarke and Glander, 2004).

The most surprising result is the almost complete lack of association of either tenure or reproductive parameters with habitat type. The dichotomy between the upland habitat and riparian habitat in dry tropical forest is a common analytical parameter, but it should be noted that while the groups labeled "upland" never used riparian habitat, all of those labeled "riparian" do make extensive use of upland habitat at some times of the year (pers. obs.). A confounding effect is involved because single-male groups are more common in the upland habitat, but from this analysis, it appears that the composition of social groups is a better predictor of tenure and reproductive success than the habitat alone.

This analysis is based on assumptions that need to be confirmed through paternity exclusion tests. The overall conclusion — that males have improved reproductive success through complete access to females in a single-male group, as opposed to competing for females in a multi-male group — should not be accepted without question. These results, based on long-term field records, should provide evidence that presumptions about male reproductive success based on observations of potential access to females alone are not valid.

Acknowledgements: The authors acknowledge the financial support of the National Science Foundation, National Geographic Research Grants, Explorer's Club, School for Field Studies, Earthwatch, Duke University, Newcomb College and Center for Latin American Studies from Tulane University, and the Tulane National Primate Research Center. We thank the management of La Pacifica, particularly Fernando Estrada, for allowing us to continue our research at the site, and we thank Ronald Carrera, Luis Herra, Vreni Hagnauer, Jorge Hagnauer, Werner Hagnauer and all of the La Pacifica personnel who have helped us over the years. We thank the legions of students for their contributions to the dataset, and Norm Scott Jr., Richard Nisbett, Evan Zucker, Carolyn Crockett, Maria Zaldivar and Mark Teaford for both formal and informal contributions to the information presented in this paper. The impetus for this analysis came from Danielle Epstein, and the analysis was improved by suggestions from Randall Ford.

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Caracterización de los Dormideros Usados por *Ateles belzebuth* en el Parque Nacional Yasuní, Ecuador

Wilmer E. Pozo R.

Introducción

En general, la mayoría de los primates duermen en árboles, pero algunas especies del Viejo Mundo, como los hamadrias (*Papio hamadryas*), duermen en peñascos (Stammbach, 1987), los orangutanes (*Pongo pygmaeus*) pernoctan en plataformas construidas sobre el suelo con ramas y hojas (Rodman y Mitani, 1987) y los gorilas (*Gorilla gorilla*) pasan la noche en nidos construidos en los árboles o sobre el suelo (Schaller, 1963; Morris, 1991).

En los bosques Neotropicales, todos los primates duermen en árboles, cuyas características difieren de una especie a otra. Así, por ejemplo, los monos nocturnos (*Aotus* spp.) utilizan diferentes tipos de dormideros, tales como huecos en troncos y ramas de árboles secos o envejecidos (obs. pers.), sitios complejos formados por una masa vegetal de epífitos, trepadoras y enredaderas, o sitios simples de un follaje denso (Aquino y Encarnación, 1986). Los escasos estudios de campo respecto a primates del género *Callithrix* sugieren diferencias entre sus especies, pero la mayoría de ellas aumentan el número de árboles utilizados como dormideros con el tamaño de sus ámbitos hogareños, pudiendo también usar el mismo dormidero por varias noches consecutivas (Stevenson y Rylands, 1988). Los monos chichicos (*Saguinus* spp.) acostumbran cambiar frecuentemente sus dormideros, los mismos que son seleccionados estratégicamente a fin de minimizar el contacto con sus predadores (Snowdon y Soini, 1988). Especies del género *Leontopithecus* presentan la tendencia de dormir en huecos de árboles (nidos) abandonados por otras especies (Kleiman *et al.*, 1988).

Monos de tamaño más grande, como los aulladores (*Alouatta* spp.), duermen en las ramas horizontales de árboles de mediano a gran tamaño; casi siempre estos árboles son forrajeados antes de ser usados como dormideros (Neville *et al.*, 1988). Los chorongos del Yasuní (*Lagothrix lagothricha*) forman grandes agrupaciones sociales (Di Fiore, 1997). Estos grandes grupos forrajean juntos y al final del día se dividen en subgrupos que duermen muy cercanamente, usando varios árboles de características diferentes (obs. pers.). Observaciones de campo realizadas por Ramírez (1988) en la Amazonía peruana indican que un subgrupo de cinco individuos escogió para dormir un gran árbol completamente lleno de hojas. Los muriquís del Brasil (*Brachyteles arachnoides*) generalmente duermen en el estrato medio del bosque, utilizando las ramas bifurcadas de sus árboles dormideros (Nishimura *et al.*, 1988).

Existe escasa información que caracterice los dormideros que usa *Ateles belzebuth*, probablemente debido a la dificultad que representa seguir a individuos de esta especie. Sin embargo, van Roosmalen (1985) y Chapman (1989) han reportado que los monos araña (*Ateles paniscus paniscus* y *Ateles geoffroyi* respectivamente) prefieren dormir en árboles de los estratos altos del bosque, usando entre 11 y 43 individuos arbóreos y que muchos de estos árboles suelen utilizarse para dormir en múltiples ocasiones. Generalmente, estos primates duermen en subgrupos que ocupan uno o varios árboles dormideros y el tamaño de los subgrupos se relaciona con las necesidades forrajeras de sus individuos (Chapman, 1989).

En este artículo se describen las características de los sitios y árboles utilizados como dormideros por parte de un grupo de *Ateles belzebuth* en el Parque Nacional Yasuní (PNY), Ecuador, durante un seguimiento realizado entre diciembre de 1994 y febrero de 1996, con el fin de estudiar el comportamiento social y las costumbres alimenticias de la especie (Pozo, 2001, 2004a).

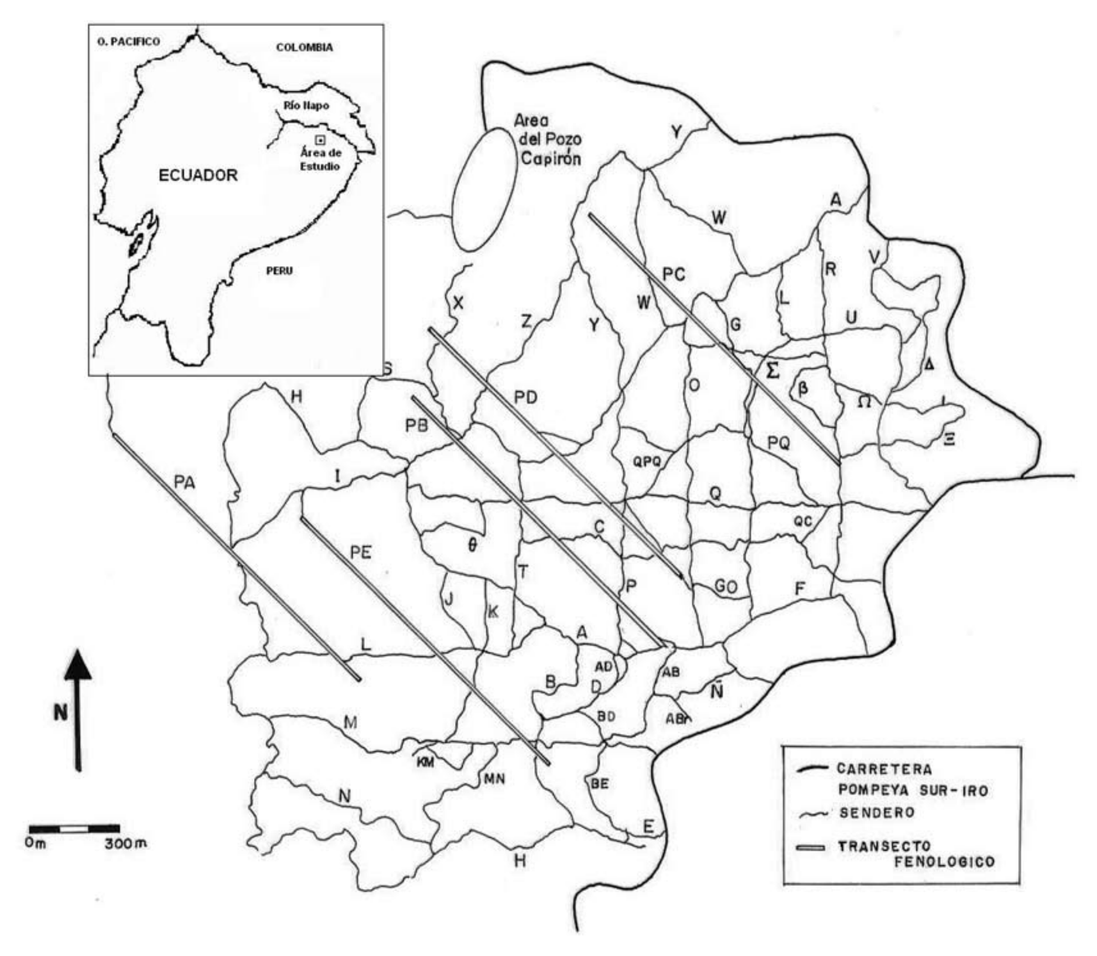

Figura 1. Sistema de transectos del área de estudio. Las letras diferentes indican los nombres de los senderos; PB, PC y PD se utilizaron para estudiar la estructura de hábitat.

Métodos

El estudio se llevó a cabo en el Oriente ecuatoriano, Provincia de Orellana, en el Parque Nacional Yasuní, en un área algo mayor a 400 ha (Fig. 1), en la que se han conducido varios estudios primatológicos (Di Fiore, 1997, 2004; Youlatos y Pozo, 1999; Cant *et al.*, 2001, 2003; Pozo, 2001, 2004a, 2004b; Pozo y Youlatos, 2005a). El sitio se ubica en el kilómetro 47 de la carretera Pompeya Sur – Iro (00°42'17"S y 76°28'05"O) y está formado por valles y colinas cuyas altitudes oscilan entre los 210 y 330 msnm. La temperatura media anual, durante el período de estudio, fue de 27.73°C, mientras que la precipitación fue de 3690.1 mm (Pozo, 2001).

Holdridge (1982) clasifica al Oriente ecuatoriano en la zona de vida llamada bosque húmedo tropical. La formación vegetal del sitio de estudio es el bosque siempre verde de tierras bajas de la amazonía (Sierra *et al.*, 1999), donde *Iriartea deltoidea*, *Oenocarpus bataua*, *Virola pavonis*, *Otoba glycycarpa*, *Parkia multijuga*, *Pouroma bicolor*, *Cedrelinga cateniformis*, *Ceiba pentandra*, *Ficus maxima*, *Trichilia* spp. y *Philodendron* spp., entre otras, forman parte de la flora típica (Sierra *et al.*, 1999). Una lista completa de las especies de plantas características del sitio de estudio se presenta en Di Fiore (1997) y Pozo (2001).

En una de las revisiones más importantes para el género, Kellogg y Goldman (1944) consideraron que *Ateles belzebuth* estaba compuesta por tres subespecies (*A. b. belzebuth, A. b. marginatus* y *A. b. hybridus*), mismas que recientemente han sido elevadas a nivel de especie (Groves, 2001). La localidad tipo de *Ateles belzebuth* es desconocida (Kellogg y Goldman, 1944), pero se sabe que esta especie se distribuye desde Venezuela, al este de la bocana del rio Guapó en el Orinoco, hasta el nororiente peruano en el Sarayacu (Kellogg y Goldman, 1944). En Ecuador, la especie vive sólo al Oriente, desde el sur del río Napo hasta la frontera sur con Perú. En español, se le denomina como "mono araña", los Huaoranis la llaman "deiye", mientras que los quichuas la conocen como "makisapa", que significa mano larga.

Un grupo de *Ateles belzebuth* de 25 individuos (entre crías, juveniles y adultos de ambos sexos, según el criterio de Izawa *et al.* [1979]), fue seguido diariamente por el mayor

Tabla 1. Estructura del hábitat del sitio de estudio. Los resultados expresan los porcentajes de las observaciones realizadas a 303 puntos de observación y a 493 árboles y palmas. BA = bosque alto, BA/L = bosque alto con lianas, BL = bosque de lianas, BB = bosque bajo, BT = bosque transicional, CLB = claro de bosque, TAB = árbol con DAP tabular, PB, PC y PD = nombre de los transectos donde se estudió la estructura del hábitat; vea también Fig. 1.

Tipo de Estructura	Subtipos	Transectos			Área Total
		PB	PC	PD	
a) Topografia	Cima	6	9	21	12
	Ladera	48	46	42	45
	Riachuelo	4	11	4	6
	Terraza	31	18	30	26
	Valle	12	17	4	11
	Total	100	100	100	100
b) Bosque	BA	42	76	56	58
	BA/L	8	6	9	8
	BL	11	1	5	6
	BB	2	0	2	1
	BT	20	7	21	16
	CLB	18	10	7	12
	Total	100	100	100	100
c) DAP	1–20 cm	43	37	53	44
	20–40 cm	40	42	35	39
	40–60 cm	7	9	5	7
	60–80 cm	4	2	0	2
	80–100 cm	1	0	1	1
	tab	5	10	7	8
	Total	100	100	100	100
d) Altura	1–5 m	3	2	1	2
	5–10 m	26	15	31	24
	10–15 m	28	31	36	32
	15–20 m	22	33	22	26
	20–25 m	14	16	8	12
	25-más	7	3	2	4
	Total	100	100	100	100

tiempo posible. Una vez que los monos llegaron a un árbol dormidero, se tomó la siguiente información: fecha, hora, topografía, tipo de formación boscosa en la que se ubicó en árbol dormidero, diámetro a la altura del pecho (DAP), altura del árbol dormidero, altura a la cual los animales usaron el árbol dormidero y, en lo posible, el taxón.

Para conocer las características ecológicas del sitio de estudio, se realizó un análisis rápido de la estructura de hábitat (Pozo y Youlatos, 2005). Este análisis se aplicó a tres senderos (PB, PC y PD, Fig. 1), mismos que presentaron una orientación de 320° noroeste y una longitud de 1000 m. Los senderos fueron marcados cada 10 m en un punto medio, desde el cual se tomó información en un ancho aproximado de 10 m. De acuerdo con el DAP, la altura arbórea y el diámetro de corona de 493 árboles, asi como los hábitos de las plantas presentes en los puntos de observación (palmas, epífitos, lianas, árboles maduros, etc.), se calificó al tipo de vegetación como bosque alto, bosque alto con lianas, bosque de lianas, bosques bajos, bosques transicionales y claros del bosque. Las características biofísicas de los tipos de formaciones boscosas se aprecian en la Tabla 2.

Se hipotetizó (H_0) que los monos araña utilizan los árboles para dormir de manera aleatoria, y por tanto, las características ecológicas de los sitios en donde se localizan los árboles dormideros serían iguales a las características ecológicas generales del sitio de estudio. Por ejemplo, se espera que las proporciones de tipos de bosque donde se localicen los árboles dormideros sean similares a las proporciones de hábitat disponibles en el área de estudio. Para contrastar esta hipótesis se realizó un análisis de estructura del hábitat y la información obtenida (Tabla 1) se usó como resultados esperados en las pruebas de χ^2 aplicadas a los resultados obtenidos, con un nivel de decisión α de 0.05. En lo que respecta a DAP, sólo 14 de los 16 árboles dormideros fueron medidos; de ellos, cinco presentaron bases con raíces tabulares, en cuyo caso no se consideró esta medida para el análisis de los datos.

Tabla 2. Características de las formaciones boscosas del sitio de estudio (según Pozo y Youlatos, 2005a y 2005b). La tabla indica los resultados globales de la altura en m y el diámetro a la altura del pecho (DAP) en cm de los árboles muestreados en los senderos PB, PC y PD; n = número de árboles medidos en cada formación boscosa, D = árbol derecho, I = árbol izquierdo, PT = promedio total de los datos obtenidos, TAB = número de árboles con bases tabulares.

Tipo de Formación Boscosa	Altura				DAP				TAB
	n	D	I	PT	n	D	I	PT	
Bosque alto	352	15.98	16.05	16.01	316	22.97	26.80	24.89	36
Bosque alto/lianas	44	15.07	12.54	13.80	42	21.95	21.06	21.50	2
Bosque de lianas	14	12.21	9.46	10.83	14	22.63	18.24	20.43	0
Claros de bosque	29	11.65	10.83	11.24	29	21.68	17.10	19.39	0
Bosque transicional	46	9.15	10.73	9.92	46	16.28	16.65	15.78	0
Bosque bajo	8	7.75	7.50	7.63	8	9.90	14.28	11.09	0

Tabla 3. Resultados de las pruebas de χ^2 para determinar la preferencia de los monos araña para dormir en los distintos tipos de bosque, de topografía, de estrato arbóreo y de DAP de los árboles utilizados como dormideros.

Estadísticas	**Preferencia de:**			
	Bosque	**Topografía**	**Estrato**	**DAP**
Suma de categorías	100	100	100	100
χ^2 Bioestat	44.479	160.192	1143.458	346.057
Grados de libertad	5	4	5	5
(p)	<0.001	<0.001	<0.001	<0.001
Significancia	**	**	**	**
H_0	Rechazada	Rechazada	Rechazada	Rechazada
H_1	Aceptada	Aceptada	Aceptada	Aceptada

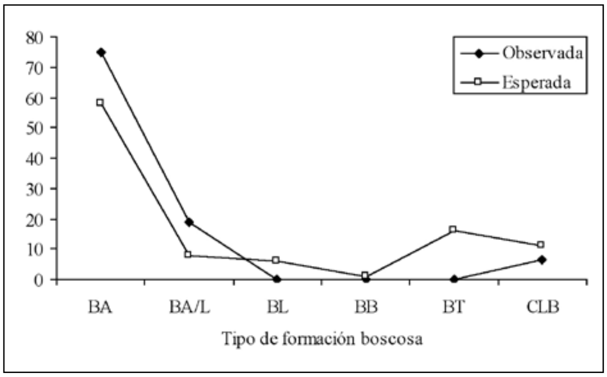

Figura 2. Frecuencias observadas vs. frecuencias esperadas del uso de dormideros en cada tipo de formación boscosa. BA = bosque alto, BA/L = bosque alto con lianas, BL = bosque de lianas, BB = bosque bajo, BT = bosque transicional, CLB = claro de bosque.

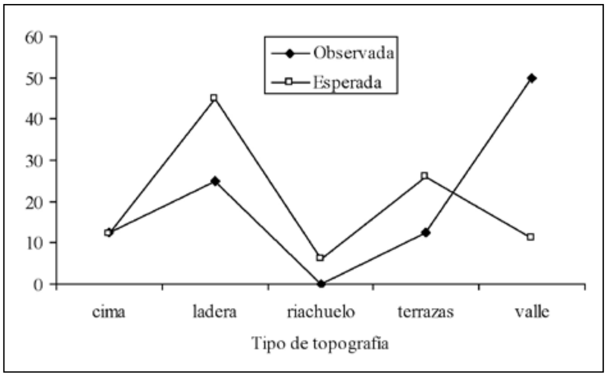

Figura 3. Frecuencias observadas vs. frecuencias esperadas del uso de dormideros considerando su ubicación topográfica.

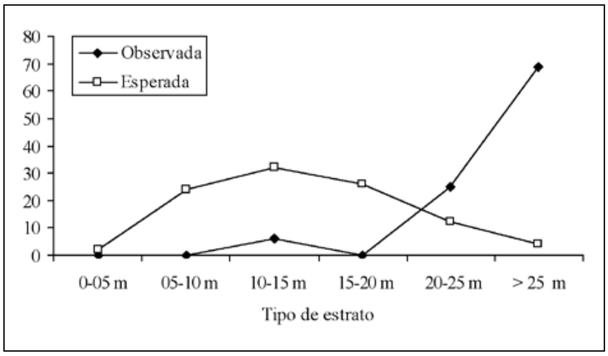

Figura 4. Frecuencias observadas vs. frecuencias esperadas del uso de estratos para dormir.

Resultados

Preferencia de hábitat
En el 75% de las ocasiones (n = 16), el grupo estudiado durmió en un tipo de formación boscosa denominada bosque alto, el 18.75% lo hizo en una mezcla de bosque alto con lianas y el restante 6.25% en bosque de lianas. Existe una diferencia altamente significativa entre las frecuencias de uso de tipo de bosque y las proporciones en las que se presentan las formaciones boscosas en el sitio de estudio (χ^2 = 44.479, gl = 5, p < 0.001, Tabla 3); lo que implica una alta preferencia de estos monos para dormir en el bosque alto (Fig. 2). Considerando la topografía donde se situaban los árboles dormideros (n = 16), los animales durmieron en valles (50%), laderas (25%), terrazas (12.5%) y cimas (12.5%). Los animales tampoco utilizaron las formaciones topográficas en las proporciones en que éstas se disponen en el área de estudio, más bien se observó la preferencia para dormir en los valles (χ^2 = 160.192, gl = 5, p < 0.001, Tabla 3, Fig. 3). Dividiendo al bosque en estratos de 5 m de altura, se determinó que los animales usaron el estrato > 25 m en un 69%, el estrato de 20 a 25 m en un 25% y el estrato de 10 a 15 m en un 6%, mientras que los estratos de 0 a 5 m, de 5 a 10 m y de 15 a 20 m jamás fueron utilizados para dormir. Los monos araña mostraron una preferencia significativa para dormir en los estratos mayores a 25 m (χ^2 = 1143.458, gl = 5, p < 0.001, Tabla 3, Fig. 4).

Características de los árboles dormideros
Tan sólo nueve de los 16 árboles usados para dormir fueron determinados por lo menos a nivel de familia; de éstos, las familias más utilizadas fueron Bombacaceae (n = 3) y Myristicaceae (n = 2), seguidas por las familias Meliaceae, Mimosaceae, Moraceae, y Papilionaceae (n = 1 cada una). Las especies identificadas como dormideros fueron *Virola pavonis* (n = 2), *Cecropia sciadophylla* (n = 1), *Guarea* sp. (n = 1) y *Huberodendron* sp. (n = 1). Dos especies de la familia Bombacaceae y una de la familia Papilionaceae no pudieron ser identificadas.

Los árboles usados como dormideros (n = 16) presentaron una altura promedio de 28.94 m (DS = ± 6.05, X_{min} = 14, X_{max} = 35), siendo el 75% de ellos emergentes. Tan sólo en una ocasión los animales durmieron en la parte más alta del

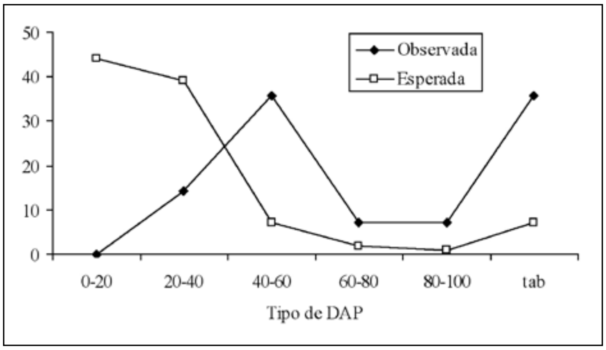

Figura 5. Frecuencias observadas vs. frecuencias esperadas del uso de árboles dormideros con distintos DAP; tab = árbol con DAP tabular.

árbol dormidero (30 m). A pesar de siempre usar el estrato alto de los árboles dormideros, los monos araña usualmente durmieron entre 1 y 9 m más abajo de la altura promedio de dichos árboles; es decir, que la altura promedio usada para dormir (n = 14) fue de 23.93 m (DS = ± 4.51, $X_{min} = 12$, $X_{max} = 30$), la cual estuvo directamente influenciada por la altura del árbol escogido para dormir ($R^2 = 0.832$, $r_p = 0.912$, gl = 12, $p < 0.001$). Es interesante notar que casi la mitad de los árboles escogidos para dormir presentaron lianas y epífitos (43.75%, n = 16).

El DAP promedio de los árboles dormideros medidos (n = 9) fue de 50.43 cm (DS = ± 14.61, $X_{min} = 30$, $X_{max} = 80.1$). Creando rangos de 20 cm para el DAP de los árboles dormideros, se observó que los animales durmieron en árboles (n = 14) con DAP entre 20 a 40 cm en un 14.30% de las veces, entre 40 a 60 cm en un 35.71%, entre 60 a 80 cm en un 7.14%, entre 80 a 100 cm en un 7.14% y además durmieron en cinco árboles (35.71%) con raíces tabulares al nivel del DAP (referidas en lo subsecuente como "DAP tabular"). Estas proporciones indican que los monos araña prefieren significativamente dormir en los árboles con DAP de 40 a 60 cm y con DAPs tabulares ($\chi^2 = 346.057$, gl = 5, $p < 0.001$, Tabla 3, Fig. 5). De los árboles con DAP de 40 a 60 cm (n = 5) el 80% fueron emergentes y el 100% ocuparon los estratos altos del bosque; mientras que sólo uno de los cinco árboles con bases tabulares no fue emergente, ocupando el estrato medio del bosque.

Composición social de los subgrupos durmientes

El tamaño de los subgrupos (n = 16) que durmieron en un árbol varió de un a tres individuos, siendo el 50% de ellos de un solo individuo, el 12.5% de dos individuos y el restante 37.5% de tres individuos (Tabla 4). En dos de los subgrupos con dos individuos y en uno con tres individuos no fue posible determinar la composición sexo-edad. Tan sólo uno de los ocho individuos solitarios fue macho adulto. El resto fueron hembras adultas con infante, mismas que fueron contadas como miembros solitarios debido a la alta dependencia de los infantes con sus madres (Izawa *et al.*, 1979). El subgrupo de dos individuos estuvo conformado por dos hembras adultas con infante. Dos de los cuatro grupos con tres individuos estuvieron conformados por una hembra adulta con infante, una hembra adulta sin infante y por una hembra juvenil; los otros dos subgrupos de tres individuos estuvieron integrados por una hembra adulta con infante, un macho adulto y una hembra subadulta (Tabla 4).

Tabla 4. Composición social de los subgrupos que usaron los árboles dormideros. HA+I = hembra adulta con infante, MA = macho adulto, ? = individuo de categoría edad-sexo no determinada, HA = hembra adulta sin infante, HJ = hembra juvenil, HSA = hembra subadulta.

Tipo de subgrupo	Composición edad-sexo	Frecuencia	Frecuencia acumulada
Solitario	HA+I	7 (43.75%)	7 (43.75%)
Solitario	MA	1 (6.25%)	8 (50.00%)
Dúo	?, ?	1 (6.25%)	9 (56.25%)
Dúo	HA+I, HA+I	1 (6.25%)	10 (62.50%)
Tríos	?, ?, ?	1 (6.25%)	11 (68.75%)
Tríos	?, MA, HA	1 (6.25%)	12 (75.00%)
Tríos	HA, HA+I, HJ	2 (15.50%)	14 (87.50%)
Tríos	MA, HA+I, HSA	2 (15.50%)	16 (100.00%)

Discusión

Al realizar análisis de uso preferencial, varios autores han interpretado al dato con mayor frecuencia de observación, como el que marca la preferencia en el uso de hábitat y de estrato (de la Torre, 1991; Reyes, 1991). No obstante, con el fin de verificar si los datos de mayor frecuencia son realmente preferenciales, es necesario compararlos con los resultados esperados (Fonseca, 1985) o con la disponibilidad de hábitat en el área de estudio (Jiménez, 1995; Pozo, 2001). Inclusive, se observa en este estudio que las frecuencias con las que se usan los diferentes tipos de bosques para dormir aparentan ser similares a las frecuencias en las que éstos se disponen en el sitio de estudio (Fig. 2). A pesar de ello, la prueba χ^2 indicó que no existe dicha semejanza. Por otro lado, las frecuencias observadas sobre la situación topográfica de los árboles utilizados como dormideros mostraron una clara preferencia por los monos araña para dormir en los valles; y, a pesar de que los estratos mayores a 25 m son escasos en el sitio de estudio (Pozo, 2001), los animales presentan una alta preferencia para dormir en ellos. Así, este artículo demuestra la utilidad de la prueba χ^2 para probar preferencia de uso de hábitat.

Las especies vegetales identificadas como dormideros en el PNY fueron *Virola pavonis*, *Cecropia sciadophylla*, *Guarea* sp. y *Huberodendron* sp.; así como dos especies no identificadas de la familia Bombacaceae y una de la familia Papilionaceae. Van Roosmalen (1985) reporta a *Buchenavia capitata*, *Vataireopsis speciosa*, *Couratari stellata*, *Hymenolobium flavum*, *H. petraeum* y *Parkia pendula* como las especies mayormente utilizadas como dormideros del mono araña en Surinam. Se puede notar que no existe una gran diferencia entre el número de especies de árboles dormideros reportados para *A. belzebuth* y para *A. paniscus*; sin embargo, hay una gran diferencia entre las familias, géneros y especies utilizadas como dormideros, lo cual seguramente depende de la disponibilidad de dichas especies en los sitios de estudio.

El 75% de los árboles utilizados para dormir por los monos araña en el PNY fueron emergentes. Este dato es similar a los publicados por otros autores, quienes sostienen que los monos araña prefieren dormir en árboles muy altos y grandes (van Roosmalen, 1985; Chapman, 1989). No obstante, los árboles preferidos como dormideros en el PNY se muestran más delgados (DAP = 50.43 cm) que los del Parque Nacional Santa Rosa en Costa Rica (DAP = 75.1 cm; Chapman, 1989). No obstante, es de notarse que la mayoría de árboles utilizados para dormir fueron emergentes y ocuparon los estratos más altos del bosque. Van Roosmalen (1985) y Van Roosmalen y Klein (1988) sugieren que el uso de árboles emergentes, de coronas completamente separadas de los estratos inferiores del bosque, así como la preferencia por una corona ancha, abierta y deshojada, parecen ser los criterios más importantes para los monos araña al momento de elegir los sitios para dormir. Los monos araña del PNY en tres ocasiones durmieron en árboles cuyas hojas habían caído completamente, pero que a la mitad de su fuste contaban con una masa vegetal compleja formada por lianas, epífitos, enredaderas y copas de árboles vecinos más bajos. Esta masa vegetal dificultaba la observación de los subgrupos durmientes desde el suelo y por ende ayudaría a reducir el riesgo de depredación por animales terrestres.

La ubicación estratégica de los dormideros de los monos araña en Costa Rica (*A. geoffroyi*) con relación a sus áreas de alimentación, así como el uso repetido de los árboles dormideros, permite calificar a estos animales como forrajeros de múltiples lugares centrales (Chapman *et al.*, 1989). Para la especie estudiada en el PNY (*A. belzebuth*) falta información que permita concordar con dicho criterio, ya que sólo uno de los 15 diferentes árboles dormideros se usó en dos ocasiones. Esto se debe, principalmente, a la escasa información obtenida en este estudio, dada la dificultad para seguir a los monos araña día tras día (Chapman *et al.*, 1989).

La categoría hembra adulta con cría dependiente conformó el 30% del grupo estudiado (Pozo, 2001); esto explica el mayor porcentaje de tiempo de observación de la mencionada categoría edad-sexo en árboles dormideros. Además, tanto en *A. geoffroyi* como en *A. belzebuth*, las hembras con crías jovenes tienden a separarse del resto del grupo (Cant, 1995; Pozo, 2001), debido a la dificultad que representa el acarreo de las mismas, lo que justifica que para este estudio una madre con cría sean considerados como un solo miembro del grupo (Izawa *et al.*, 1979). El bajo porcentaje de subgrupos durmientes compuesto por machos adultos solitarios también fue encontrado en Costa Rica (Chapman, 1989) y seguramente está influenciado por la composición social y la tendencia de agregación del grupo, pues los machos tienden a ser menos solitarios que las hembras (Cant, 1995).

Los subgrupos durmientes presentaron períodos de alimentación, antes y después de utilizar el árbol dormidero, lo que coincide con lo reportado para *A. geoffroyi* (Chapman y Chapman, 1991) y para *A. paniscus* (van Roosmalen, 1985). Cinco de los árboles dormideros se registraron como componentes de la dieta del mono araña (Pozo, 2001); aunque sólo en una ocasión se observó que una hembra adulta con infante dependiente se alimentó del mismo árbol donde durmió.

Finalmente, se concluye que *Ateles belzebuth* del PNY prefiere dormir en árboles mayores a 25 m de los bosques altos asentados en los valles del sitio de estudio; la mayoría de especies de los árboles dormideros pertenecen a las familias Bombacaceae y Myristicaceae, alcanzando una altura promedio de 28.94 m y un DAP promedio de 50.43 cm. Los árboles dormideros son utilizados por subgrupos conformados por un máximo de tres individuos que incluyen una alta proporción de hembras adultas con crías dependientes.

Agradecimientos: Los datos de campo fueron tomados gracias al auspicio financiero de la National Science Foundation (Grant # SBR 9222526) y de los fondos del Departamento de Anatomía de la Facultad de Medicina de la Universidad de Puerto Rico. Debo agradecer al Dr. J. G. H. Cant por las muy valiosas sugerencias para mi trabajo de campo en el Yasuní. Gracias también al Dr. L. Albuja V. de la Escuela Politécnica Nacional de Quito por avalar mi participación en el Proyecto Primates Ecuador, a los Drs. Peter S. Rodman y A. Di Fiore de la Universidad de California en Davis (USA) por permitirme trabajar en su área de estudio y por compartir juntos el trabajo de campo, a la Dra. L. Arcos T. de la Pontificia Universidad Católica del Ecuador y a los trabajadores de la Estación Científica Yasuní por el apoyo logístico brindado, al Dr. O. Báez T. de la Universidad Central del Ecuador por su supervisión al análisis de los datos, al Ministerio del Ambiente del Ecuador por otorgar los permisos de investigación No. 009-IC y 018-IC INEFAN/DANVS/VS, y al Departamento de Relaciones Comunitarias de la Maxus-YPF-Repsol por su colaboración en los diálogos con la Nacionalidad Huaorani. Quiero expresar mi eterna gratitud a L. Dew, D. Youlatos y B. Orengo por su ayuda en la toma de datos. Por último quiero agradecer al Dr. D. Youlatos, al Ing. E. Basante y a los editores de esta revista, por las sugerencias y cambios que hicieran al primer borrador del presente artículo.

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NEWS

NEW LOCALITY FOR THE BLACK-AND-GOLD HOWLER MONKEY, *ALOUATTA CARAYA* (HUMBOLDT, 1812), IN SOUTHERN BRAZIL

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Fabiana Cristina Alves
Juliana Arpini

Introduction

The conservation of Neotropical primates is compromised by a lack of information on their distributions (Hirsch *et al.*, 2002). The black-and-gold howler monkey, *Alouatta caraya* (Humboldt, 1812), has a large range—from eastern Bolivia, western Paraguay and northern Argentina to central and southern Brazil, from the states of Piauí and Bahia to Rio Grande do Sul (Hirsch *et al.*, 1991). It is found mainly in forests and woodlands in the Cerrado, Pantanal, Chaco and Pampa biomes (Hirsch *et al.*, 2003), in continuous forest, gallery forest, and flooded forests (Brown and Zunino, 1994; Eisenberg and Redford, 1999; Zunino *et al.*, 1996, 2001).

The northern limit of its distribution was recently extended to 10°S, following the discovery of groups in the Chapada das Mangabeiras, Piauí (Flesher, 2001). Its possible occurrence in Uruguay (Department of Artigas, 31°S) would also extend its southern limit. The presence of this species in the state of Rio Grande do Sul was only recorded in the beginning of the past decade in Alegrete (Bicca-Marques, 1990), and until recently only a few populations have been recorded from the Campanha region. Following a broad survey of all of Rio Grande do Sul (south of Santa Catarina), Codenotti and Silva (2004; Codenotti *et al.*, 2002) recorded *A. caraya* throughout its western half, in the physiographic regions of Alto Uruguai (western part), Planalto Médio (western part), Missões, and Campanha.

Methods and Study Area

We found *Alouatta caraya* during an expedition in August–September 2003 to the municipality of Guaraciaba, state of Santa Catarina, Brazil. Our aim was to find a study site and habituate a group of brown howler monkeys (*Alouatta guariba clamitans*) for an ecological and behavioral study, since we knew that it occurs in the Brazilian pine forest (mixed umbrophilous forest) found in western Santa Catarina (Klein, 1978).

Our study area was the district of Ouro Verde, about 30 km west of the city of Guaraciaba. The vegetation there is typically seasonal semideciduous forest (Klein, 1978). Brazilian pine (*Araucaria angustifolia*) is scarce, but found in some places as this is a transition region. The area is bisected by the Rio Maria Preta (tributary of the left bank of the Rio Peperi-guaçu), marking the limit between the municipalities of Guaraciaba and São José do Cedro. The landscape is a mix of pasture and corn and bean plantations, with the forest cover restricted to a few small remnants, mostly on the banks of the Rio Maria Preta and other small streams.

Results and Discussion

The first group was sighted on 25 August 2003, resting in a Brazilian pine, in a forest fragment (26°30.731'S, 53°41.117'W) connected to the riparian forest of the Rio Maria Preta. There were five of them: one adult male, two adult females and two juveniles. Another group was seen on 12 September 2003, in an isolated fragment close to the first (*c.* 300 m). A few sparse trees provided a scanty connection between the two forest fragments. We were unable to count the entire group in this case, since they spread out when they saw us. We saw an adult male and two adult females, but the group was certainly larger.

This is the first record of *A. caraya* in Santa Catarina. This is not unexpected, however. following the surveys of Codenotti and Silva (2004) in Rio Grande do Sul. In some areas they found *A. caraya* to be sympatric—overlapping in its range—with *A. guariba*, and this might well be the case in Santa Catarina. *A. guariba* has been confirmed for the

Figure 1. The new locality for the black-and-gold howler monkey (*Alouatta caraya*), municipality of Guaraciaba, and the nearest localities where the species has been recorded previously.

municipality of São Miguel do Oeste, near Guaraciaba (see Hirsch *et al.*, 2003).

Black-horned capuchin monkeys (*Cebus nigritus*) also occur in Santa Catarina, and are sympatric with *A. caraya* in the district of Ouro Verde, as they are in Tobuna (Brown and Zunino, 1994) and Foz do Iguaçu (Parera and Bosso, 1992). We did not see them in the same forest patches, however. The capuchin group we sighted was in an isolated fragment (26°31.015'S, 53°39.970'W) about 1 km away.

The nearest municipalities in southern Brazil where black-and-gold howlers have been recorded previously are Foz do Iguaçu, Paraná (Hirsch *et al.*, 2003), and Cruz Alta, Rio Grande do Sul (Codenotti *et al.*, 2002; Codenotti and Silva, 2004), about 160 km north and 225 km south from Guaraciaba, respectively. Black howlers also occur at Puerto Iguazú, Paraguay, along the Brazilian frontier (Parera and Bosso, 1992). In Argentina, the closest record is in the municipality of Tobuna, Misiones (Brown and Zunino, 1994), about 50 km west from our locality (Fig. 1).

The discovery of *A. caraya* at this locality is not unexpected, since it is within the known potential limit of its geographical distribution (Fig. 2). It emphasizes, however, the lack of primatological studies in the region, and the urgency of conducting more detailed and intensive studies there in order to achieve a better knowledge of the occurrence and distribution of primates for their conservation in the state of Santa Catarina.

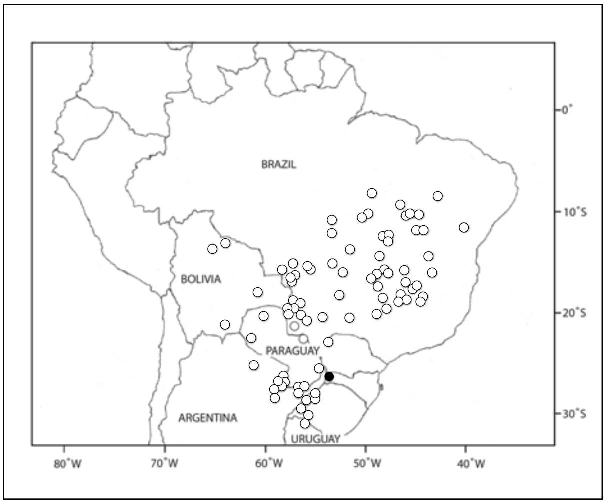

Figure 2. Geographic distribution of black-and-gold and brown howler monkeys (adapted from Hirsch *et al.*, 2003). The new locality is indicated by the arrow.

Acknowledgments: We thank José Simionni for permission to work in his property. We are also grateful to Júlio César Bicca-Marques for commenting on the manuscript.

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THE SILVERY-BROWN TAMARIN (*SAGUINUS LEUCOPUS*) CONSERVATION PROJECT

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J. Bryan Carroll
Alba Lucia Morales-Jiménez

Considered one of the richest countries in diversity of mammals (471 species), Colombia is regarded as the second richest in terms of primate diversity in the Neotropics, and the fourth in the world with approximately 39 species, six of which are endemic (Rylands *et al.*, 1997; Alberico *et al.*, 2000; Cowlishaw and Dunbar, 2000).

Primates are important for tropical forests. They are key components in the evaluation of strategies for biodiversity conservation for specific areas (Rylands *et al.*, 1997). Colombian primates are under great threat from hunting, forest loss and other human activities, resulting in the designation of one species as Critically Endangered (*Ateles hybridus*), one as Endangered (*Saguinus oedipus*) and five as Vulnerable (*Ateles belzebuth, Aotus lemurinus, Saguinus leucopus, Callicebus ornatus, Lagothrix lugens*) (IUCN, 2005).

The silvery-brown tamarin or tití gris, *Saguinus leucopus*, is a Colombian endemic (Defler, 2003). It geographic range is the smallest of the genus, the main reason for its status as Vulnerable (Defler, 2003: 112). *Saguinus leucopus* can be found in one regional reserve (Cañon del Rio Alicante) where, however, protection is inadequate because this reserve is being exploited by the communities in the vicinity (A. L. Morales-Jiménez, pers. obs.). Only a few studies have been conducted on this species, and these have focused on population density estimates, habitat use (Calle, 1992; Vargas and Solano, 1996; Poveda, 2000; Poveda and Sánchez-Palomino, 2004; Valle, 2004), behaviour (Rueda, 2003; Del Valle, 2004) and reintroduction of pet trade animals into the wild (Garcia, 1997). There are few studies on these animals in captivity (Alveario *et al.*, 1985).

In Colombia, *S. leucopus* is maintained in at least seven zoos, but all of them have problems with its reproduction and survival. At least 50 zoo animals have died in the last five years. As of January 2006 no zoo had successfully bred and parent-reared these animals. The single litter of surviving young at that time were hand-reared, and most captive-born animals die before they are one year old (A. L. Morales-Jiménez, unpublished). Despite this history, there are no studies of the causes of mortality in Colombian zoos, but it is certainly associated with housing, stress, inadequate nutrition and husbandry, inappropriate management of social groups and blood and intestinal parasites. This species is also suffering from the illegal pet trade. There are currently (March 2006) around 100 individuals in four rescue centres that need to be re-located, and at least one new individual is confiscated each week (Orjuela and Caicedo, pers. comm.). Rehabilitation and release programmes are in their infancy and the success of these so far is not clear.

All these problems indicate that the species is under very high pressures, and that urgent *in situ* and *ex situ* conservation measures are needed to avoid its further decline, or even extinction, in the short term. For this reason, a conservation programme was organised in 2005 under the umbrella of the EAZA Callitrichid Taxon Advisory Group (TAG). It was coordinated by Lisbon Zoo (Portugal), and resulted from a consortium of 17 European zoos and local organisations, including nine Colombian zoos, regional conservation authorities (Corantioquia and Cornare), NGOs, Colombian universities and researchers. The programme is co-ordinated locally by Alba Lucia Morales, Researcher at Fundación BioDiversa, Colombia, that aims to establish long term *in situ* and *ex situ* conservation measures to protect *S. leucopus.* A combination of *ex situ, in situ* and education projects is necessary to protect this threatened species.

Goals of the Program

- Assess the current distribution and density of the silvery-brown tamarin in Colombia, in order to establish priorities and potential areas for conservation and research. Collection of local information on this species from specimens in museum collections, literature reviews and interviews with researchers that have worked in Colombia. This information will be included in a Geographical Information System (GIS) database, and GAP analysis will be used to predict the species' potential distribution. Maps will be generated showing the historical distribution of the species and its current range, overlaid with maps of Colombian ecosystems.

- Improve husbandry of silvery-brown tamarins under human care in Colombia through the distribution of EAZA husbandry guidelines, and the organisation of workshops on captive care of callitrichids.

- Analyze information on deaths in captivity and determine causes of mortality. Zoos in ACOPAZOA (Asociación Colombiana de Parques Zoológicos y Acuarios) will implement a necropsy protocol for this species to provide uniform data for comparison and analysis. Behavioral studies will be conducted to acquire more information about pair bonding, stress, infanticide, aggression and nutrition, which are key factors in the survival of this species in captivity. The programme will provide funding support for the analyses necessary to identify the causes and patterns of death in all callitrichids under human care.

- Establish a captive-breeding programme for the silvery-brown tamarin in Colombia (including a studbook) and build appropriate enclosures in participating Colombian zoos (three cages per zoo) where pairs will be housed for reproduction. Support rehabilitation centres by improving their housing, husbandry and diet and by trying to relocate animals in appropriate places, including future reintroduction programs, or *ex situ* programs if animals cannot be released.

- Continue the reintroduction of confiscated silvery-brown tamarins into their natural habitat. CORNARE (Corporación Autónoma Regional del Rio Negro – Nare) is the leader on this project and the silvery-brown tamarin is their flagship species. Releases will be conducted according to IUCN guidelines, and released animals will be monitored with radio transmitters in follow-up studies.

- Evaluate the pet trade in silvery-brown tamarins and work on solutions to end it. This project will identify the main regions involved in the tamarin pet trade in order to focus efforts on education and identify alternatives for people.

- Assess the possible existence of two subspecies of *Saguinus leucopus.*

- Use education as an important tool to diminish habitat destruction and the pet trade. A Festival will be organised in order to increase the awareness of local populations concerning this conservation issue. An exhibition cage will be built in La Pintada to meet education goals for schools in the region, to house surplus silvery-brown tamarins not suitable for release or the breeding program. The program will look for alternative income for local populations to help mitigate the current exploitation of natural resources.

- Export captive-born animals from the Colombian Zoos Breeding Program to establish the European Breeding Program (EEP) for this species.

Results

The *Saguinus leucopus* conservation project is already a starting point for the conservation of this endemic callitrichid species in Colombia, and offers solutions for animals in the pet trade and support to zoos and rescue centers in order to create an *ex situ* conservation program. It also supports research and conservation efforts in Colombia and organizes educational campaigns to reduce the volume of the pet trade. This project already has many national and international partners, and is supported by the central government of Colombia as well as local conservation authorities such as CORNARE (Corporación Autónoma Regional del Rio Negro – Nare), CORANTIOQUIA (Coorporación Autónoma Regional de Antioquia) and ACOPAZOA (Asociación Colombiana de Parques Zoológicos y Acuarios).

Some important results have already been achieved since the program started in 2005:

1. Animals housed in poor conditions in rescue centers were relocated to adequate facilities in Colombian zoos.
2. Husbandry of this species was improved with the distribution of the *EAZA Husbandry Guidelines for the Callitrichidae* (Carroll, 2002) translated into Spanish for all Colombian zoos and rescue centers.
3. A workshop on callitrichid husbandry was organised in January 2006. The programme supported all expenses of this workshop, including housing and meals for all attendants.
4. Model breeding cages were built during the workshop to be used as a template for all other breeding cages, and two infants have already been born in these demonstration cages.
5. Maps showing the present distribution of *S. leucopus* are in preparation.
6. Educational poster on *S. leucopus* is in production and will be sent to all Colombian zoos.
7. Breeding cages are under construction in six Colombian zoos.
8. Quarantine, rehabilitation and reintroduction cages were designed for rescue centers, including a management protocol for *S. leucopus* arriving at rescue centers. This conservation program will help CORNARE in designing and building their new rescue center at Los Olivos.

Conclusion

The committed involvement of so many entities in Colombia that have joined efforts to save the silvery-brown tamarin is already a sign of success for this program. It is most likely the first time in Colombian history that so many different people and institutions — from private zoos to NGOs, central and regional conservation authorities, and private and public universities — are working together towards a national conservation goal.

Finally, this serves as a pilot project for other species of *Saguinus*, and will contribute to the management of other threatened Colombian taxa such as *S. oedipus* and *S. geoffroyi*. These species are underrepresented in Colombian zoos, and it is a priority to maintain *ex situ* viable populations in Colombia to contribute to their conservation. All the experience acquired from this project will help Colombian zoos to start *ex situ* conservation projects for other species.

Acknowledgments: The authors would like to express their gratitude to the following institutions that have contributed to this conservation program: Apenheul (The Netherlands), Zooparc de Beauval (France), Belfast Zoo (UK), Bristol Zoological Gardens (UK), CEPA (France), CERZA (France), Chester Zoo (UK), Parc Zoologique de Doué-la-Fontaine (France), Durrell Wildlife Conservation Trust (British Isles), Faunia (Spain), Zoo de La Palmyre (France), Jardim Zoológico (Portugal), London Zoo (UK), Parc Zoologique et Botanique de Mulhouse (France), South Lakes Wild Animal Park (UK), La Vallée des Singes (France), Zodiac Zoos (The Netherlands), and in Colombia Fundación BioDiversa Colombia, Fundación Ecolombia, CORNARE, CORANTIOQUIA, Jaime Duque Zoo, Santa Cruz Zoo, Piscillago Zoo, Santafe Zoo, CAFAM, Matecaña Zoo, Baranquilla Zoo and Cali Zoo.

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A SUCCESSFUL INTRODUCTION OF 2.10 WILD COMMON SQUIRREL MONKEYS (*SAIMIRI SCIUREUS*) INTO CAPTIVITY AT THE PHOENIX ZOO

Hilda Tresz

Prior to 2002 the Phoenix Zoo had identified the existing otter exhibit as deficient, both in terms of husbandry standards and the quality of public experience. Based upon visitor feedback, it was determined that this area of the zoo needed a reliable and more intense animal experience. The management was looking for a new type of exhibit that would give our guests a different perspective on animals. The availability of an appropriate and preferably cohesive group of monkeys was suggested and researched before the final commitment was made to the improvement.

We contacted Dr. Ken Gold about his experience as curator at the Apenheul Zoo in the Netherlands, and he was brought in to consult on the feasibility of a walk-through primate exhibit. Based on his advice, the zoo decided to build an exhibit — to be named Monkey Village — housing squirrel monkeys and saki monkeys together. The zoo already had the saki monkeys in its collection, and while the exhibit was under construction the management began searching for a group of squirrel monkeys. This group would preferably have more females than males, a common proportion both in the wild and in captivity.

Because the New World Primate TAG does not collaboratively manage common squirrel monkeys, they are not often bred in the zoo environment. Since there were no groups of captive squirrel monkeys that would be available within the necessary timeframe, we chose to obtain wild-caught monkeys. Wild-caught monkeys would be less used to people and more likely to maintain a larger flight distance from our guests, an important factor for liability issues. Working with the Bucksire Corporation, the Phoenix Zoo located and acquired 2.10 squirrel monkeys from Guyana. They arrived in pairs on April 29, 2003 from Bucksire Corporation's facility in Pennsylvania, and were immediately placed under quarantine in the Phoenix Zoo's Animal Care Center (ACC). In the ACC the animals were housed the same way they arrived, in pairs. All animals were tattooed on their inner left thigh and were shaved for identification.

After the 30-day quarantine, the squirrel monkeys were transferred into the Upper Education cages (an off-exhibit area, not open to visitors) for temporary housing. This consisted of six cages which permitted visual and tactile contact, but which did not allow the animals to have direct access to each other. This was the perfect setting to maintain the animals in pairs until the introductions could begin. After consulting several times with Leo Hulsker, Primate Supervisor at the Apenheul Zoo, and with Dr. Lawrence Williams, Assistant Professor at the Primate Research Laboratory at the University of South Alabama, we decided that since none of these primates had seen the new exhibit before, did not know each other well and had not have a chance to form subgroups yet, the best course would be to introduce all the animals together at the same time.

Since the animals were wild-caught, it was necessary to establish a feeding routine quickly, while they would be accustomed to seeing people but still not overly friendly toward them. While the animals were housed in the Upper Education cages, we began a new behavioral management program, which focused on teaching the animals to recognize feeding time through classical conditioning. Keepers wore orange-colored jackets while provisioning the monkeys, and always approached from the front of the section, to allow the animals to see the orange jackets clearly.

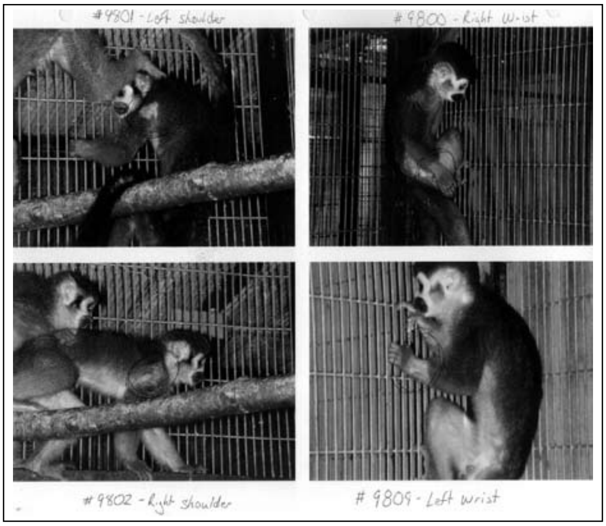

Figure 1. All squirrel monkeys were uniquely shaved and tattooed for purposes of identification. Photo by Josh Crabtree.

Figure 2. Primary trainer Tracy Fleshman, wearing an orange-colored vest during feeding conditioning. Photo by Hilda Tresz.

Figure 3. Common squirrel monkey exhibit on the Discovery Trail. Photo by Hilda Tresz.

At this point we were faced with a dilemma: the monkeys needed to be moved out from the small cages into a more natural exhibit, but Monkey Village was still under construction. The keepers started renovating another exhibit, this one open to the public, where the squirrel monkeys could be held temporarily until Monkey Village could be built. The keepers put an enormous effort into remodeling the exhibit: they changed all the branches, logs and ropes, painted all the walls with murals, provided extra hiding places and escape routes and redesigned the night house. By the end of June 2003 everything was ready for the introduction.

The introduction took place on July 1, 2003 at 7:00 am in the temporary Squirrel Monkey Exhibit on the Discovery Trail. We decided that the best approach would be to leave the animals alone to work out their differences and to establish a social hierarchy; we would not intervene unless a severe injury occurred. An observation program was developed to document the introduction; due to a shortage of volunteers, we scheduled a combination of instructors, keepers, interns and volunteers to make observations for at least two weeks, including documentation on video.

The introduction was a complete success. The monkeys were released through their night house area to the exhibit. The animals spent their time cautiously looking around, testing the mesh and branches and foraging from their feed pans. Mating behaviors were observed and mostly were initiated by the dominant male. At first the two males spent a considerable amount of time huddling together, but by the second day they were seen joining some of the females. Aggressive chasing and grabbing was minimal among both sexes.

On the second day we released our male ocelot back into his own exhibit, directly across from the squirrel monkeys — he had been confined out of sight during their introduction — and the squirrel monkeys came together in a single group when he appeared. Our hot weather also aided us. On most mornings, the temperature rose above 90°F after 8:30 am, slowing all activities down; at those temperatures, the squirrel monkeys spent most of their time drinking and huddling in the trees, either by themselves or in groups of up to six individuals. All the animals acclimated very fast to their new environment and started to form bonds within a couple of days.

After the animals settled down, a second training program started. For medical and husbandry reasons the animals had to be taught to enter the night house every day. Wooden branches were provided to connect the night house entrance with the exhibit for easy access, and food was placed on it to lure the animals inside. They received novel food items only inside the night house, to encourage them to enter and explore. Keepers routinely entered onto exhibit, rang a bell and distributed food items as a reward; they gradually reduced the distance between the animals and the night house, and eventually the squirrel monkeys were only fed within.

In October the monkeys received their physical exams and were transferred into the Monkey Village holding area. We repeated the same night-house training program before they were introduced to the visitors. Monkey Village opened to the public on the weekend of November 13–14, 2004, and has been one of the zoo's most popular exhibits ever since.

Acknowledgements: The Phoenix Zoo would like to give special thanks to Leo Hulsker, Primate Supervisor at the Apenheul Zoo, and to Dr. Lawrence Williams, Assistant Professor at the Primate Research Laboratory at the University of South Alabama, for their advice and collaboration.

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TEACHER TRAINING FOR CONSERVATION OF THE GOLDEN LION TAMARIN (*LEONTOPITHECUS ROSALIA*) AND THE ATLANTIC FOREST IN BRAZIL

Patrícia Mie Matsuo
Vanessa Boucinha

Introduction

The Atlantic Forest is one of Brazil's most threatened ecosystems, ranking among the world's top five biodiversity "hotspots" (Mittermeier *et al.*, 1999). Today less than 8% of the original forest remains (Fundação SOS Mata Atlântica / INPE, 1998). Among the countless species affected by this extreme habitat fragmentation is the golden lion tamarin (*Leontopithecus rosalia*), an Endangered primate endemic to the coastal lowland forest of the state of Rio de Janeiro.

The range of *L. rosalia* is now restricted to a few forest remnants in the region. According to Kierulff and Procópio de Oliveira (1996), the species occurs in only seven municipalities: Armação dos Búzios, Cabo Frio, Casimiro de Abreu, Rio Bonito, Rio das Ostras, Saquarema and Silva Jardim (Fig. 1). Together these municipalities cover an area of 2,916,631 km^2; their total human population is approximately 327,000, served by 247 municipal schools (IBGE, 2000). The local economy is based on agriculture, livestock, commerce and tourism.

Two biological reserves protect the golden lion tamarin: Poço das Antas Biological Reserve and União Biological Reserve, both administered by IBAMA, the Brazilian Institute of the Environment and Renewable Natural Resources. Poço das Antas, located in Silva Jardim, is the largest remaining fragment of golden lion tamarin habitat.

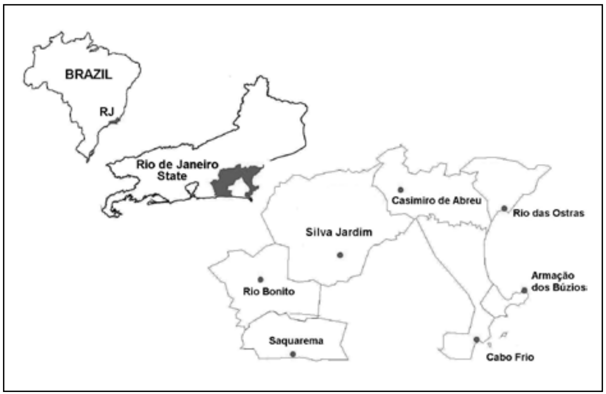

Figure 1. The occurrence of the golden lion tamarin (*Leontopithecus rosalia*) in the state of Rio de Janeiro, Brazil.

The Golden Lion Tamarin Association (*Associação Mico-Leão-Dourado* – AMLD), a Brazilian non-governmental organization, coordinates a multidisciplinary program to conserve a viable population of golden lion tamarins in their natural habitat. AMLD's strategy includes monitoring all known populations of golden lion tamarins; working with landowners to protect smaller forest fragments for reintroduction of zoo-born family groups; and the implementation of forest corridors connecting these fragments. Both research and community involvement are essential to guarantee the long-term conservation of threatened ecosystems and species (Dietz and Nagagata, 1995; Padua *et al.*, 2002).

The AMLD recognizes that support and involvement from local communities will be essential for the successful implementation of any conservation strategy. We use environmental education to stimulate the local population to become more aware and active in all aspects of forest conservation. The AMLD coordinates environmental education efforts in Poço das Antas Biological Reserve and the surrounding communities.

Methods

The long-term training program started in June 2003 and ended in December 2004 with the participation of 25 teachers from 14 schools in Silva Jardim. The training program began with the basics of the Atlantic Forest: physical characteristics of the forest, native flora and fauna, threats and conservation actions. The activities included presentations by researchers that conduct research in the area, field projects in the forest (Fig. 2), and suggestions on how teachers could carry out similar projects with their students in forest fragments in their region.

After each topic was explored, each teacher planned his or her own project to integrate these concepts and community conservation actions into his or her curriculum. We encouraged the teachers to plan activities according to the characteristics of their school, community, students' level, and their teaching interest. As the program developed, the

Figure 2. Field activity on the soil types of the Atlantic Forest.

teachers presented the activities they carried out in their schools and the results they obtained, and incorporated the feedback they received into subsequent activities.

Results

Out of the original 25 participants, 17 teachers from ten schools completed the entire program, consisting of ten workshops and one seminar. These teachers developed and presented to their students more than 80 study units on the themes of the workshops — native plants and animals, threats, water resources, and conservation actions — integrating subjects such as art, biology, mathematics and Portuguese.

The teachers worked on many conservation-themed activities with their students, including drawing, posters, poetry, music, games, writing projects, interviews, exhibits, history projects, and activities in the field. More than 90% of the teachers began conducting field exercises in nearby forests after the second workshop, helping to improve their students' awareness and appreciation of the local environment. Similarly, these activities helped enhance the teachers' appreciation of the importance of conserving the Atlantic Forest, as well as the local problems that affect the forest and animals such as the golden lion tamarins.

The core group of teachers participated in all decisions relating to the project. They also collaborated in the production of a 2004 calendar produced by the AMLD, intended to highlight the training program; the calendar incorporated 15 drawings about the Atlantic Forest created by the teachers' students. In addition, the teachers helped with the organization of the First Environmental Education Workshop in Silva Jardim, a one-day seminar featuring posters, presentations and mini-courses. The teachers assisted in the planning of the workshop and presented classes to the workshop participants, who included 180 educators from 60 institutions from the seven municipalities where the golden lion tamarin is found. It was an important event in the region to promote a better understanding of the role of education for the Atlantic Forest and for the conservation of golden lion tamarins.

The training program provided an opportunity for the teachers to try new ideas and teaching methodologies, to evaluate the results, and to share their experiences with the wider community. As a result of this first training program, the Public Departments of Education and Environment of the municipality of Silva Jardim signed an agreement with the AMLD to support the teacher training program and provide financial resources. In addition, the Department of the Environment started its own teacher training project in 2003, based on the official environmental curriculum recommended by the Brazilian Ministry of Education. As this curriculum does not specifically focus on the Atlantic Forest, the Department of the Environment invited the AMLD to participate in these courses, by presenting talks on the local Atlantic Forest habitat and field activities at the Poço das Antas Biological Reserve. This initiative by Silva Jardim is a valuable complement to our efforts to build the capacity of local teachers of Silva Jardim, as — owing to financial limitations — the AMLD teacher training project is only able to train 25 teachers per year.

Conclusions

Support and involvement from the local communities will always be essential for the successful implementation of conservation strategies for the Atlantic Forest and the golden lion tamarin. The AMLD teacher training program has demonstrated its ability to improve awareness of this threatened ecosystem and its flagship primate species, and is important to achieving sustained public support for conservation in the region.

The participation of the teachers in all project decisions is essential to establish a cooperative relationship and responsibility for the project. When each teacher can plan the content and methods used in his or her own project, he or she feels more responsible and invests more time and resources into it.

The partnership between the AMLD and the Public Departments of Education and Environment of the municipality of Silva Jardim has been crucial to guaranteeing the long-term success of our education project in that municipality. This is the model we intend to follow when establishing partnerships aimed at long-term implementation of environmental education in the schools of the seven municipalities where golden lion tamarins still survive.

Acknowledgements: We thank all the teachers who participated in this project, the researchers that gave talks on their studies, the participants in other AMLD programs, the Disney Wildlife Conservation Fund, the Philadelphia Zoological Park, the American Society of Primatologists,

the Copenhagen Zoo and the Departments of Education and the Environment of the municipality of Silva Jardim.

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CYTOGENETICS AND SPERM MORPHOLOGY AS TOOLS OF SYSTEMATIC VALUE: THE EXAMPLE OF *SAIMIRI BOLIVIENSIS* (PRIMATES: PLATYRRHINI)

In December 2005, Eliana Ruth Steinberg defended her undergraduate thesis (tesis de licenciatura) analyzing sex chromosomes and sperm morphology in the squirrel monkey, *Saimiri boliviensis.* It was presented at the School of Exact and Natural Sciences at the University of Buenos Aires (FCEyN – UBA), Argentina. Her supervisor was Marta Dolores Mudry, Associate Professor in the Department of Ecology, Genetics and Evolution. This research was funded by MDM CONICET PIP 2450, UBACyT X031 and ERS Sigma Xi Grant 3040277. The following is a summary of her thesis.

Accurate systematic information is essential to mammal conservation, both in captivity and in the wild, and taxonomic, phylogenetic and biogeographic analyses are indispensable tools. The geographic origin of many animals held in zoos and conservation breeding centers is often unknown, obscured by the exchange of individuals between institutions. The challenge, then, is to generate accurate identifications for animals with uncertain provenance.

Phenotypic and morphometric characters have been traditionally employed for systematic diagnosis, but the wide variety of phenotypes and polymorphisms may cause confusion when designing programs for *ex situ* maintenance. This may result in the unintentional assembly of mixed groups, with the possible consequence of loss of variability due to endogamic depression. In this context, genetic tools such as karyotyping and DNA analysis take on a new importance, and have been employed in the last decade in many breeding centers. Mitotic parameters in particular have been widely used in the past decade to accurately typify individuals. However, only meiotic data allow a confirmation of sex determination, and are thus essential for guiding breeding efforts.

Sperm from different species of mammals may clearly differ in their morphology and dimensions. This is important for the successful implementation of biotechnological techniques, such as cryopreservation of gametes and assisted reproduction, in *ex situ* conservation programs in zoos and in breeding and research facilities. In this thesis, cytogenetics and sperm morphology were used for the first time for taxonomic diagnosis in the Ceboidea, using the squirrel monkey, *Saimiri* sp., as an experimental model.

Species and subspecies of squirrel monkeys may be distinguished by their coat coloration, but this is often difficult for the untrained eye and may be ambiguous in backcrossed animals. However, species of *Saimiri* differ in their karyotypes by pericentric inversions, resulting in differences in the ratio of acrocentrics to non-acrocentrics. This allows a clear identification of species and hybrids both in captivity and in the wild. This study examined male squirrel monkeys held at the Corrientes Biological Station (EBCo) and females from the Buenos Aires Zoo and the Córdoba Zoo, all in Argentina.

This study found a diploid number of 2N = 44, XX/XY, in all specimens analyzed, with a fundamental number FN = 75. The karyotype included five metacentric chromosome pairs, 10 submetacentric pairs and six acrocentric pairs. The X chromosome is submetacentric and the Y is a small acrocentric. In the meiotic analysis, the presence of 22 bivalents with a distinctive XY bivalent was observed in late diakinesis/Met I. The G banding patterns agreed with those previously published for *S. boliviensis boliviensis.*

As a result of this analysis, the animals held at the Buenos Aires and Córdoba Zoos, previously assigned to *Saimiri sciureus*, are now recognized as *S. b. boliviensis*. In addition, the morphometric characterization and comparison with other cebids demonstrated that the spermatozoa of *Saimiri b. boliviensis* are distinguished by a larger midpiece. The different variables analyzed here support genetic characterization in this and other New World primate genera in the "total evidence" framework accepted for modern taxonomic studies.

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NOVA REVISTA ELETRÔNICA – *UAKARI*

O Instituto de Desenvolvimento Sustentável Mamirauá, uma unidade de pesquisas do Ministério da Ciência e Tecnologia (IDSM-OS/MCT), lançou a revista eletrônica *Uakari*. *Uakari* foi concebida para a publicação de resultados de pesquisas originais em conservação da biodiversidade e uso sustentável e participativo dos recursos naturais do biota amazônico, e se dedica especialmente na publicação dos resultados das pesquisas desenvolvidas nas Reservas de Desenvolvimento Sustentável Mamirauá e Amanã, ou mesmo em outros sítios amazônicos com o apoio ou patrocínio do IDSM. Deste modo, *Uakari* publica textos de ciências biológicas e ambientais em geral, e também de ciências humanas relacionadas à questão da conservação da biodiversidade amazônica.

Os trabalhos publicados em *Uakari* devem se enquadrar numa das duas categorias seguintes: 'Artigos científicos' e 'Notas curtas.' (Na última categoria também se admitem as listas de levantamentos taxonômicos, e as séries históricas de dados ambientais ou sociais ligados à conservação da biodiversidade.) Uma versão física, em papel, também será produzida, em baixa tiragem, exclusivamente para envio e depósito em algumas bibliotecas de referência.

O primeiro número (Ano 1, Número 1, Novembro de 2005), inclui os seguintes artigos: Frugivoria e dispersão de sementes por peixes na Reserva de Desenvolvimento Sustentável Amanã – L. Lopes de Souza; Participação comunitária na preservação de praias para reprodução de quelônios na Reserva de Desenvolvimento Sustentável Mamirauá, Amazonas, Brasil – A. F. Terán; Comportamento reprodutivo das mulheres ribeirinhas do Amanã – E. A. F. Moura; O manejo sustentável das áreas alagáveis da Amazônia Central e as comunidades de herbáceas aquáticas – M. T. F. Piedade, J. Schoengart e W. J. Junk; Richness and abundance of gall-forming insects in the Mamirauá *várzea*, a flooded Amazonian forest – G. R. Julião, E. M. Venticinque e G. W. Fernandes; Um ensaio sobre a adaptação de *Pygocentrus nattereri* à variação sazonal das águas do Lago Mamirauá – Reserva do Desenvolvimento Sustentável Mamirauá – M. Camargo e H. Queiroz; Ritmo de atividade diária de *Osteoglossum bicirrhosum* (Peixes: Osteoglossiformes) em quatro lagos da Reserva de Desenvolvimento Sustentável Mamirauá, AM – R. Chaves, M. Camargo, H. Queiroz e A. Hercos. *Para maiores informações*: <www.mamiraua.org.br/uakari>.

TWO NEW PROTECTED AREAS IN BRAZIL

On 20 October 2005, Brazil's Ministry of the Environment announced the creation of two protected areas in the state of Santa Catarina. The Araucárias National Park of 12,481 ha and the Mata Preta Ecological Station of 6,563 ha are both of great importance in protecting remnant forests of the Paraná or Brazilian pine, *Araucaria angustifolia* (Araucariaceae). The Araucaria pine forest of southern and southeastern Brazil, a distinctive formation of the Brazilian Atlantic forest, once covered more than 20 million ha, but—devastated by the timber industry and clear-cutting—is today reduced to remnants covering a mere 2% of that area. The Brazilian pine has been on the Brazilian threatened species list since 1992. *Source:* SBS – Sociedade Brasileira de Silvicultura, website: <www.sbs.org.br>, accessed 25 October 2005.

INTERNET PRIMATE AGING DATABASE

The National Institute on Aging (NAI) and the Wisconsin National Primate Research Center are proud to announce the release of the internet Primate Aging Database (iPAD), a new tool for researchers interested in studying biomarkers of aging in nonhuman primates.

The iPAD is a multi-centered, relational database of biological variables in aging, captive nonhuman primates. iPAD provides an invaluable veterinary and clinical resource capable of generating normative values from over half a million data points drawn from 18 different species, including representatives of *Aotus*, *Callithrix*, *Cebuella*, *Leontopithecus*, *Saguinus* and *Saimiri*. These data were drawn from routine screenings of healthy animals at regular intervals throughout their lifetimes, and include blood chemistry, hematology, and body weight. Users of the database are able to access individual data points at the species-, biomarker- or site-specific level, and are able to export and manipulate the data at will.

The iPAD database has already resulted in several papers published in peer-reviewed journals, and its usefulness increases as new datasets are contributed. iPAD is now expanding the number of species and measurements in the database, and augmenting the number of data points for existing species. Researchers interested in becoming a part of this collaborative effort and contributing data from healthy, non-experimental primates are encouraged to contact the System Administrator, Wendy Newton, at <wnewton@primate.wisc.edu> for more information. The iPAD database is available online at <http://ipad.primate.wisc.edu>.

International Journal of Biological Sciences – Announcement and Call for Papers

The *International Journal of Biological Sciences* is an open-access general biological journal which publishes peer-reviewed scientific papers in all areas of the biological sciences. Types of articles include regular research papers, reviews, short research communications, viewpoints and commentaries. In addition to the mainstream areas of biology, the *Journal* encourages articles from emerging fields or cross-disciplinary with mathematics, physics, chemistry, engineering, and computer science. The *Journal* will publish special issues that focus on topics of common interest from time to time.

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Genetic Studies of Neotropical Primates at the Extremes of Their Natural Distributions

Researchers at the Universidad Veracruzana (UV), Universidad de Buenos Aires (UBA) and the University of Michigan (UM) are conducting a collaborative project on the genetics of Neotropical primates at the northern and southern edges of their distributions. The main aim of this project is to combine expertise in ecological, genetic and behavioral approaches to understand the taxonomy and evolution of primates in these regions.

This complementary effort started in 2001, when Marta D. Mudry visited field sites in Mexico with members of the UV primate research group, collecting samples from *Alouatta palliata* and *Ateles geoffroyi* as part of a cytogenetic project on atelid taxonomy. Dr. Mudry described the karyotypes of these species and identified the presence of different patterns in sex chromosomes from the samples obtained during this trip (Mudry *et al.*, 2001; Nieves and Mudry, 2001; Nieves, 2003; Nieves *et al.*, 2005; Solari and Rahn, 2005). At the same time, Liliana Cortés-Ortiz was using molecular data to examine the phylogenetic relationships and biogeography of the genus *Alouatta* (Cortés-Ortiz *et al.*, 2003), as well as characterizing the hybridization between Mexican howler monkey species and studying the phylogeography of *A. palliata* in Mesoamerica (Cortés-Ortiz, 2003). In addition, Ernesto Rodríguez-Luna, Domingo Canales-Espinosa, and Francisco García-Orduña had initiated a long-term study to understand the current distributions of Mexican primates, as well as the sympatry of *A. palliata* and *A. pigra* in the state of Tabasco, Mexico (García-Orduña *et al.*, 1999, 2005; Rodríguez-Luna *et al.*, 2001).

For over 25 years, researchers at UV have studied the ecology, physiology and behavior of Mexican primates, including *A. palliata mexicana* (see Appendix I), *A. pigra* (*e.g.*, García-Orduña *et al.*, 1999, 2005; Rodríguez-Luna *et al.*, 2001) and *Ateles geoffroyi* (see Appendix II), and have developed and implemented strategies for their conservation (see Appendix III). Over approximately the same period, researchers of GIBE (Grupo de Investigación en Biología Evolutiva) of UBA have analyzed the cytogenetics of several Neotropical primates, including *Alouatta caraya*, *Aotus azarae*, *Ateles* spp., *Callithrix jacchus*, *Cebus apella*, and *Saimiri boliviensis* (see Appendix IV for a complete listing by species). The GIBE team has used heterochromatic patterns and chromosome rearrangements to elucidate the taxonomy of New World primates (see Appendix IV). More recently, researchers at GIBE have also used biochemical electrophoresis (Szapkievich *et al.*, 1998; Szapkievich, 2000; Szapkievich and Mudry, 2003) and other molecular techniques to characterize populations and to explore the phylogenetic relationships of some of these taxa (Ascunce *et al.*, 2002, 2003a, 2003b). Finally, Liliana Cortés-Ortiz, formerly part of the UV group and now affiliated with UM, is continuing her studies on the systematics and phylogeography of Mesoamerican primates, the genetic characterization of a hybrid zone between *A. palliata* and *A. pigra*, the evolution of reproductive isolation in howler monkeys, and the application of molecular approaches to the understanding of primate behavior.

These researchers from UV, UBA and UM are now joining efforts to study the taxonomy and evolution of Neotropical primates using molecular, cytogenetic, ecological and behavioral approaches. Through this collaboration, researchers are currently investigating the heterochromatic pattern and sex chromosome system of *A. pigra* — the only species of *Alouatta* whose karyotype has never been studied. This cytogenetic work will be complemented by morphological and molecular characterizations of each sampled individual to verify their identification to species.

These molecular and cytogenetic studies will improve our understanding of the origin and evolution of the exceptionally diverse chromosomal arrangements that occur in howler monkeys (see for example, Ma *et al.*, 1975; Lima and Seuánez, 1991; Consigliere *et al.*, 1996; Rahn *et al.*, 1996; Mudry *et al.*, 2001; Oliveira *et al.*, 2002; Rahn and Solari, 2005). In addition, the cytogenetic study of *A. pigra* will provide a foundation for the comparison of karyotypes of hybrid and backcrossed *A. palliata* / *A. pigra* individuals against the typical karyotype of each parental species.

We expect that this multidisciplinary approach will contribute to the understanding of primate evolution in the Neotropics, as well as establishing a basis for primate conservation in this region. Furthermore, this collaborative project can be a model for combining efforts, expertise, and resources to study primates and other organisms in Latin America.

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Appendix I: Universidad Veracruzana studies on *Alouatta palliata mexicana.*

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Appendix II: Universidad Veracruzana studies on *Ateles geoffroyi.*

Cortés-Ortiz and Rodríguez-Luna, 1997; García-Orduña et al., 1993, 2002; Hernández-Salazar et al., 2001, 2003; Laska et al., 1996, 2000a, 2000b, 2003; Rodas et al., 2002; Rodríguez-Luna, 1991; Rodríguez-Luna et al., 1996; Silva-López *et al.*, 1986, 1988.

Appendix III: Universidad Veracruzana studies on primate conservation.

Canales-Espinosa, 1997; Cortés-Ortiz *et al.,* 1996; García-Orduña *et al.*, 1987; Rodríguez-Luna *et al.*, 1987a, 1987b, 1993a, 1993b, 1996a, 1996b, 1996c; Rodríguez-Luna and Cortés-Ortiz, 1994, 1995a, 1995b; Rodríguez-Luna and Domínguez-Domínguez, 2002; Rylands and Rodríguez-Luna, 2000.

Appendix IV: Universidad de Buenos Aires cytogenetic studies on Neotropical primates.

Alouatta caraya: Fundia *et al.*, 2000; Mudry, 1983; Mudry *et al.*, 1992, 1994, 1998; *Aotus azarae*: Mudry, 1983; Mudry *et al.*, 1982c, 1984, 1990; Mudry and Galliari, 1985; *Ateles* spp.: Nieves, 2003; Nieves *et al.*, 2003, 2005; *Callithrix jacchus*: Mudry *et al.*, 1981, 1982a, 1990; *Cebus apella*: Fundia *et al.*, 1987; Mantecón *et al.*, 1984; Martinez, 2003; Martinez *et al.*, 2002, 2004; Mudry, 1983, 1990; Mudry *et al.*, 1984, 1985, 1990; Mudry and Slavutsky, 1987; Mudry and Vinuesa, 1988; Ponsá Fontanals *et al.*, 1995; and *Saimiri boliviensis*: Fundia *et al.*, 2000; García *et al.*, 1995; Mudry *et al.*, 1982b, 1990; Slavutsky and Mudry, 1990; Steinberg *et al.*, 2003, 2004, 2005.

RECENT PUBLICATIONS

Books

Commensalism and Conflict: The Human-Primate Interface, edited by James D. Paterson and Janette Wallis. 2005. American Society of Primatologists. 504pp. ISBN: 0965830136 (hardback, $60.00). *Contents*: Foreword – L. D. Wolfe; Preface – J. D. Paterson; Perceptions of pests: Human attitudes to primates, conflict and consequences for conservation – P. C. Lee and N. E. C. Priston; By-product mutualism: Conservation implications amongst monkeys, figs, humans, and their domesticants in Honduras – F. Burton and A. Carroll; People, crops, and primates: A conflict of interests – C. M Hill; Human social issues, disease, and sympatric apes in the Central African Republic – A. A. Lilly; Residents and immigrants: Reactions and perceptions of crop raiding in Masindi District, Uganda – J. Paterson; Primates in the forest: Sakalava ethnoprimatology and synecological relations with black lemurs at Ambato Massif, Madagascar – I. C. Colquhoun; Tanala synecological relations with lemurs in southeastern Madagascar – P. C. Wright, B. R. Andrianamihaja and S. Raharimiandra; Tourist impacts on the behavior of black howling monkeys (*Alouatta pigra*) at Lamanai, Belize – A. Treves and K. Brandon; Monkey forests and human landscapes: Is extensive sympatry sustainable for *Homo sapiens* and *Macaca fascicularis* on Bali? – A. Fuentes, M. Southern and K. Gde Suaryana; Characterizing primate pet ownership in Sulawesi: Implications for disease transmission – L. Jones-Engel, M. Schillaci, G. Engel, U. Paputungan and J. Froehlich; Farmer attitudes toward the conservation of "pest" monkeys: The view from Nepal – M. K. Chalise and R. L. Johnson; Rhesus commensalism in India: Problems and prospects – C. H. Southwick, I. Malik and M. Farooq Siddiqi; City monkeys (*Macaca mulatta*): A study of human attitudes – A. Srivastava and F. Begum; Coexistence of bonnet monkeys (*Macaca radiata radiata* Geoffroy) with planters in the cardamom (*Elettaria cardamum* Maton) and coffee (*Coffea arabica* L.) plantations of Karnataka, South India: Hospitable or hostile? – A. K. Chakravarthy and N. E. Thyagaraj; Habitat destruction, population compression and overbrowsing by the Zanzibar red colobus monkey (*Procolobus kirkii*) – K. S. Siex; Round up the usual suspects – conflict between monkeys and farmers in East and West Africa – J. Chism; The population status of the ursine colobus (*Colobus vellerosus*) at Boabeng-Fiema, Ghana – T. Saj, J. Teichroeb and P. Sicotte; Tibetan macaques, visitors, and local people at Mt. Emei: Problems and countermeasures – Qi-Kun Zhao; Recent expansion of the range of Japanese macaques, and associated management problems – K. Watanabe and Y. Muroyama; Applied conditioned taste aversion and the management and conservation of crop-raiding primates – D. L. Forthman, S. C. Strum and G. M. Muchemi; Managing monkeys and mangos – M. Baker and A. Schutt. Online ordering only; more information available at <http://www.asp.org/research/aspbook/volume4.html>.

The Laboratory Primate, edited by Sonia Wolfe-Coote. 2005. Academic Press, New York. 650pp. ISBN 0120802619 (hardback, $200.00). A volume in the Handbook of Experimental Animals series, *The Laboratory Primate* details the past and present use of primates in biomedical research, and the husbandry, nutritional requirements, behaviour, and breeding of each of the commonly used species. Practical information on regulatory requirements, not available in other texts, is also covered. Sections on experimental models cover the major areas of biomedical research, including AIDS, cancer, neurobiology and gene therapy; assisted reproductive technology, tissue typing, and minimum group sizes for infectious disease/vaccine studies are also included. Several chapters deal with the husbandry and biomedical applications of New World primates. *Contents*: Part 1: Definition of the primate model. 1.1. The taxonomy of primates in the laboratory context – C. Groves; 1.2. Similarities of non human primates to humans – G. M. Miller and B. K. Madras; 1.3. General anatomy – L. R. Godfrey; 1.4. Pathology: 1.4.1. Non infectious diseases – A. D. Lewis and L. M. A. Colgin; 1.4.2. Common viral infections – N. W. Lerche; 1.4.3. Modelling parasitic diseases in non human primates: Malaria, Chagas disease and filariasis – M. T. Philipp and J. E. Purcell; 1.5. Reproduction: Definition of a primate model of female fertility – A. Einspanier and M. A. Gore; 1.6. Male reproduction and fertilization – R. M. Harrison and H. M. Kubisch; 1.7. Primate natural history and social behaviour: Implications for laboratory housing – C. K. Lutz and M. A. Novak. Part 2: Primate Management. 2.1. New World Primates: 2.1.1. Husbandry and management: Marmosets and tamarins – S. Rensing and A.-K. Oerke; 2.2. Old World Primates: 2.2.1. Practical care and management of macaques – K. Terao; 2.2.2. Vervet monkey breeding – J. Seier; 2.3. Nutrition and nutritional diseases – S. M. Lewis, C. E. Hotchkiss and D. E. Ullrey; 2.4. Environmental enrichment and refinement of handling procedures – V. Reinhardt; 2.5. Development of specific pathogen free (SPF) non human primate colonies – K. Mansfield; 2.6. Medical care – J. Mahoney.

Part 3: Current Uses in Biomedical Research. 3.1. Factors affecting the choice of species – H. Weber; 3.2. Techniques and Procedures: 3.2.1. Anaesthesia – S. Unwin; 3.2.2. Rigid endoscopy – J. W. Fanton; 3.2.3. Ultrasound imaging in rhesus (*Macaca mulatta*) and long-tailed (*Macaca fascicularis*) macaques: Reproductive and research applications – A. F. Tarantal; 3.2.4. Functional magnetic resonances imaging in conscious marmoset monkeys: Methods and applications in neuroscience research – C. F. Ferris and C. T. Snowdon; 3.2.5. Radiographic imaging of non human primates – C. R. Valverde and K. Christe; 3.2.6. Imaging: Positron Emission Tomography (PET) – S. Chefer. 3.3. Current Uses in Biomedical Research: 3.3.1. The use of the primate model in research – W. R. Morton, K. B. Kyes, R. C. Kyes, D. R. Swindler and K. E. Swindler; 3.3.2. Chronic diseases – B. Hart, M. Losem, H. P. M. Brok and M. H. de Baets; 3.3.3. Practical approaches to pharmacological studies in non human primates – F. H. Koegler and M. A. Cowley; 3.3.4. Non human primate models of human aging – X. Tigno, J. M. Erwin and B. C. Hansen; 3.3.5. Primate models of neurological disease – C. A. Szabo; 3.3.6. Genetics: A survey of non human primate genetics, genetic management and applications to biomedical research – J. Rogers; 3.3.7. The respiratory system and its use in research – C. G. Plopper and J. R. Harkema; 3.3.8. Reproduction – Male – G. van der Horst; 3.3.9. Reproduction – Female – W. R. Dukelow; 3.3.10. The baboon as an appropriate model for study of multifactoral aspects of human endometriosis – J. M. Mwenda, C. M. Kyama, D. C. Cahi, S. Debrock and T. M. D. Hooghe; 3.3.11. Virology research – P. Barry, M. Marthas, N. Lerche, M. B. McChesney and C. J. Miller; 3.3.12. Parasitic diseases of non human primates – J. E. Purcell and M. T. Philipp. *Available from*: Academic Press / Elsevier Inc., 30 Corporate Drive, Suite 400, Burlington, MA 01803, USA, Tel.: 1-781-221-2212, Fax: 1-781-221-1615. Website: <http://www.academicpress.com>.

Parenting for Primates, by Harriet J. Smith. 2005. Harvard University Press, Cambridge, Massachusetts. 394pp. ISBN 0674019385 (hardback, $29.95). In this natural history of primate parenting, Smith compares parenting by nonhuman and human primates. In a narrative rich with vivid anecdotes derived from interviews with primatologists, from her own experience breeding cottontop tamarin monkeys for over thirty years, and from her clinical psychology practice, Smith describes the thousand and one ways that primate mothers, fathers, grandparents, siblings, and even babysitters care for their offspring, from infancy through young adulthood. Smith learned the hard way that hand-raised cottontop tamarins often mature into incompetent parents. Her observation of inadequate parenting by cottontops, plus her clinical work with troubled human families, sparked her interest in the process of how primates become "good-enough" parents. The story of how she trained her tamarins to become adequate parents lays the foundation for discussions about the crucial role of early experience on parenting in primates, and how certain types of experiences, such as anxiety and social isolation, can trigger neglectful or abusive parenting. Smith reveals diverse strategies for parenting by primates, but she also identifies parenting behaviors crucial to the survival and development of primate youngsters that have stood the test of time. *Available from*: Harvard University Press, 79 Garden Street, Cambridge, MA, 02138 USA, Tel.: 1-800-405-1619, Fax 1-800-406-9145. Website: <http://www.hup.harvard.edu>.

Primate Cytogenetics, edited by Stefan Müller. S. Karger, Basel. 2005. 268pp. ISBN 3805578601 $111.00 (hardback). Primate molecular genetics, cytogenetics and genomics currently form a highly dynamic field of research, largely due to the insight that many aspects of human genome functioning can be better understood in light of the conservation of, and changes in, genome organization during the course of evolution. Studies of our closest phylogenomic relatives, the nonhuman primates, can provide detailed information on the molecular mechanisms that shape the human genome. Including review articles and original investigations, this single-topic issue of *Cytogenetic and Genome Research* bundles various different perspectives and provides a broad overview of the present knowledge about molecular cytogenetics, genome organization and evolution of primates. It will be of great interest to researchers and geneticists in the fields of primatology, anthropology, molecular phylogeny, evolution, human genetics and genome research. Of particular interest is its emphasis on the genetics of New World primates, with papers involving *Alouatta*, *Ateles*, *Brachyteles*, *Cebuella* and *Callithrix*. *Contents*: Preface. Part I: Comparative Genomics and Molecular Evolution. Conservation genomics: Applying whole genome studies to species conservation efforts – O. A. Ryder; Evolution of hominoids and the search for a genetic basis for creating humanness – N. Saitou; The dynamic nature and evolutionary history of subtelomeric and pericentromeric regions – S. K. Mewborn, C. Lese Martin & D. H. Ledbetter; Primate phylogeny: Molecular evidence from retroposons – J. Schmitz, C. Roos & H. Zischler; The primates of the Neotropics: Genomes and chromosomes – H. N. Seuánez, C. R. Bonvicino & M. A. M. Moreira; Evolutionary implications of pericentromeric gene expression in humans – J. M. Mudge & M. S. Jackson; Tandem insertions of Alu elements – M. El-Sawy & P. Deininger; Identity by descent and DNA sequence variation of human SINE and LINE elements – A. H. Salem, D. A. Ray & M. A. Batzer; Molecular evolution of the human chromosome 15 pericentromeric region – D. P. Locke, Z. Jiang, L. M. Pertz, D. Misceo, N. Archidiacono & E. E. Eichler; Nucleotide sequence comparison of a chromosome rearrangement on human chromosome 12 and the corresponding ape chromosomes – M. K. Shimada, C.-G. Kim, T. Kitano, R. E. Ferrell, Y. Kohara & N. Saitou; Breakpoint analysis of the pericentric inversion between chimpanzee chromosome 10 and the homologous chromosome 12 in humans – H. Kehrer-Sawatzki, C. A. Sandig, V. Goidts & H. Hameister; Genomic structure and paralogous regions of the inversion breakpoint occurring between human chromosome 3p12.3 and orangutan chromosome

2 – Y. Yue, B. Grossmann, E. Tsend-Ayush, F. Grützner, M. A. Ferguson-Smith, F. Yang & T. Haaf; Cytochrome *b* polymorphisms and population structure of two species of *Alouatta* (Primates) – F. F. Nascimento, C. R. Bonvicino, F. C. D. da Silva, M. P. C. Schneider & H. N. Seuánez. Part II: Comparative Molecular Cytogenetics and Chromosome Evolution. The impact of chromosome sorting and painting on the comparative analysis of primate genomes – M. A. Ferguson-Smith, F. Yang, W. Rens & P. C. M. O'Brien; Origins of primate chromosomes – as delineated by Zoo-FISH and alignments of human and mouse draft genome sequences – L. Froenicke; Fluorescence in situ hybridization to chromosomes as a tool to understand human and primate genome evolution – J. Wienberg; Evolutionary conserved chromosomal segments in the human karyotype are bounded by unstable chromosome bands – A. Ruiz-Herrera, F. García, L. Mora, J. Egozcue, M. Ponsà & M. Garcia; Reciprocal painting between humans, De Brazza's and patas monkeys reveals a major bifurcation in the Cercopithecini phylogenetic tree – R. Stanyon, R. Bruening, G. Stone, A. Shearin & F. Bigoni; Phylogenetic inferences of Atelinae (Platyrrhini) based on multi-directional chromosome painting in *Brachyteles arachnoides*, *Ateles paniscus paniscus* and *Ateles b. marginatus* – E. H. C. de Oliveira, M. Neusser, J. C. Pieczarka, C. Nagamachi, I. J. Sbalqueiro & S. Müller; Investigation of marmoset hybrids (*Cebuella pygmaea* × *Callithrix jacchus*) and related Callitrichinae (Platyrrhini) by cross-species chromosome painting and comparative genomic hybridization – M. Neusser, M. Münch, G. Anzenberger & S. Müller; Application of molecular cytogenetics for chromosomal evolution of the Lemuriformes (Prosimians) – S. Warter, M. Hauwy, B. Dutrillaux & Y. Rumpler; Evolutionary breakpoint analysis on Y chromosomes of higher primates provides insight into human Y evolution – R. Wimmer, S. Kirsch, G. A. Rappold & W. Schempp; The evolution of the azoospermia factor region AZFa in higher primates – R. Wimmer, S. Kirsch, G. A. Rappold & W. Schempp; New insights into the evolution of chromosome 1 – A. Weise, H. Starke, K. Mrasek, U. Claussen & T. Liehr; Panels of somatic cell hybrids specific for chimpanzee, gorilla, orangutan, and baboon – R. Marzella, C. Carrozzo, P. Chiarappa, V. Miolla & M. Rocchi; Comparative mapping of human claudin-1 (CLDN1) in great apes – I. Nanda, F. Krämer, B. H. F. Weber, W. Schempp & M. Schmid; Evolutionary breakpoints are co-localized with fragile sites and intrachromosomal telomeric sequences in primates – A. Ruiz-Herrera, F. García, E. Giulotto, C. Attolini, J. Egozcue, M. Ponsà & M. Garcia. Part III: Primate Meiosis and Nuclear Architecture. Chimpanzee chromosomes: Retrotransposable compound repeat DNA organization (RCRO) and its influence on meiotic prophase and crossing-over – H. Hirai, K. Matsubayashi, K. Kumazaki, A. Kato, N. Maeda & H.-S. Kim; Inter- and intra-specific gene-density-correlated radial chromosome territory arrangements are conserved in Old World monkeys – H. Tanabe, K. Küpper, T. Ishida, M. Neusser & H. Mizusawa; Fine structure and meiotic behaviour of the male multiple sex chromosomes in the genus *Alouatta* – A. J. Solari & M. I. Rahn.

FIELD BEHAVIORAL ENDOCRINOLOGY – A SPECIAL ISSUE OF THE *AMERICAN JOURNAL OF PRIMATOLOGY*

Volume 67(1) (September 2005) of the *American Journal of Primatology* was a special issue, dedicated to "Advances in Field Behavioral Endocrinology," edited by Karen B. Strier and Toni E. Ziegler. *Contents*: Introduction: Advances in field-based studies of primate behavioral ecology – K. B. Strier & T. E. Ziegler, pp.1–4; Effects of reproductive and social variables on fecal glucocorticoid levels in a sample of adult male ring-tailed lemurs (*Lemur catta*) at the Beza Mahafaly Reserve, Madagascar – L. Gould, T. E. Zeigler & D. J. Wittwer, p.5–23; Social and reproductive factors affecting cortisol levels in wild female golden lion tamarins (*Leontopithecus rosalia*) – K. L. Bales, J. A. French, C. M. Hostetler & J. M. Dietz, pp.25–35; Behavioral strategies and hormonal profiles of dominant and subordinate common marmoset (*Callithrix jacchus*) females in wild monogamous groups – M. B. C. de Sousa, A. C. S. da R. Albuquerque, F. da S. Albuquerque, A. Araújo, M. E. Yamamoto & M. de F. Arruda, pp.37–50; Behavioral indicators of ovarian phase in white-faced capuchins (*Cebus capucinus*) – S. D. Carnegie, L. M. Fedigan & T. E. Zeigler, pp.51–68; Variation in the resumption of cycling and conception by fecal androgen and estradiol levels in female northern muriquis (*Brachyteles hypoxanthus*) – K. B. Strier & T. E. Ziegler, pp.69–81; Coming of age: Steroid hormones of wild immature baboons (*Papio cynocephalus*) – L. R. Gesquiere *et al.*, pp.83–100; Female testosterone, dominance rank, and aggression in an Ethiopian population of hybrid baboons – J. C. Beehner, J. E. Phillips-Conroy & P. L. Whitten, pp.101–119; Radioimmunoassay of estrone conjugates from urine dried on filter paper – C. D. Knott, pp.121–135; Reproductive endocrinology of wild female chimpanzees (*Pan troglodytes schweinfurthii*): Methodological considerations and the role of hormones in sex and conception – M. E. Thompson, pp.137–158; Fecal steroid research in the field and laboratory: Improved methods for storage, transport, processing, and analysis – T. E. Ziegler & D. J. Wittwer, pp.158–174.

COLOR VISION RESEARCH – ANOTHER SPECIAL ISSUE OF THE *AMERICAN JOURNAL OF PRIMATOLOGY*

Volume 67(4) (December 2005) of the *American Journal of Primatology* was dedicated to "Recent Advances in Color Vision Research." It was edited by Hannah M. Buchanan-Smith, and includes eight articles along with an introduction by the editor. *Contents*: Introduction: Recent advances in color vision research – H. M. Buchanan-Smith, pp.393–398; Comparative use of color vision for frugivory by sympatric species of platyrrhines – K. E. Stoner, P. Riba-Hernández & P. W. Lucas, pp.399–409; Sugar concentration of fruits and their detection via color in the Central American spider monkey (*Ateles geoffroyi*) – P. Riba-Hernández, K. E. Stoner & P. E. Lucas, pp.411–423;

Advantage of dichromats over trichromats in discrimination of color-camouflaged stimuli in nonhuman primates – A. Saito, A. Mikami, S. Kawamura, Y. Ueno, C. Hiramatsu, K. A. Widayati, B. Suryobroto, M. Teramoto, Y. Mori, K. Nagano, K. Fujita, H. Kuroshima & T. Hasegawa, pp.425–436; Influence of stimuli size on color discrimination in capuchin monkeys – U. R. Gomes, D. M. A. Pessoa, E. Suganuma, C. Tomaz & V. F. Pessoa, pp.437–446; Color vision polymorphism in wild capuchins (*Cebus capucinus*) and spider monkeys (*Ateles geoffroyi*) in Costa Rica – C. Hiramatsu, T. Tsutsui, Y. Matsumoto, F. Aureli, L. M. Fedigan & S. Kawamura, pp.447–461; Color vision pigment frequencies in wild tamarins (*Saguinus* spp.) – A. K. Surridge, S. S. Suarez, H. M. Buchanan-Smith, A. C. Smith & N. I. Mundy, pp.463–470; Demonstration of a genotype-phenotype correlation in the polymorphic color vision of a non-callitrichine New World monkey, capuchin (*Cebus apella*) – A. Saito, S. Kawamura, A. Mikami, Y. Ueno, C. Hiramatsu, K. Koida, K. Fujita, H. Kuroshima & T. Hasegawa, pp.471–485; Color vision in marmosets and tamarins: Behavioral evidence – D. M. A. Pessoa, C. Tomaz and V. F. Pessoa, pp.487–495.

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MEETINGS

2005

Primate Society of Great Britain (PSGB) Winter Meeting 2005, 9 December 2005. Flett Theatre, The Natural History Museum, London. The theme is "Primate Evolution and the Environment." Guest speakers include R. D. Martin (The Field Museum, Chicago), Erik Seiffert (Oxford University), Peter Andrews (The Natural History Museum), Jussi Eronen and Mikael Fortelius (University of Helsinki), Susan Antón (New York University), Sarah Elton (University of Hull), Christophe Soligo (The Natural History Museum), Jonathan Kingdon (Oxford University), Urs Thalmann (University of Zürich) and Laurie Godfrey (University of Massachusetts). Organised by: Christophe Soligo, The Natural History Museum, e-mail: <C.Soligo@nhm.ac.uk>. See website: <http://www.psgb.org/Meetings/Winter2005.html>.

V Göttinger Freilandtage "Primate Diversity – Past, Present and Future," 13–16 December 2005. University of Göttingen and German Primate Center, Göttingen, Germany. Organized by Peter M. Kappeler. Confirmed invited speakers: *Diversity in the past*: Extinct primate communities – John Fleagle (State University of New York, Stony Brook). *Diversity today*: Diversity of Malagasy primates – Anne Yoder (Yale University); Diversity of American primates – Anthony B. Rylands (Conservation International); Diversity of Asian primates – Jatna Supriatna (Conservation International Indonesia); Diversity of African primates – John F. Oates (Hunter College New York); Primate biogeography – Shawn Lehman (University of Toronto); Speciation and taxonomy – Colin P. Groves (Australian National University); Human diversity – Mark Stoneking (Max Planck Institute, Leipzig). *Preserving Diversity for Tomorrow*: Diversity and conservation hotspots – Russell A. Mittermeier (Conservation International); Extinction biology – Carlos Peres (University of East Anglia); Conservation genetics – George Amato (Wildlife Conservation Society); Conservation genetics – Michael Bruford (Cardiff University); Reintroductions – Carel P. van Schaik (University of Zürich). *Comparative Perspectives*: Speciation in birds – Trevor Price (University of Chicago); Bird taxonomy and conservation – Robert Zink (University of Minnesota). Contact: Prof. Dr. Peter M. Kappeler, Deutsches Primatenzentrum (DPZ), Kellnerweg 4, D-37077 Göttingen, Tel/Fax: +49-551-3851-284/291, e-mail: <pkappel@gwdg.de>, website: <http://www.dpz.gwdg.de/sociobiology/GFT2005/index.htm>.

2006

Ecology in an Era of Globalization: Challenges and Opportunities for Environmental Scientists in the Americas, 8–12 January 2006, Merida, Mexico. This conference will be held at the Fiesta Americana Hotel in Merida and is co-hosted by the Universidad Autónoma de Yucatán and the Centro de Investigaciones Científicas de Yucatán. Abstracts should address one of the meeting's three subthemes: invasive species, human migration, and production. The invasive species subtheme includes such topics as dispersal of invasive plant and animal species, emerging diseases, and resistance of local ecosystems to invasive species and disease. The human migration subtheme includes the environmental effects of international and local emigration and immigration on recipient and source areas. Potential topics include infrastructure development needs and impacts, effects on land cover, and land-use impacts. The production subtheme focuses on ecosystem transformations, including land-use change required to produce goods and services for human use. Potential topics include the effects of changes in forest and agricultural policy on economies, biodiversity, and ecosystems throughout the Americas, in terrestrial, marine, and freshwater systems. We particularly welcome reports of projects that are interdisciplinary and that consider the need to communicate with broad audiences. For more information or to submit an abstract, visit <http://www.esa.org/mexico>. Deadline for abstract submissions: 16 September 2005.

75th Annual Meeting of the American Association for Physical Anthropology, 5–12 March 2006, Anchorage, Alaska, USA. For program information, please contact the Program Chair, Lyle W. Konigsberg, Department of Anthropology, University of Tennessee, Knoxville, TN 37996-0720, USA, Tel: (865) 974-4408, fax: (865) 974-2686, e-mail <aapavp@utk.edu>. Local Arrangements Committee Chair: Christine Hanson, Department of Anthropology, University of Alaska Anchorage, Anchorage, AK 99508, USA, tel: 907-786-6839, fax: 907-786-6850, e-mail <afclh@uaa.alaska.edu>. Website at <http://www.physanth.org/annmeet>.

Primate Society of Great Britain (PSGB) Spring Meeting 2006, 27–28 March 2006, University of Stirling, Stirling, Scotland. The theme is "Primate Mentality and Wellbeing." On the afternoon of 27 March invited speakers will address the relationship between cognition and welfare in primates. Other topics are welcomed for posters and oral sessions. There will be a prize for the best postgraduate presentation and poster. A provisional programme and instructions for presenters can be found on the meeting web site at: <http://www.psychology.stir.ac.uk/staff/svick/PSGB2006.php>. For more information please contact: Dr Sarah Vick (PSGB), Psychology Department, University of Stirling, FK9 4LA, Scotland. E-mail address for enquiries: <psgbspring@stir.ac.uk>.

21st Congress of the International Primatological Society, 25–30 June 2006, Imperial Resort Beach Hotel, Entebbe, Uganda. Theme: "Primate Conservation in Action." Preliminary contact details: Dr. William Olupot, Chair, Organizing Committee, IPS 2006 Congress, P. O. Box 21669, Kampala, Uganda, Tel: 077598134, 077947397, 041501020, e-mail <wolupot@yahoo.com>.

29th Annual Meeting of the American Society of Primatologists (ASP), 16–19 August 2006, San Antonio, Texas. Sponsored by Southwest National Primate Research Center. Tentative deadline dates are 5 December 2005 to notify program chair of intent to offer a symposium or workshop; 9 January 2006 to send symposia and workshop abstracts with confirmed list of participants to program chair; and 6 February 2006 for all final abstracts for symposia, oral, and poster presenters. See the ASP website for updates and further information: <http://www.asp.org/meetings/index.html>.

1st European Congress of Conservation Biology, 22–26 August 2006, Eger, Hungary. The European Section of the Society for Conservation Biology is determined to promote the development and use of science for the conservation of European species and ecosystems, and to make sure that conservation policy is firmly underpinned by the best available scientific evidence. This keystone congress will bring together a wide array of academics, policymakers, students, NGO representatives, and biodiversity managers from throughout Europe and beyond. For more information, see the Congress website at <http://www.eccb2006.org> or contact András Báldi, Chair of the Local Organising Committee, at <baldi@nhmus.hu>.

VII Congreso Internacional sobre Manejo de Fauna Silvestre en la Amazonía y América Latina, del 3 al 7 de septiembre de 2006, Ilhéus, Bahia, Brasil. El VII Congreso Internacional sobre Manejo de Fauna Silvestre en la Amazonía y América Latina enfocará su atención en los estudios y programas de manejo que actualmente están siendo ejecutados en la Amazonía y en Latinoamérica, con el propósito de evaluar los resultados alcanzados y las limitaciones encontradas en la conducción de los mismos. Una de sus principales metas será expandir el enfoque del evento a los más amplios aspectos del manejo de fauna en toda Latinoamérica. El VII Congreso Internacional sobre Manejo de Fauna Silvestre en la Amazonía y América Latina incluirá conferencias magistrales, mesas redondas, secciones temáticas con presentaciones orales libres, exposiciones en posters, simposios, workshops, cursos durante y posteriores al congreso, y excursiones pos-congreso. Las áreas temáticas que se abordarán en este evento serán: conservación *in situ* y áreas naturales protegidas, conservación *ex situ* de fauna silvestre, preservación y recuperación de hábitats, metodologías aplicadas para el manejo de fauna silvestre con comunidades, criterios para el uso sustentable de fauna silvestre, indicadores de sustentabilidad, etología aplicada al manejo, medicina veterinaria de la conservación, fisiología y ecología, producción en criaderos, comercio, política y legislación de fauna silvestre. Estamos recibiendo propuestas para mini-cursos, workshops y simposios hasta el 31/12/05. Apreciaremos el apoyo de diversas instituciones. Existen posibilidades de instalación de stands institucionales para difusión y ventas. El plazo para el envío de resúmenes es hasta el 30/04/06. Para mayor información: <http://www.viicongresso.com.br>.

Primate Society of Great Britain (PSGB) Winter Meeting 2006 – 5 December 2006, Cambridge, UK. The focus of the winter meeting will be on Primate Conservation Genetics; it will take place in the West Road Concert Hall at the University of Cambridge from 9:00 – 19:00 on 5 December 2006. This will be a unique opportunity to hear about current exciting research on molecular genetic studies of great apes, Old and New World monkeys and strepsirrhines. Information about the meeting, including titles and abstracts of presentations, can be found at <http://www.psgb.org>. Registration at the door (PSGB student members: £10; student non-members: £15; PSGB members: £15; non-members: £25). The meeting is organised by Prof. Mike Bruford (<brufordmw@cardiff.ac.uk>) and Dr. Leslie Knapp (<lak26@cam.ac.uk>), who can be contacted for further information.

2007

6th Zoos & Aquariums Committing to Conservation Conference, 26–31 January 2007, Houston, Texas. ZACC is a bi-annual event that promotes the role of zoos and aquariums in supporting conservation activities worldwide, both at their institutions and in the field. Conference participants include representatives from zoological institutions, international conservation organizations, local non-governmental organizations, government agencies, funding agencies and, most importantly, field biologists and conservationists. Presentations at the 2007 ZACC will highlight both ongoing projects and new initiatives that offer opportunities for institutional support. There will be a major focus on field-based initiatives that have already established links to zoos and aquariums, as well as promising candidates for such partnerships. In addition, the program will feature presentations related to the organization, management, and support of zoo-based and aquarium-based conservation programs. The full conference registration fee ($195) will include icebreaker event, all sessions, breaks, lunches, conference proceedings, zoo day transport, zoo day lunch and dinner. All funds raised above conference costs will be allocated to the conservation fund for this conference. The deadline for submitting paper and poster abstracts is 1 September 2006. Abstracts submitted electronically should be addressed to <bkonstant@houstonzoo.org> and to <priger@houstonzoo.org>. Abstracts submitted as hard copy should be addressed to: 2007 ZACC Conference, Attn: Bill Konstant, Director of Conservation and Science, Houston Zoo, 1513 North MacGregor, Houston, Texas 77030, USA. For more information, see the conference website at <http://www.houstonzoo.org/ZACC>.

XII Congresso Brasileiro de Primatologia, 22 a 27 de julho de 2007, Belo Horizonte, Minas Gerais, Brasil. O local escolhido é a PUC-BH, de excelente infra-estrutura e localizada no bairro Coração Eucarístico, em Belo Horizonte (MG), o que facilitará o acesso de quem vem de fora. O tema escolhido pela diretoria foi "Prioridades de pesquisa para o estudo de primatas neotropicais" e, portanto, solicitamos a colaboração e participação de todos os interessados na construção da programação deste evento tão importante para todos nós. Estaremos recebendo propostas de mesas-redondas, palestras, mini-cursos e eventos paralelos, tudo voltado ao tema citado acima, até dia 30 de abril próximo, onde colocaremos à disposição no site da SBPr ou na lista de discussões dos primatólogos (<http://br.groups.yahoo.com/group/primatologia>) para votações finais e conclusão de nossos trabalhos ainda neste semestre. Informações adicionais: <http://www.carangola.br/primatologia/> ou entrar em contato com Prof. Dr. Fabiano R. de Melo, Presidente da Sociedade Brasileira de Primatologia, Coordenador do curso de Ciências Biológicas, UEMG/FAFILE, campus de Carangola, Praça dos Estudantes, 23, Santa Emília, Carangola 36800-000, Minas Gerais, Brasil, (32) 3741-1969 / (32) 8845-2904.

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: John M. Aguiar, Conservation International, Center for Applied Biodiversity Science, 2011 Crystal Drive, Suite 500, Arlington, VA 22202, Tel: 703 341-2400, Fax: 703 979-0953, e-mail: <j.aguiar@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 may 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.aguiar@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 should 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 usually reviewed only by the editors. A broader range of topics is 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 may 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, etc.

References. Examples of house style may be found throughout this journal. Please refer to these examples when listing 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.

Chapter in book
Brockelman, W. Y. and Ali, R. 1987. Methods of surveying and sampling forest primate populations. In: *Primate Conservation in the Tropical Rain Forest*, C. W. Marsh and R. A. Mittermeier (eds.), pp. 23–62. Alan R. Liss, New York.

Book
Napier, P. H. 1976. *Catalogue of Primates in the British Museum (Natural History). Part 1: Families Callitrichidae and Cebidae.* British Museum (Natural History), London.

Thesis/Dissertation
Wallace, R. B. 1998. The behavioural ecology of black spider monkeys in north-eastern Bolivia. Doctoral thesis, University of Liverpool, Liverpool, UK.

Report
Muckenhirn, N. A., Mortensen, B. K., Vessey, S., Fraser, C. E. O. and Singh, B. 1975. Report on a primate survey in Guyana. Unpublished report, Pan American Health Organization, Washington, DC.

Neotropical Primates is produced in collaboration with Conservation International, Center for Applied Biodiversity Science, 2011 Crystal Drive, Suite 500, Arlington, Virginia 22202, USA.

PRINTED WITH SOY INK

Neotropical Primates
A Journal and Newsletter of the IUCN/SSC Primate Specialist Group
Vol. 13(3), December 2005

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Short Articles

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