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# *Neotropical Primates*

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**Front cover:** Wied's black-tufted-ear marmoset (*Callithrix kuhlii*), Una, Bahia, Brazil, 1985. Photo by Russell A. Mittermeier.


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# Articles

## HOWLER AND CAPUCHIN MONKEY DENSITIES IN RIPARIAN FORESTS ON ISLANDS AND ADJACENT SHORES ON THE UPPER PARANÁ RIVER, SOUTHERN BRAZIL

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### Abstract

Three primates (*Alouatta caraya*, *Sapajus nigritus* and *Sapajus cay*) are found in riparian areas of the Upper Paraná River in southern Brazil. Population densities of these three species were estimated from October 2004 through September 2005 by counts on linear transects in riparian forests on two riverine islands and adjacent shores in the states of Mato Grosso do Sul and Paraná. A total of 397 sightings of these species were accumulated in 188 km of traversed transects. *Alouatta caraya* was the most abundant species on the large island (2.56 ind ha-1) and on the Mato Grosso do Sul side (0.84 ind ha$^{-1}$). This density was greater than twice that of the sympatric *S. cay* (0.31 ind ha$^{-1}$). *Sapajus nigritus* was the most abundant species on the Paraná side (0.51 ind ha$^{-1}$) followed by *A. caraya* (0.40 ind ha$^{-1}$). The folivorous *A. caraya* was the most abundant in flooded forests, while the omnivorous *Sapajus* species were less so. Differences in forests, conservation status, dispersal restrictions and autecology of the primates help explain differences in primate abundance.

**Keywords:** *Alouatta caraya*, *Sapajus cay*, *Sapajus nigritus*, habitat fragmentation, population survey, primate conservation.

### Resumo

Três espécies de primatas (*Alouatta caraya*, *Sapajus nigritus* e *Sapajus cay*) podem ser encontradas nas matas ciliares do Alto Rio Paraná, sul do Brasil. Suas densidades populacionais foram estimadas através do método das transecções lineares em matas ciliares de duas ilhas fluviais e das margens opostas do rio, no limite entre os estados do Mato Grosso do Sul e Paraná, durante outubro de 2004 a setembro de 2005. Obteve-se um total de 397 avistamentos de primatas ao longo de 188 km percorridos. *Alouatta caraya* foi a espécie mais abundante na maior ilha (2.56 ind ha$^{-1}$) e na margem do Mato Grosso do Sul (0.84 ind ha$^{-1}$). A densidade da espécie neste local foi maior que o dobro da densidade da espécie simpátrica, *S. cay* (0.31 ind ha$^{-1}$). *Sapajus nigritus* foi a espécie mais abundante na margem do Paraná (0.51 ind ha$^{-1}$), seguido de *A. caraya* (0.40 ind ha$^{-1}$). A espécie folívora, *A. caraya*, foi mais abundante na floresta de inundação, mais conservada, enquanto que *Sapajus*, onívoro, foi mais abundante na floresta de terra firme. Diferenças entre a estrutura das florestas, grau de conservação, restrições para dispersão e autoecologia dos primatas ajudam a explicar as diferenças entre as abundâncias encontradas.

**Palavras-chaves:** *Alouatta caraya*, *Sapajus cay*, *Sapajus nigritus*, fragmentação florestal, levantamento populacional, conservação de primatas.

### Introduction

Fragmentation may result in rapid population growth in mammal species whose population sizes, in other more diverse communities, would have been controlled by competition or predation (Redford, 1992; Peres and Dolman 2000; Terborgh *et al*., 2001; Link *et al*., 2010). At least three hypotheses may explain these increased densities: (1) absence of predators, (2) ecological plasticity and (3) density compensation, in which the effects of isolation result in the elimination of some species (Redford, 1992; Glanz, 1996; González-Solís *et al*., 2001; Terborgh *et al*., 2001). For example, in the Amazon, small and medium-sized primate species increase in abundance where larger

species of the family Atelidae are preferentially hunted (Peres and Dolman, 2000). Also, greater densities in *Alouatta* and *Sapajus* species may be found in degraded communities in fragments and islands (Chiarello and Galetti 1994; González-Solís *et al*., 2001; Ludwig *et al*., 2005; Martins, 2005; Almeida-Silva *et al*., 2005; Link *et al*., 2010).

Islands may serve as natural experiments to examine the effects of isolation on mammal populations (Glanz, 1996; Terborgh *et al*., 2001). For example, abundance of *Alouatta seniculus* increased in the absence of predators as well as with simplification of forests on artificial islands (Terborgh *et al*., 2001). Similarly, black-and-gold howler monkey (*Alouatta caraya*) densities are greater on an island than the nearby shores of the Paraná River in Argentina (Rumiz, 1990; Zunino *et al*., 2001). However, islands in the Paraná River are natural and have primate predators, such as large cats (Aguiar *et al*., 2007; Ludwig *et al*., 2007). On the islands of the Paraná River, with rich alluvial soils, two important factors may contribute to high howler population densities: (1) greater productivity of high-quality resources, such as fruits and young leaves, and (2) year-round resource availability (Janzen, 1974; Rumiz, 1990; Zunino *et al*., 2001; Bravo and Sallenave, 2003).

Although *A. caraya* population studies have taken place in the system of islands of the Middle Paraná River (Rumiz, 1990; Zunino *et al*., 2001), few studies include other primates in this area (Brown and Zunino, 1994) and in others portions of this river. Given the importance of understanding local variation in primate abundances, the main goal of this study was to examine and compare densities of *A. caraya*, *Sapajus nigritus* and *Sapajus cay* on forested islands and along the adjacent margins of the Upper Paraná River in southern Brazil.

## Methods

*Study area*

Primates were studied in the Upper Paraná River Protected Area in the southern Brazilian Atlantic Forest. Primate abundances were estimated on two islands and along the margins of the river near the city of Porto Rico in Paraná, and near the city of Taquarussu in Mato Grosso do Sul (22°43'60"S and 53°24'18"W; Fig. 1). The region is subtropical, with an average rainfall between 1,200–1,300 mm (Romagnolo and Souza, 2000). Human impact has degraded the forests, although today the area is in process of recovery (Campos and Souza, 2002). The study area comprises two main forest types: alluvial, or flooded forests (*várzeas*), that are found in the islands and flood plains on the Mato Grosso do Sul side of the river; and submontane (higher than 250 m above sea level) on the Paraná side of the river. Alluvial forests flood annually and have low tree diversity and are dominated by pioneer species (Romagnolo and Souza, 2000; Campos and Souza, 2002). The canopy is open and low (10–15 m, emergent to 25 m). Productivity is high due to the rich alluvial soils and so high-quality forage (leaves) is abundant and relatively constant for folivorous howler monkeys (Rumiz, 1990). *Cecropia pachystachya* is the dominant tree and the main food source for howler monkeys here (Ludwig *et al*., 2008). Submontane forests are the most diverse and mature forests in the region in areas that do not flood (M. C. Souza, unpublished). However, productivity of resources used by folivorous primates is relatively lower and more seasonal (Rumiz, 1990). The canopy is more closed with trees of 15–30 m. Today, the submontane forest is nearly extinct in this region with only a few fragments remaining (Campos and Souza, 1997).

Primates were counted on two islands and both margins of the river (Fig. 1). Mutum Island is the largest island (1,050 ha), near the river center (1,000 m from Paraná, 700 m from Mato Grosso do Sul) and comprises a mosaic of alluvial forests, swamps, and patches of more preserved forests, and is dominated by the pioneer tree *C. pachystachya*. Carioca Island is smaller (360 ha), 600 m from Paraná, 800 m from Mutum Island, and comprises a mosaic of degraded alluvial forests with few trees and discontinuous canopy with many vines. Humans and feral domestic pigs (*Sus scrofa*) have impacted the island. The shores of Mato Grosso do Sul comprise alluvial forests that are naturally narrow corridors above the dikes formed by the river. Today, they are fragmented and poorly preserved due to an increasing pressure from agriculture, cattle, fire, and human settlements. Farther from the dikes, the forests are rapidly being replaced by pasture and marshes. Finally, the Paraná shore has submontane forests and, despite some anthropic influence, has continuous, wider stretches that retain most of the original forest structure (M. C. Souza, unpublished). Abundant palms (*Acrocomia aculleata* and *Syagrus romanzoffianum*), and agriculture, including corn and cassava, are only on the Parana side of the river (L. M. Aguiar, personal observation).

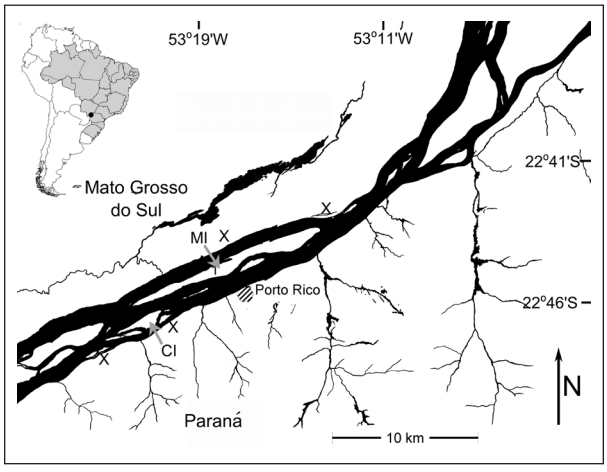


**Figure 1.** Location of the study area on the Upper Paraná River, southern Brazil. X marks the transect locations on the river shore; MI: Mutum Island; CI: Carioca Island. Porto Rico: nearby city.

*Study animals*

Three species of primates are found in the region (Aguiar *et al*., 2007). The black-and-gold howler monkey is found on both shores of the river, and is the only monkey on the islands. The black-horned capuchin (*S. nigritus*) is found on the Paraná side of the river, and Azara's capuchin (*S. cay*) on the Mato Grosso do Sul side of the river. The Paraná river is a barrier for dispersal of both capuchins (Aguiar *et al*., 2007). Monkeys are seldom hunted in the region and so populations are not responses to hunting pressure (Aguiar *et al*., 2007). Capuchin taxonomy follows Alfaro *et al*. (2011).

*Density estimates*

Linear transects with multiple counts (Buckland *et al*., 1993; Ferrari, 2002) were used to estimate primate density. Due to the narrow riparian forests in various degrees of perturbation, transects were established to accompany the forest habitat and had to vary in length to fit within these patches. Transect lengths were 1500 m on Mutum Island, 560 and 1260 m on Carioca Island, 1000 and 1010 m on the Mato Grosso do Sul shore, and 1000 and 1180 m on the Paraná shore. Transects were walked once or twice each week from October 2004 through September 2005. Transects were walked at an average speed of 0.5 km $h^{-1}$, between 06:00–12:00 h, and between 14:00–19:00 h. No transect was walked twice in the same day. At each sighting, the perpendicular distance to the trail was measured (Bushnell distance meter or tape), and time, species and numbers of visible individuals were noted (measurable individuals following Marshall *et al*., 2008). The distance to the most distant individual in each group was measured. The program Distance version 4.1 was used to estimate abundance using the size-biased sampling method, using a probability of 0.15 for significance of regressions between clusters sizes and sighting distances to the clusters (Buckland *et al*., 1993).

## Results

A total of 397 sightings were recorded during about 500 h of walking over 188 km (Table 1). Howler monkey density varied between 0.40–2.56 ind $ha^{-1}$, with the lowest densities on the Paraná side and on Carioca Island, and the greatest on the Mato Grosso do Sul side and Mutum Island. Capuchin monkey density varied between 0.31 ind $ha^{-1}$ for *S. cay* in Mato Grosso do Sul and 0.51 ind $ha^{-1}$ for *S. nigritus* in Paraná.

## Discussion

The flooded, and more conserved forests on Mutum Island are apparently the most favorable local habitats for *A. caraya* such that their density is more than five times that of the other locations. Primate density is similar in the other locations, although capuchin density was greater in more mature and conserved forests (*e.g.*, *S. nigritus* in Paraná) and greater than the density of sympatric howlers. Indeed, howler density was lower than that of the capuchins in mature forests of Paraná and in the most disturbed habitat of Carioca Island. Howler abundance, therefore, may be strongly influenced by productivity (such as flooded forests), while the more generalist capuchins do better in mature forests and more conserved habitats. We suggest that the flooded habitat in Mutum Island is important to maintain the extremely abundant *C. pachystachya* as a very important resource that allows greater population sizes in *A. caraya*. In contrast, while often flooded, Carioca Island apparently cannot support similar population sizes there due to environmental degradation. A similar relationship of abundance, productivity and degradation has been found in the Middle Paraná River (Rumiz, 1990; Brown and Zunino, 1994; Zunino *et al*., 2001).

Other factors may also influence densities in this study area: 1) low predation and hunting pressure, 2) density compensation (Redford, 1992; Glanz, 1996; González-Solís *et al*., 2001; Terborgh *et al*., 2001) and 3) crowding (Lovejoy *et al*., 1986). First, hunting pressure by humans is low and natural primate predators are less abundant in this region, probably due to the presence of humans. While predation is an important component of primate life histories, predation as a constraint on primate population size has not been clearly demonstrated in most species (Isbell,

**Table 1.** Sampling effort (distance walked in km), number of sightings, sighting rate (sightings km-1), average group (cluster) size, and density estimate (individuals ha-1) at four sampling locations on the Upper Paraná River, in southern Brazil.

| Estimates-statistics | Mutum Is. | Carioca Is. | Paraná | | Mato Grosso do Sul | |
|---|---|---|---|---|---|---|
| | *A. caraya* | | *A. caraya* | *S. nigritus* | *A. caraya* | *S. cay* |
| Distance | 21 | 49 | 57 | 57 | 61 | 61 |
| Sightings | 99 | 42 | 45 | 52 | 111 | 48 |
| Sighting rate | 13.2 | 1.6 | 1.1 | 1.59 | 2.6 | 0.43 |
| Group sizea | 3.1 | 3.3 | 3.2 | 2.8 | 2.1 | 1.6 |
| Density | 2.56 | 0.63 | 0.40 | 0.51 | 0.84 | 0.31 |
| Function | Uni/Cos | Hazard rate | Uni | Uni/Cos | Half-normal | Half-normal/Cos |

a Group size (average) was counted on the islands and estimated on the mainland using the program Distance. Coefficient of variation (CV) varied between 15–25%. Effective width varied between 20 m (*S. cay*) and 32 m (*A. caraya* in Paraná).

1994). Density compensation may also allow greater abundance. Since the local primate community is depauperate, with never more than two co-occurring species in any one place, it is possible that reduced competition for resources and isolation due to fragmentation combine to favor increased density. Also, other potential competitors for howlers, such as capuchins and coatis are absent from the islands (Aguiar *et al*., 2007). This distribution raises the question of why there are not three primate species, and coatis, at any given site, since they are all locally available?. Perhaps the river is an effective barrier for dispersal of capuchins and coatis, or flooded forests may not provide the additional resources (prey, fruit) that these omnivorous species require (Haugaasen and Peres, 2005; Aguiar *et al*., 2011).

The crowding effect (Lovejoy *et al*., 1986) may also be important, since these primates are opportunists and generalists, and may have overlapping ranges. They may coexist at relatively high densities in environmentally degraded areas due to dispersal limitation, such as on the islands. This is an important possibility, because it suggests that degraded areas may still provide resources to maintain large or dense populations. Usually, capuchins are more frugivorous and more resource generalists than howlers (Freese and Oppenheimer, 1981; Link *et al*., 2010). However, *S. cay* is not very abundant (in contrast to howlers), apparently because the flooded forest is not ideal habitat for capuchin species (Peres, 1989; Haugaasen and Peres, 2005). Riparian forest along the river in Mato Grosso do Sul is a narrow corridor and with a relatively small area for foraging. In contrast, *S. nigritus* is more abundant on the Paraná side of the river than is typical (Ludwig *et al*., 2005; Martins, 2005; Almeida-Silva *et al*., 2005). On the Paraná side, the riparian forest corridor is wider, with more mature and better-preserved forest including many palm trees where they forage, as well has having cultivated crops that they may also consume (Ludwig *et al*., 2005). These complex interactions require autecological studies that examine the importance of each resource to better understand how these resources influence abundance patterns.

Therefore, here, the abundance patterns of these three primate species suggest that forest structure and conservation status may be the main influences regulating population size. Greater abundance may be explained by both, immigration and reproduction (Begon *et al*., 2006). Since howlers can swim (Aguiar *et al*., 2007) and then find abundant resources, their populations will grow as long as resources are not limiting. If riparian areas are well protected, they can maintain populations of primates and other animals. We suggest that the interactions of density compensation, crowding, low hunting and predation pressures, and the extremely abundant *Cecropia* (for howlers) probably allow the unusually high densities. Although humans have fragmented the habitat, primates are still relatively abundant, which suggests that these are important populations for conservation, in contrast with the lower abundances of these species elsewhere (Ludwig *et al*., 2005; Moura, 2007). Thus, populations along the Paraná River are potentially important sources for regional maintenance of these species. We recommend further study to specifically tests the hypotheses presented here and thereby assure conservation of these primates.

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# Short Articles

## UM CASO DE USO ESPONTÂNEO DE FERRAMENTA POR UM MACACO-PREGO (*CEBUS APELLA*) MANTIDO EM CATIVEIRO

*Miguel Angelo Monteiro Lessa*
*Olavo de Faria Galvão*
*Paulo Elias Gotardelo Audebert Delage*

### Introdução

Os macacos-prego são macacos do Novo Mundo que compõem o gênero *Cebus* (Rylands *et al.*, 2000). Eles são encontrados a partir de Honduras na América Central até o nordeste da Argentina na América do Sul (Fragaszy *et al.*, 2004b). Seu repertório manipulativo é bastante diversificado. Logo nos primeiros meses de vida já manipulam e combinam objetos com superfícies e outros objetos (Fragaszy *et al.*, 2004b). O desenvolvimento dessas ações ainda na infância é fator importante para o surgimento do uso de ferramentas no final da juventude e início da fase adulta (Resende *et al.*, 2008). O comportamento de usar ferramentas ocorre quando um animal altera as propriedades físicas de um objeto, substância, superfície ou qualquer outro alvo por meio da manipulação de outro objeto externo (St. Amant e Horton, 2008; Bentley-Condit e Smith, 2010). Episódios de uso espontâneo de ferramentas por macacos do gênero *Cebus* são registrados em diferentes espécies, sistemas ecológicos e objetivos.

Em cativeiro (zoológicos e laboratórios) um macaco-prego adulto da espécie *Cebus apella fatuellus* utilizou um pedaço de madeira para se defender dos ataques de outros membros do grupo (Cooper e Harlow, 1961). Um macho da espécie *Cebus apella* foi visto utilizando pedaços de alimentos, como batata, tomate ou banana como iscas para atrair os peixes para a margem e capturá-los (Mendes *et al.*, 2000). Manipulando as iscas na margem do rio ou arremessando dentro da água foram as maneiras que os macacos desenvolveram para atrair os peixes. Em um estudo descritivo do comportamento de *Cebus apella* mantidos em cativeiro foi observado dois tipos diferentes de uso de ferramentas (Serbena e Monteiro-Filho, 2002). No primeiro, o macaco-prego posicionava pedaços de laranja ou mamão em uma pedra grande e com uma pedra menor ele golpeava os alimentos. No segundo, a extremidade de um instrumento oco de madeira foi utilizada para cavar a terra em busca de formigas. Macacos da espécie *Cebus paraguayanus* foram observados usando galhos e folhas para buscar alimentos fora do alcance das mãos e pernas (Giudice e Pavé, 2007). E uma fêmea adulta supostamente da espécie *Cebus nigritus* foi observada fabricando e usando um graveto para sondar um buraco provavelmente em busca de água, e também utilizando pedras para quebrar frutos de casca dura e cubos de gelo contendo alimentos (Bortolini e Bicca-Marques, 2007).

As primeiras observações sistemáticas de uso espontâneo de ferramentas no gênero *Cebus* fora do ambiente de cativeiro foram feitas por Mannu e Ottoni (1996) e Rocha *et al.* (1998). Nestes estudos, macacos da espécie *Cebus apella* usaram espontaneamente pedras como martelos para quebrar cocos (*Syagrus cf. romanzoffianum*) apoiados em substratos planos. Ottoni e Mannu (2001), em um estudo mais sistemático sobre este tipo de uso de ferramentas observaram que os macacos mais jovens (entre 2 e 5 anos de idade) eram os que mais quebravam cocos usando ferramentas em comparação aos adultos. Para os autores, esta diferença pode estar relacionada ao monopólio de alimentos mais desejáveis pelos dominantes e, também, pelo fato dos cocos estarem mais dispersos no ambiente o que restringe o controle de acesso pelos dominantes. No ambiente de vida livre diversas publicações também têm mostrado as habilidades do gênero *Cebus* no uso de ferramentas. Na floresta tropical da Costa Rica um grupo de *Cebus capucinus* utilizou pedaços de madeira para atacar e matar uma cobra venenosa (*Bothrops asper*) (Boinski, 1988). Na região de manguezal do Nordeste brasileiro, um macho adulto da espécie *Cebus apella* utilizou pedaços de conchas de ostras (*Crassostrea rhizophorae)* para bater insistentemente na concha de outra ostra até quebrá-la e se alimentar do molusco (Fernandes, 1991). Mas é nas regiões brasileiras do Cerrado e Caatinga onde há a maior concentração de uso de ferramentas por populações de macacos-prego em vida livre (Ottoni e Izar, 2008). A utilização de pedras ("martelos") para quebrar cocos (*Attalea spp*., *Astrocaryum sp*.) previamente posicionados em cima de uma superfície sólida ("bigorna") constitui uma atividade comum entre os macacos da espécie *Cebus libidinosus* que habitam essas regiões (Langguth e Alonso, 1997; Fragaszy *et al.*, 2004a; Moura e Lee, 2004). Além de martelos as pedras desempenham outras funções na vida diária desses macacos. Podem funcionar como "enxadas" para cavar a terra ou espalhar folhas secas do chão, como "machados" para cortar partes de galhos e "pilões" para amolecer a terra facilitando o ato de cavar (Mannu e Ottoni, 2009).

A utilização de pedras e pedaços de madeira são os materiais mais comuns que os macacos-prego usam como ferramentas para alcançar alimentos que não podem ser alcançados diretamente. Registros de outros tipos de materiais como ferramentas são escassos na literatura primatológica. O uso de água como ferramenta, por exemplo, somente tem sido descrito até o momento em orangotangos (*Pongo abelii* e *Pongo pygmaeus*), chimpanzés (*Pan troglodytes*) e humanos (*Homo sapiens*). Mendes *et al.* (2007) investigaram o uso de água como ferramenta em cinco fêmeas de orangotangos (*Pongo abelii*) que viviam em um zoológico. Apresentaram às fêmeas um recipiente (26 × 5 cm) de acrílico transparente preenchido com um quarto de água. Dentro do recipiente colocaram um grão de amendoim de modo que mesmo boiando na água o alimento não podia ser alcançado diretamente pelos sujeitos da pesquisa. Para resolver o problema, então, todos os sujeitos se dirigiram ao bebedouro, armazenaram a água dentro da boca e cuspiram de volta dentro do tubo. Essa ação era repetida até aumentar o nível da água suficientemente para pegar o alimento com os dedos, por volta de três a cinco vezes.

Para comparar os desempenhos dos orangotangos no estudo de Mendes *et al*. (2007), Hanus *et al*. (2011) apresentaram a mesma tarefa para orangotangos (*Pongo pygmaeus*), chimpanzés (*Pan troglodytes*), gorilas (*Gorilla gorilla*) e crianças humanas (*Homo sapiens*). No caso das crianças ao invés do bebedouro foi usada uma jarra contendo água que deveria ser usada para conseguir pegar o amendoim. No geral apenas os gorilas não conseguiram resolver a tarefa, alguns chimpanzés e orangotangos conseguiram resolver e somente crianças a partir de seis anos de idade derramaram a água no tubo para pegar o prêmio. Neste artigo apresentamos um caso de uso espontâneo de ferramenta por um macaco-prego (*Cebus apella*) mantido em cativeiro no qual é freqüente o fornecimento de material para manipulação. O macaco-prego utilizou a água do bebedouro para conseguir um alimento que não podia ser alcançado diretamente. Trata-se do primeiro registro em macacos (i.e. que possuem rabo) da utilização deste tipo de material como ferramenta para conseguir um alimento de difícil acesso, sem que o animal tivesse algum tipo de treino para resolver tal problema.

## Materiais e métodos

O sujeito focal foi um macaco-prego chamado Negão com aproximadamente quatro anos de idade no dia da observação. Negão chegou à Escola Experimental de Primatas (http://www.ufpa.br/eep/) no ano de 2005 oriundo do Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA). Na época da filmagem o animal pesava cerca de 2 kg e media aproximadamente 40 cm de corpo e 40 cm de cauda (hoje já está maior inclusive prestes a se tornar o dominante do grupo). O Negão e todos outros macacos da Escola Experimental de Primatas (EEP) participam diariamente de sessões experimentais. Ao todo a EEP contava com 16 macacos-prego. Suas tarefas são realizadas em monitores LCD de 17" sensível ao toque (Elo Entuitive) voltadas aos estudos de aprendizagem e desenvolvimento de pré-requisitos de comportamentos cognitivos (Galvão *et al*., 2002). O sujeito focal vivia em companhia de mais dois macacos machos adultos da mesma espécie em uma gaiola-viveiro de 2,50 × 2,50 × 2,50 m., construída de tubos e tela metálica galvanizada, e ficava sobre uma base de alvenaria. Mais três gaiolas-viveiro semelhantes estavam lateralmente posicionadas uma do lado da outra. A aproximadamente 1m de distância do topo das gaiolas havia uma cobertura de telha de barro que media 20,0 × 3,0 m. No interior de todas as gaiolas, inclusive a do sujeito focal, havia plataformas de madeira a 1 m e a 2 m do solo. Sobre a plataforma mais alta na parte coberta ficava uma caixa de madeira medindo 0,47 × 0,49 × 0,47 m, com várias entrada e saídas. Em todas as gaiolas havia bebedouros de bico de aço posicionados a 2 m do solo que eram acionados por pressão. Anexas a uma das laterais de cada gaiola se encontravam quatro gaiolas de contenção (0,60 × 0,50 × 0,50 m), com portas de correr que davam acesso ao interior da gaiola e um suporte (0,24 × 0,33 × 0,24 m) utilizado para colocar uma bandeja com alimento. Os macacos eram alimentados uma vez ao dia no período da tarde. A dieta era composta por ração para primatas (Megazoo P18), frutos variados (banana, maçã, melão, melancia, laranja, manga, abacate, milho verde), legumes e verduras (pepino, cenoura, beterraba, batata doce), ovos, e bolachas tipo cream-cracker. Para suplementar a dieta, os macacos recebem semanalmente um suplemento vitamínico (Revitam Júnior –BIOLAB).

A EEP conta com uma médica veterinária que avalia periodicamente a saúde dos animais, coleta fezes e sangue para exames laboratoriais, e efetua as medidas profiláticas recomendadas. No próprio ambulatório veterinário da EEP ela atende prontamente aos casos de urgência como ferimentos, diagnostica e trata eventuais doenças. Sua participação também é essencial no planejamento da dieta normal para os macacos saudáveis e dieta especial para os em tratamento. A EEP também conta com um profissional responsável pela manutenção do biotério, que envolve principalmente a higiene do ambiente e a alimentação dos animais. As condições de alojamento, manejo, alimentação, cuidados veterinários e os procedimentos experimentais que são adotados na EEP foram aprovados junto ao IBAMA (Inscrição no IBAMA 207419; Código Unidade/Convênio 381.201-4) e junto ao Comitê de Ética em Pesquisa com Animais da Universidade Federal o Pará (CEPAE), mediante o documento CEPAE-UFPA: PS001/2005. O ambiente do sujeito era enriquecido diariamente com objetos manipuláveis (p. ex., garrafas plásticas, papelão, correntes de aço e tubos de PVC). A garrafa pet utilizada nas filmagens foi uma garrafa de água mineral de 500 ml sem tampa, medindo aproximadamente 17 cm de altura, 6,5 cm de diâmetro do corpo e 3 cm de diâmetro do bocal.

## Procedimento

Uma observação casual de utilização espontânea de ferramenta para alcançar alimento de difícil acesso foi filmada pelo primeiro autor. O sujeito experimental utilizou a água do bebedouro para obter farelo de bolacha do tipo água e sal grudado no fundo de uma garrafa pet. A partir dessa observação seguiu-se uma segunda observação na qual foram mantidas as mesmas condições em que a utilização da ferramenta ocorreu anteriormente. Na segunda observação, o primeiro autor prendeu os dois membros do grupo nas gaiolas de contenção, deixando apenas o sujeito experimental solto na gaiola-viveiro. Antes de entregar a garrafa pet ao macaco, o primeiro autor colocou alguns farelos de bolacha dentro da garrafa e pingou algumas gostas de água mineral dentro da garrafa para fixar o farelo no fundo. Tanto a garrafa quanto a bolacha foram semelhante à observação anterior. Com o material pronto, o primeiro autor entregou a garrafa ao macaco e logo em seguida realizou a filmagem da utilização de ferramenta.

## Resultados

Na observação casual, após um dos membros do grupo (o dominante) ter se desinteressado de uma garrafa de plástico anteriormente depositada na gaiola pelo tratador, o sujeito

experimental (Negão) se aproximou dela, agarrou-a com as mãos e lambeu algumas vezes na parte de dentro do bocal. Em seguida, o sujeito experimental prendeu o bocal da garrafa entre as mandíbulas e transportou-a até o bebedouro. Um deslocamento de aproximadamente 3 metros de distância. Chegando ao lado do bebedouro, o sujeito sentou-se na plataforma e com uma das mãos segurou a garrafa pelo bocal posicionando-o em direção ao bebedouro. Com a outra mão pressionou o dispositivo do bebedouro para a liberação da água. O sujeito pressionou o dispositivo do bebedouro por aproximadamente dois segundos, introduzindo apenas uma pequena quantidade de água dentro da garrafa. Em seguida, segurou a garrafa com as duas mãos, bateu levemente o fundo da garrafa na plataforma e lambeu o interior do bocal. Na sequência ergueu a garrafa com as mãos (a garrafa formava um ângulo de aproximadamente 30º com o poleiro), posicionando o gargalo em frente a sua boca e, então, bebeu o líquido que fora depositado dentro do objeto (Fig. 1). Como ainda restavam alguns farelos no fundo da garrafa, o sujeito repetiu a ação. Mas, desta vez


**Figura 1.** Observação casual do macaco-prego (*Cebus apella*) macho sub-adulto utilizando a água do bebedouro como ferramenta. Filmagem do primeiro autor, em 02 de agosto de 2007.

além de bater levemente o fundo da garrafa na plataforma, ele balançou a garrafa presa nas mandíbulas pelo bocal antes de beber o líquido. A duração deste episódio, isto é, a partir do momento em que o sujeito se aproxima da garrafa até o momento em que ele bebe o líquido pela segunda vez, foi de 2 minutos e 17 segundos.

Na segunda observação, após receber do primeiro autor a garrafa com farelo de bolacha grudado no fundo, o sujeito prontamente se deslocou em direção ao bebedouro. Ele exibiu um repertório comportamental semelhante ao que fora realizado na primeira observação: (a) sentou-se ao lado do bebedouro, (b) posicionou o gargalo da garrafa em frente ao bebedouro, (c) colocou apenas uma pequena quantidade de água dentro da garrafa e (d) bebeu o líquido (Fig. 2). Porém, desta vez ele não bateu com a garrafa na plataforma nem a balançou como fez na observação anterior. A duração deste episódio, isto é, do momento em que ele recebe a garrafa do primeiro autor até o momento em que bebe o líquido, foi de 16 segundos.


**Figura 2.** Replicação da primeira observação do macaco-prego utilizando a água do bebedouro como ferramenta. Filmagem do primeiro autor, em 17 de Agosto de 2008. As filmagens das duas observações podem ser vistas através dos sites: http://www.youtube.com/watch?v=EP1BaKRHZTw http://www.youtube.com/watch?v=dFJ0rGtqyPU

## Discussão

Observações do uso espontâneo de ferramentas por diferentes espécies de macacos-prego mostram o quanto este comportamento é característico do gênero *Cebus*. Fatores comportamentais e ambientais contribuem para o surgimento do comportamento de usar ferramentas. A habilidade que os macacos-prego possuem de manipular e combinar objetos juntamente com algum nível de terrestrialidade representam os fatores comportamentais (Fragaszy *et al.*, 2004b). Entre os fatores ambientais destacam-se o grau de provisionamento, o baixo risco de predação (Ottoni e Izar, 2008), e a presença de objetos adequados que possam assumir a função de ferramenta (Rocha *et al.*, 1998).

No entanto, a maioria dos relatos de uso de ferramentas no gênero *Cebus* incluem pedras e pedaços de madeira como os materiais mais comuns. A utilização de outros tipos de materiais como ferramenta é escasso entre os macacos deste gênero e também entre os grandes primatas. Embora haja relatos de que orangotangos (*Pongo abelii* e *Pongo pygmaeus*), chimpanzés (*Pan troglodytes*) e crianças humanas (*Homo sapiens*) utilizem a água como ferramenta para alcançar determinado objetivo (Mendes *et al.*, 2007; Hanus *et al.*, 2011).

O presente estudo é o primeiro entre os macacos (i.e., primatas com rabo) a registrar o uso espontâneo de água do bebedouro como ferramenta para conseguir um alimento de difícil acesso. Com o alimento preso no fundo da garrafa plástica, o sujeito experimental não tinha ao seu redor nenhum outro tipo de ferramenta disponível a não ser utilizar a água para destacar o alimento do fundo. De acordo com a classificação dos níveis de uso de ferramentas proposta por Fragaszy *et al*. (2004b), o sujeito experimental exibiu uma relação com o objeto no nível de Primeira-Ordem/Estático, pois combinou um objeto (garrafa plástica) com outro objeto fixo (bebedouro) para conseguir o alimento. Na primeira observação, o macaco-prego levou pouco mais de dois segundos para resolver a tarefa, mas na segunda observação esse tempo caiu para apenas 16 segundos. Essa diferença na latência entre tentativas também foi observada nos estudos de Mendes *et al*. (2007) e Hanus *et al*. (2011) com grandes primatas.

O episódio de uso espontâneo de ferramenta tratado aqui é uma demonstração da variedade de atividades manuais e da flexibilidade cognitiva que são características marcantes entre os macacos do gênero *Cebus* (Fragaszy *et al.*, 2004b). Westergaard e Fragaszy (1985) observaram algo semelhante ao que é registrado aqui. Após fornecer diversos tipos de objetos manipuláveis aos macacos-prego (*Cebus apella*) cativos, os autores fizeram o primeiro registro do uso de uma colher de plástico para coletar água e levar à boca em macacos do Novo Mundo. Portanto, tanto o trabalho de Westergaard e Fragaszy (1985) como a observação tratada aqui demonstram a importância da presença de objetos manipuláveis dentro dos recintos dos macacos-prego. Fortalece, também, a ideia de que a manutenção de animais em um ambiente que crie oportunidades para a emissão de comportamentos típicos para aquela espécie é um fator essencial quando se leva em conta a melhoria da qualidade de vida desses animais (Celli *et al.*, 2003; Bortolini e Bicca-Marques, 2007).

O registro de uso de ferramentas feito aqui juntamente com o registro feito por Westergaard e Fragaszy (1985) chamam a atenção não somente para o uso de objetos manipuláveis como parte de um programa de enriquecimento ambiental. Além de proporcionar um padrão comportamental típico do gênero, os objetos manipuláveis criam oportunidades para que comportamentos criativos e inéditos sejam descobertos no cativeiro.

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## FIRST OBSERVATIONS OF TERRESTRIAL TRAVEL FOR OLALLA'S TITI MONKEY (*CALLICEBUS OLALLAE*)

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### Introduction

Primates are characterized by a morphology and anatomy that clearly shows adaptations for an arboreal life including climbing, brachiating and swinging abilities (Chivers, 1991). Marked terrestrial habits are present in some Catarrhini members such as *Mandrillus, Papio* and *Macaca* in the Old World. Observations of terrestrial behaviors were also reported for some essentially arboreal Neotropical primate species such as *Alouatta, Cebus, Ateles* and *Brachyteles* to obtain some food, water or minerals and/or for geographic dispersion (Dib *et al.*, 1997; Emmons, 1999; Mandujano *et al.*, 2004; Almeida Silva *et al.*, 2005; Campbell *et al*, 2005; Mourthe *et al.*, 2007; Pozo-Montuy & Serio-Silva, 2007). This last point is very important in fragmented forest habitats where monkeys move on the ground to reach new patches of forest but in so doing expose themselves to increased predation risks. As such, increases in forest fragmentation may affect primate conservation and survival beyond just the immediate effects of habitat loss.

Olalla brother's titi monkey (*Callicebus olallae*) has one of the most restricted distribution ranges of Neotropical primate species inhabiting a small naturally fragmented forest-savanna area in the southwestern portion of the Beni department in Bolivia, almost exclusively within the riverine forest of Yacuma River. Initial work on this species concentrated on their distribution, demography and taxonomy (Barreta *et al.*, 2007; Felton *et al.*, 2006; Lopez-Strauss & Wallace, in prep; Martinez & Wallace, 2007). To better understand the ecological requirements of this primate a behavioral ecology survey was initiated in 2007. In this note we present a series of observations concerning terrestrial movements of these monkeys obtained during this study.

## Methods

The study site was at La Asunta, a cattle ranch located along the Yacuma River where, according to previous distributional knowledge, a number of *C. olallae* groups occurred (Figure 1). Two general types of forest habitats are present: gallery and fragmented forest, with the latter more evident at greater distances from the river. In July 2007 two groups inhabiting gallery forest and fragmented forest respectively, were chosen for study. Primate observations were made from 06:30 to 18:00 h, searching for study groups at sunrise and then attempting to follow them all day. We registered places visited frequently by the groups in order to record resting, feeding and sleeping sites.

## Results

*Observations 1 and 2*

Early on in the habituation phase, the original fragmented forest group of five individuals (Quinteto, Fig. 1) abandoned their territory when two groups one of squirrel monkeys (*Saimiri boliviensis*) and another of night monkeys (*Aotus azarae*) arrived in the forest patch. Individuals of this group were observed travelling to and between several of the forest patches adjacent to their original site, covering distances by ground of 5 to 20 m. During these displacements, the titi monkeys remained some time at the edge of the forest before jumping to the ground and jumping quickly with arms and legs moving together and the tail lifted. Upon reaching the adjacent forest patch the leading titi monkey, usually the adult male, waited for the rest of the group in a tree on the edge of the patch before together moving off in the forest.

Similar observations were recorded for gallery forest group (Rio group, Fig. 1) following the burning of a grassland area next to the forest, which forced the two adult individuals of the group to search for a new territory. The two monkeys were observed travelling along the ground between forest patches covering greater distances than in the previous case (around 40 m) due the isolation of forest islands although they looked for forest connections to avoid the ground whenever possible.

*Observation 3*

As the original groups mentioned in observations 1 and 2 were not yet habituated, other groups were selected for study in fragmented and gallery forests, Pistero and

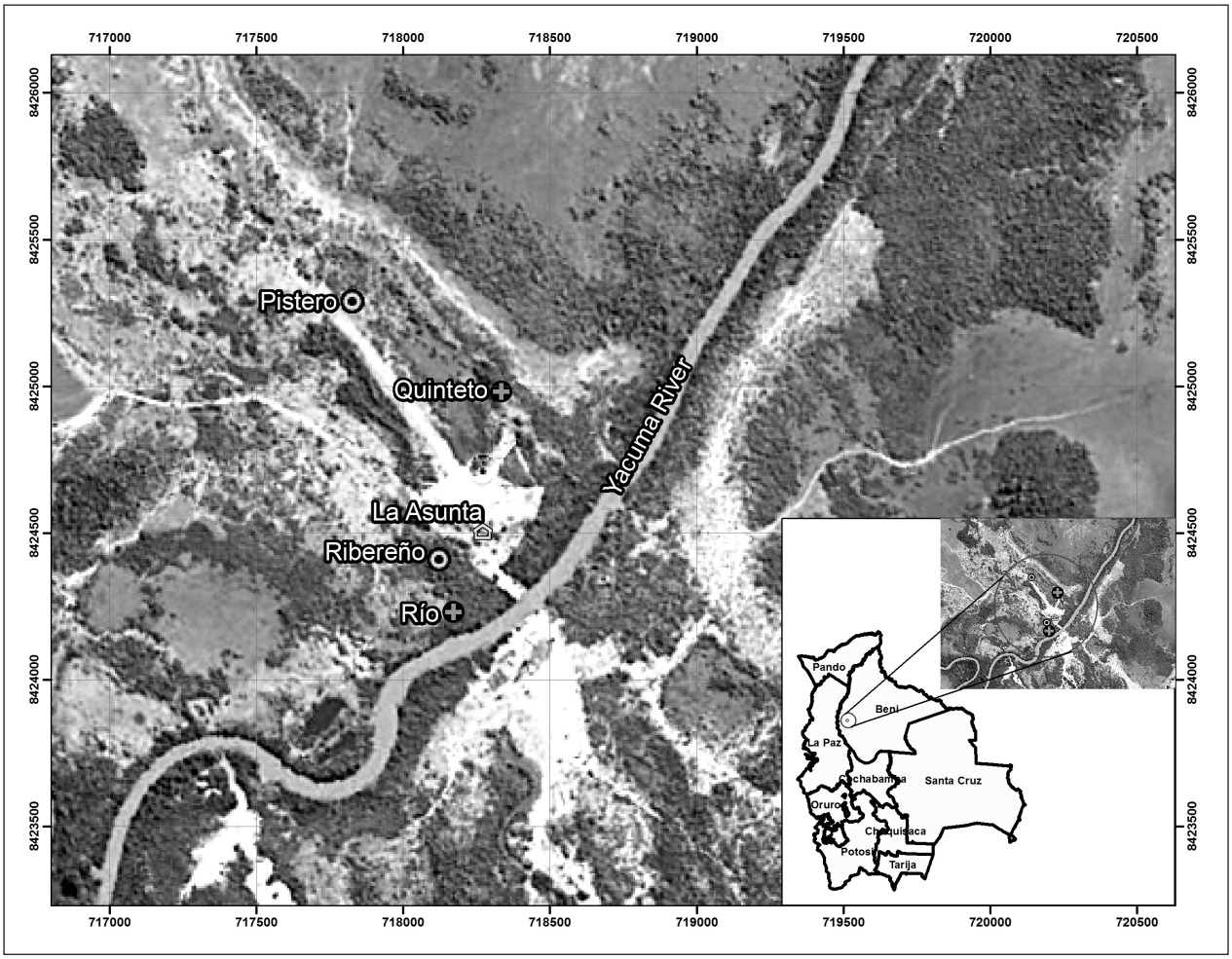


**Figure 1.** Location of La Asunta and observed *Callicebus olallae* groups.

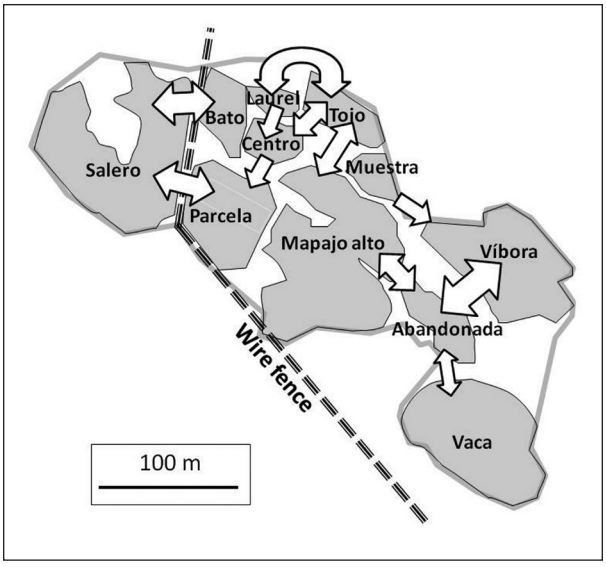


**Figure 2.** Map of the Pistero groups territory including reported terrestrial travel routes between forest fragments.

Ribereño, respectively. The Pistero group inhabited a highly fragmented forest area consisting of several forest islands located near each other including three larger islands. Initially, this group was observed in the largest forest patch with the highest trees and this was assumed to be the group's entire home range. However, during the course of the study we observed the group in neighboring and isolated forest islands accessible only by ground displacements (Figure 2). Terrestrial displacements were first confirmed when the group was spotted moving along a wire fence located in the middle of the group territory dividing two cattle camps. When terrestrial the monkeys showed the same jumping style of movements previously described. In total, we obtained 100 observations of these terrestrial movements from September 2007 to March 2008. The mean distance covered was 10 m (DS=4; range 5 –16 m), and although these displacements represent a low proportion of the total movement records (7 %), it is significant for a Neotropical primate. Finally, of 11 sites where terrestrial movements were reported in the Pistero group territory, in all except three cases the movements were in both directions (see white arrows in Fig. 2).

## Conclusions

Titi monkeys are arboreal and previous studies on the diverse *Callicebus* genus show very low percentages of activities made at ground level related principally to individuals playing, falling and casual predation of insects (1%, Kinzey, 1981). According to their distribution, most of the *Callicebus* species inhabit continuous forest areas with high vegetation density (Anderson, 1997; Hershkovitz 1990; Martinez & Wallace, 2010; Van Roosmalen *et al.*, 2002). The naturally fragmented forest-savanna inhabited by *C. olallae* (Martinez & Wallace, 2007) clearly necessitates frequent terrestrial travel during ranging behavior, as was previously suggested by Felton and colleagues (2006) and confirmed by our observations. Even if individuals inhabit large continuous forest areas, eventually they may need to travel terrestrially to look for new areas when they reach sexual maturity and form new groups (Kinzey, 1981; Wright, 1986). In all cases the monkeys travelled the shortest terrestrial route between neighboring forested areas showing an evident effort to reduce the predation risks associated with terrestrial travel. The first two observations where longer distances were covered must represent extreme risks given the small size of these primates and the diverse carnivore community associated with these forests. Indeed, when isolated small trees are on pathways to large forest areas, the monkeys climb them making their displacement in stages instead of passing directly from one forest patch to another.

In naturally fragmented habitats, terrestrial movements of monkeys may not always be related to terrestrial-based feeding or drinking behavior but also due to ranging requirements. As the world's forests become more fragmented due to human intervention these terrestrial movements may become more commonplace in primate species that normally occur in more continuous forests increasing exposition to predation risks.

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## EXTRAGROUP COPULATIONS IN *ALOUATTA GUARIBA CLAMITANS*

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Howler monkeys often live in unimale-multifemale or multimale-multifemale cohesive groups in which the alpha male may monopolize estrus females, although females may mate promiscuously with subordinate and extragroup males (Kowalewski and Garber, 2010; Di Fiore et al., 2011). Extragroup copulations (EGCs) have been reported for *A. arctoidea* (Agoramoorthy and Hsu, 2000), *A. caraya* (Kowalewski and Garber, 2010), *A. guariba clamitans* (Fialho and Setz, 2007), *A. palliata* (Glander, 1992), and *A. pigra* (Van Belle et al., 2008). EGCs in *Alouatta* spp. have been related to a female strategy to increase paternity confusion (both inside and outside the group) and decrease the risk of infanticide following alpha male takeover (Kowalewski and Garber, 2010) and to female choice of higher quality or unfamiliar males (Fialho and Setz, 2007). Considering that fertility and compatibility may vary among males, EGCs may also maximize the reproductive success of promiscuous females (Reeder, 2003). These hypotheses are not mutually exclusive.

Here we report seven EGCs between an adult male brown howler monkey (*Alouatta guariba clamitans*) from a group monitored from dawn to dusk during 26 days from January to July 2011 in a ca. 1-ha forest fragment (30°19'57"S, 51°00'47"W; ca. 45 m a.n.s.l.) in Itapuã District, Viamão, state of Rio Grande do Sul, Brazil, with an adult female from a neighboring group. In January, our study group was composed of six individuals: an adult male (Jorge), two adult females, one juvenile, and two infants. An adult female died electrocuted in a power line in March. In May, a birth increased group size to six individuals again. Also, the juvenile was classified as subadult and the infants as juveniles beginning this month. The neighboring group was composed of, at least, four individuals, including two adult males, an adult female (Jane), and a subadult male. We have no information about the degree of relatedness between individuals both within and between groups. The forest fragments that they inhabited are separated by a 20 m-wide dirty road.

Intergroup interactions were witnessed between April and July. These are described in chronological order below.

When Jorge reached the canopy, the neighboring adult males chased him back to the post. Jorge rubbed his chin at the post and was supplanted by a male. Then, the male also rubbed his chin in the same place, while Jorge observed him from the electric wire. When the adult male left the pole and returned to a place behind Jane in the canopy, Jorge attempted to approach her again and was once more chased by her male mates. Finally, Jorge went back to the other side of the road and his group left the border of the fragment.

June 22nd: At noon, all members of the study group ran to a strip of forest near the road. At 12:15, Jorge and the three males were howling at their home range borders. Jorge moved to the electric post at the other side using the cables and came back without trying to get closer to Jane. At 13:00, Jane crossed the road using the cable. Jorge unsuccessfully attempted to mate with her on the cable and they almost fell to the ground. After that, the couple

moved to an electric post and mated. Jorge's group was resting in a nearby tree. There was no attempt of copulation interruption by his group's adult female or her adult male group mates, who remained at the other side of the road. At 13:15, the couple mated again and Jane returned to her group. Jorge vocalized while she crossed the road via the cable.

July 19th: Jorge, the adult female, and the subadult vocalized at 16:15 when Jane arrived at the border of her home range. She crossed the road as usual at 16:30, reaching a tree within the home range of Jorge's group. The couple mated four times near his group while her male group members howled at the other side of the road. At 16:45, Jorge began to slowly moving away from the border of the road, only stopping to rub his chin on tree trunks. He was followed by Jane. An adult male from Jane's group (apparently slightly larger than Jorge) also crossed the road using the electric cable, reaching the trees. The last EGC was recorded at 17:15. After that, Jane returned to her home range, whereas Jorge remained with his group. We don't know whether the adult male from Jane's group left the area prior or together with her.

In sum, both Jorge and Jane sought EGCs, but only her attempts were successful. When Jorge moved to her home range, he was chased away by her adult male group mates. On the other hand, his adult female group mate appeared to ignore his sexual interactions with Jane. We have no data on the occurrence and frequency of EGCs during the days we were not monitoring our study group and whether Jane mated within her group during our study. We also do not know whether Jane got pregnant as a result of these EGCs because our study ended only five weeks after the record of the first event. Therefore, our data do not allow excluding any of the aforementioned hypotheses for explaining the EGCs between Jorge and Jane. This was the second report on EGC in *Alouatta guariba clamitans*.

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# THE SOUTHERNMOST RECORD OF *MICO EMILIAE* (THOMAS, 1920) FOR THE STATE OF MATO GROSSO, NORTHERN BRAZIL

*Guilherme Siniciato Terra Garbino*

The marmoset genus *Mico* comprises 14 species, 13 of which are endemic to Brazil (Rylands *et al.*, 2009; Ferrari *et al.*, 2010). *Mico emiliae* was described by Thomas (1920) based on two specimens collected by Emilia Snethlage in the Rio Curuá, a tributary of the Rio Iriri, that is an affluent of the Rio Xingu (Thomas, 1920; Vivo, 1985). *Mico emiliae* is restricted to the region between the Rio Curuá and Rio Iriri to the north, reaching the Rio Teles Pires to the west (Pimenta and Silva Jr., 2005; Fialho, 2010). The southern limit of the distribution remains unconfirmed but has been proposed by Roosmalen *et al.* (2000) to lie between the Xingú headwaters region and the eastern (or right) margin of the Upper Rio Teles Pires. Besides the aforementioned distribution, *M. emiliae* was believed to occur westwards, in the Madeira/Aripuanã interfluvium (Alperin, 1993; Ferrari and Lopes, 1992; Vivo, 1985, 1991). The form from this region, however, has now been described as a new species, *M. rondoni* (Ferrari *et al.*, 2010). In this note, I report the first record of *M. emiliae* south of the Rio Teles Pires

and Rio Iriri interfluvium, in the Xingú headwaters region, and provide an updated map of the known occurrence records of *M. emiliae*.

After reviewing the published records of *M. emiliae* and analyzing 12 museum specimens housed in the Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP) and Museu Paraense Emílio Goeldi, Belém (MPEG) zoological collections, a total of seven locality records of *M. emiliae* were found (Figure 1). Pimenta and Silva Jr. (2005) cited the record from Vieira (1955) as distinct from Thomas (1920), but both publications refer to the type locality of *M. emiliae*. The new record is based on a stuffed skin, with separated skull and postcranial skeleton (field number PEV 1194–1195, voucher number MZUSP 35106), collected in the municipality of Cláudia (10°30'S, 54°53' W, 345m) (Figure 1) by Marilia Kerr in 24.vii.1997. The determination of the species was based on diagnostic characters described in the literature (Vivo, 1991; Ferrari *et al.*, 2010). According to the field notes made by the collector, the animal was run over by a vehicle while crossing the MT-423 highway (the label identifies it as "MT-427", but since this road does not exist, and MT-423 passes through the municipality of Cláudia, I assume that the collector was referring to this highway) and was previously identified as *Callithrix melanura*. The collecting locality lies on a particular region, on the southeastern limit of the Brazilian Amazon Forest that can be classified phytogeographically as "Evergreen Seasonal Forest" (Ivanauskas *et al.*, 2008).

The observed characters agree with the analyzed series from Alta Floresta (MPEG 24595, 24596), Ourolândia, Alta Floresta (MPEG 24606, 24608, 24609, 24610, 24611), Serra do Cachimbo (MPEG 38104, 38105, 38106) and also with the paratype (MPEG 170). The specimen showed the typical black crown, white patch at the brow, unpigmented face, pigmented naked ears, light gray dorsum and black tail. The specimen differs slightly from the other analyzed specimens in its darker pelage (dark gray) of the dorsal sacral region and by having a tail with signs of annulations, caused by the presence of a dark brown basal band and a black distal band on the tail fur. The external measurements were taken from the label and are as follow: weight = 330 g, total body length = 539 mm, tail length = 333 mm, foot length = 65 mm, ear length = 25 mm.

This record confirms the occurrence of the species 165 km south of its previous southernmost locality, in the Xingú headwaters region, as predicted by Roosmalen *et al.* (2000) and is an important confirmation of the species' presence

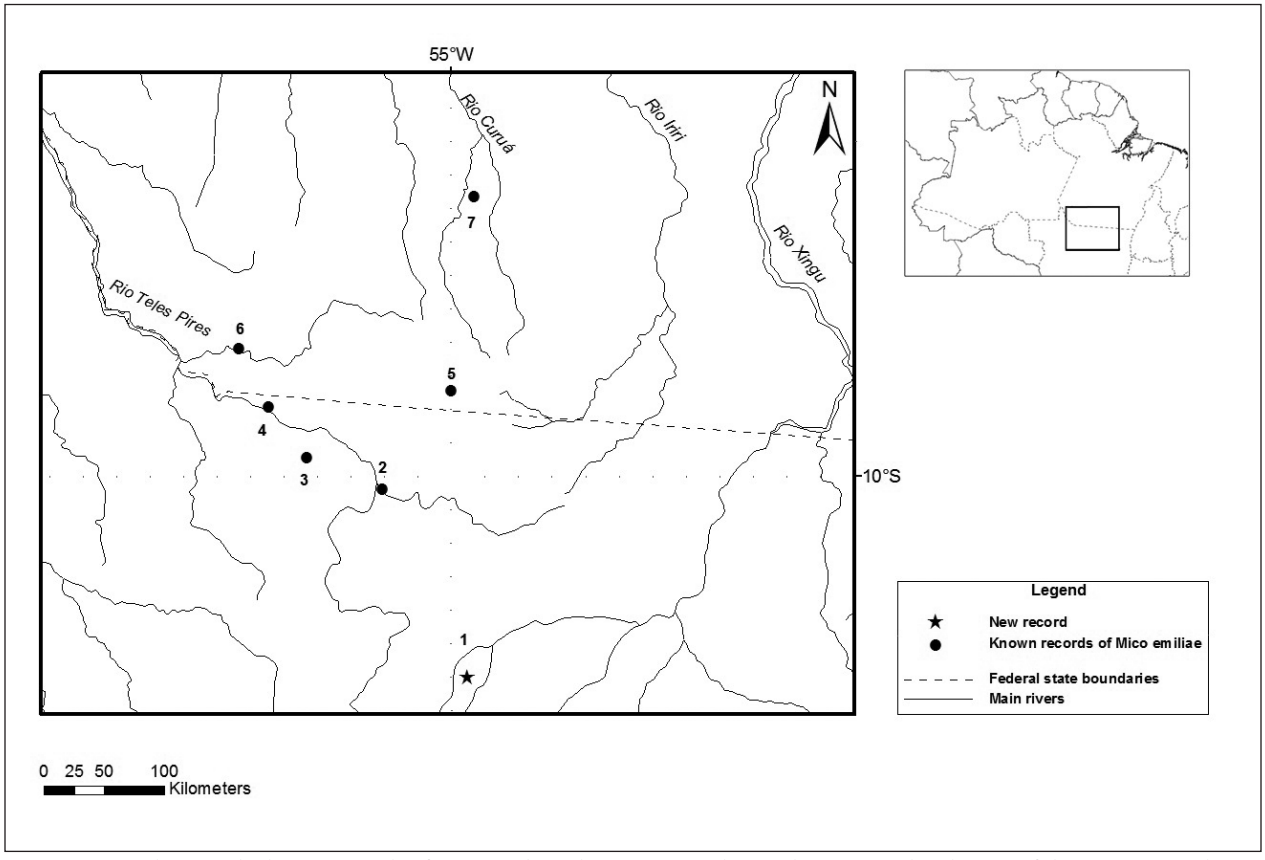


**Figure 1.** Map showing the known records of *Mico emiliae*. The grey area indicates the putative distribution of the species according to Rylands *et al.* (2009). 1. Cláudia (11°30'S, 54°53'W) (new record); *2. Fazenda São José, Peixoto de Azevedo (10°06'S, 55°31'W) (Ávila-Pires, 1986); 3. Alta Floresta (09°52'S, 56°05'W) (Ferrari *et al.*, 2010); 4. Ourolândia, Alta Floresta (09°29'S, 56°22'W) (Ferrari *et al.*, 2010); 5. Serra do Cachimbo (09°22'S, 55°00'W) (Pimenta and Silva Jr., 2005); **6. Rio São Benedito, left margin (09°03'S, 56°35'W) (Fialho, 2010, Fialho pers. comm.); 7. Maloca, Upper Rio Curuá (type locality) (07°55'S, 54°50'W) (Thomas, 1920).
***Specimen housed in private collection; ****Observational record**

in the area. The possibility that the animal was kept in captivity by the local human population cannot be ruled out, as the collector did not state whether the single collected specimen belonged to a larger group of individuals or was found alone. As more specimens become available, a more comprehensive study about geographical variation in pelage among distinct populations of *M. emiliae* would be important for understanding whether the variation found within the species warrants its division into separate specific taxa or not.

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# OBSERVATIONS OF TERRESTRIAL BEHAVIOR IN THE PERUVIAN NIGHT MONKEY (*AOTUS MICONAX*) IN AN ANTHROPOGENIC LANDSCAPE, LA ESPERANZA, PERU

*Sam Shanee*
*Noga Shanee*

## Introduction

The Peruvian night monkey (*Aotus miconax*) is one of the least studied of all Neotropical primate taxa. *A. miconax* is endemic to northeastern Peru (Aquino and Encarnacion 1994) and its entire range lies within the 'tropical Andes biodiversity hotspot', an area characterized by its high levels of species endemism and threats to conservation (Myres et al. 2000). This species has not been the focus of previous behavioral studies and is only known from *ad libitum* observations and collection localities in the departments of Amazonas, Huánuco and San Martin (Thomas 1927a; 1927b; Butchart et al. 1995; Cornejo et al. 2008). These same departments have some of the highest rates of deforestation in Peru (Elgregen 2005; INEI 2007). Deforestation in the area is fuelled by immigration of people from the central and northern highlands looking for land for small scale agriculture, cattle ranching and timber extraction (Garland 1995; Schjellerup 2000; Shanee 2010). In many areas this has caused the complete loss of large areas of forested land (Shanee et al. 2007; Shanee 2010). In other areas patterns of land use and ownership have caused the isolation of many small patches of forest forming an anthropogenic landscape mosaic (Shanee 2010). *A. miconax* is listed as Vulnerable by the IUCN (Red List categories A2c) and Endangered under Peruvian law (Decreto Supremo 34–2004-AG). *A. miconax* lives in small family groups of 2–6 individuals (personal observation). Like other night monkey species these groups generally comprise a heterosexual pair and their off-spring. The diet of night monkeys

is primarily frugivorous although leaves, buds and insects also figure in their diet (Ganzhorn and Wright 1994; Fernandez-Duque 2003). Fruiting figs (*Ficus spp.*) are a preferred food source in all studied *Aotus* species (Fernandez-Duque 2007).

Terrestriality has been recorded in other species of neotropical primates. Most commonly terrestriality has been observed in populations of *Cebus spp.* using stone tools to open hard shelled fruit (Fleagle 1999; Waga et al. 2006) and at dry season waterholes (Freese 1978). Terrestriality has also been observed in populations of *Ateles spp.* (Campbell et al. 2005) at dry season water holes as well as to access salt-licks and other scarce resources. A similarly wide range of terrestrial behaviors has been observed in *Brachyteles spp.* (Mourthe et al. 2007).

We aimed to gather basic ecological data on this little known species. We conducted night follows and *ad libitum* data collection to monitor the behavior of a group of *A. miconax* in a mosaic landscape of forest patches and cultivated land, to better understand the interactions between night monkeys and their habitat in an anthropogenic environment. The work will aid ongoing conservation efforts for *A. miconax* and other endangered primates in the northeast of Peru.

## Methods

*Study site*
Our observations took place in the *Centro Poblado La Esperanza* (S 05°39'46", W 77°54'32"), Amazonas department, Peru. Habitat in the area is comprised of disturbed primary and regenerating secondary montane and pre-montane cloud forests interspersed with pasture and plantations. In areas closer to human settlements this landscape becomes decreasingly forested with isolated forest patches ranging in size from ~ 0.5 ha to ~ 10 ha surrounded by cattle pasture and small cultivated plots of corn, potatoes, beans and other vegetables for local sale or local consumption. The area lies on the eastern slopes of the Andes with elevations between 1800 and 2400 meters above sea level. Terrain is very rugged with steep valleys separated by high mountain ridges. Temperatures fluctuate between approximately 25 °C in the day and can reach as low as 6 °C before dawn. Rainfall is heavy year round with a drier season during June – November. Average monthly rainfall is 1500 mm.

*Habituation*
We conducted group follows on a habituated group of *A. miconax.* When the group was identified it was already well habituated to the presence of humans due to the proximity of the village of La Esperanza and nearby houses (three houses bordered the patch). Local residents frequently pass through the forest patch on their way to their fields and many use the patch as a source of firewood for their homes. We furthered the habituation process between January 2008 and the start of the study period while testing methodologies and preparing transects for the study. No dedicated habituation program was implemented as this was deemed unnecessary.

*Study group*
At the start of the study period the group consisted of 5 individuals (2 adults, 2 sub-adults/juveniles and one infant). One individual was born in April 2010, for a group of 6 individuals (3 adults, 2 sub-adults/juveniles and one infant) at the end of the study period.

*Data collection*
Observations took place between 18:00–22:00 hours and 03:00–06:30 hours for five nights each month between December 2009 and November 2010. Our night follows were conducted on the days preceding, during and after the full moon. Group follows were made by one to three trained observers using red light LED headlamps (Silva) as well as conventional light flashlights. The focal group lives in a small ~ 1.4 ha isolated forest patch (S 05°42'17", W 77°54'14"). Trails were cut in a 10 × 10 meter grid; all intersections were tagged with high visibility flagging tape. We also recorded *ad libitum* data from observations of *A. miconax* while conducting other research in the same area, since the initiation of the project in October 2007.

## Results

We observed terrestrial behavior during a four day period whilst carrying out group follows; we also inferred terrestrial behavior from two *ad libitum* observations. The first *ad libitum* observation was made on the 27th February 2008. A lone adult female was found in a patch of eucalyptus trees (*Eucalyptus globulus*) just outside the village of La Esperanza. The trees, located next to a house on the edge of the main highway (*Carretera Fernando Belaunde Tierry*), were over 100 meters from the nearest forest patch and ~20 meters from the next nearest trees. In the morning the patch of trees was surrounded by dogs trapping the individual until we were able to remove her from the tree and release her in a nearby forest patch.

The second *ad libitum* observation was made on the 11th August 2010. Again a lone adult female was found behind a house in the village of La Esperanza. The individual was heard vocalizing continuously for 15 minutes. The trees where this individual was observed were >300 meters from the nearest forest patch. A discontinuous line of trees runs from this forest patch almost to the village but is broken in places, with one gap of >15 meters and one gap of ~6 meters, where the individual had to descend to the ground to cross. Other less substantial gaps also exist in this line but were probably crossed by leaping from one tree to another.

During group follows on the nights of 20th, 21st, 22nd and 23rd of November 2010 we observed a group of 6 individuals leaving the forest patch where they live to gain access to

a fruiting fig tree (*Ficus* spp.). On all occasions the group left the forest in the undergrowth and crossed ~5 meters of open ground before climbing a neighboring tree to gain access to the fig. On each occasion the group stayed in the tree for 15–25 minutes before returning to the forest by leaping from neighboring trees into the undergrowth on the border area of the home patch, thus avoiding crossing open ground again. On one occasion the group returned to the same tree, crossing open ground, twice in the same night.

## Discussion

We found no published records of terrestrial behavior in any *Aotus* species although similar behavior has been reported for *A. a. azarai* in Argentina (M. Svensson & E. Fernandez-Duque pers. comm.), and probably exists in other areas where habitat is similarly fragmented. The highly disturbed and fragmented habitat of *A. miconax* at La Esperanza is representative of forests in much of this species range where anthropogenic pressures on remaining forests are increasing. The ability of primates to cope in anthropogenic landscapes is becoming more and more important to their survival as human populations continue to grow, particularly for those with restricted ranges and in areas of high human population density (Marsh 2003). Our first two observations were probably individuals dispersing from their natal groups, although solitary individuals are reported to be common in populations of *A. a. azarai* in Argentina (Fernandez-Duque 2004) and *Aotus* spp. in Colombia (Villavicencio-Galindo 2003).

Our observations on *Aotus* diet at this site show a relatively high reliance on buds and leaves, accounting for 30% of their diet (Shanee and Shanee in prep). This is more than for most other night monkey species (Fernadez-Duque 2007). High consumption of leaves has also been observed in the cathemeral *A. a. azarai* (Fernadez-Duque 2007). Increased leaf consumption could be a strategy developed to cope with reduced availability of fruiting species in smaller patches or less productive forest types. The home patch of the focal group contains other fruiting trees, including figs. However, only two other food species were seen to be fruiting at the time, *Styrax* sp. and one unidentified species. Both of these have smaller, less fleshy fruits then figs and so are probably less desirable to *A. miconax.*

The forests of La Esperanza are home to three other primate species: *Oreonax flavicauda, Ateles belzebuth and Cebus albifrons* (Shanee and Shanee 2010), however only *Aotus miconax* has been observed so close to villages or in such small forest patches (> 50 ha). In part this is probably because of their smaller body size, nocturnal habits and undesirability to hunters. There are however reports from local people of *O. flavicauda* crossing open ground between forests and in one incident an individual of this species was captured by a local man in a semi-isolated patch of ~30 ha when it tried to enter a coffee plantation (A. Mego-Rodriguez, pers. comm.).

Terrestrial behavior in primarily arboreal primates' such as *Aotus* may leave individuals at greater risk to predation (Isbell 1994; Mourthe 2007). The risk of attack or predation by domestic animals such as dogs and possible opportunistic capture by hunters will be especially great in areas with relatively high human population densities such as La Esperanza. Even with these increased risks many species of neotropical primate demonstrate occasional terrestriality (Freese 1978; Dib et al. 1997; Fleagle 1999; Campbell et al. 2005; Waga et al. 2006; Mourthe 2007). Several populations of *Cebus* spp. regularly descend to the ground to open dry or hard shelled fruits (Waga et al. 2006), a resource that would be unavailable without access to stone 'tools'. Similarly, *Cebus* spp., *Ateles* spp. and *Brachyteles* spp. have all been observed descending to the ground to access dry season waterholes and otherwise un-available resources (Freese 1978; Port-Carvalho et al. 2004; Campbell et al. 2005; Mourthe et al. 2007). In the 12 months of our study the focal group was only observed descending to the ground during a single four-day period to access an otherwise un-available resource. This occurred during the dry season when fruit is scarce.

In one study Dib et al. (1997) reported that groups of northern muriqui (*Brachyteles hypoxanthus*) descend to the ground to cross areas of pasture between isolated forest patches. Terrestriality in dispersing females has also been observed in *Brachyteles* (Lemos de Sa 1988 cited by Dib et al. 1997). If individuals need to disperse from groups in isolated patches then occasional terrestriality becomes a necessary behavior to avoid inbreeding and intragroup conflicts. The solitary *Aotus* females we observed were probably dispersing from their natal groups. Our observations suggest that conservation of *A. miconax* and other primates in similar landscapes can be aided by the preservation of connectivity between forest patches. Through better planning when converting forest to pasture or plantations, arboreal food sources close to forest habitat could be conserved. Understanding the reasons for, and risks and benefits involved in, terrestrial behaviors in *Aotus* spp. will greatly aid in conservation assessments and planning for this and other species.

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## A WILD TAMARIN WITHOUT A FOOT—SURVIVAL DESPITE A HANDICAP

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### Introduction

One might suspect that for arboreal animals like most primates, full functionality of the locomotor apparatus is an essential condition for survival. Nevertheless, the presence of healed fractures and of (congenital) malformations of the extremities reported from several wild primate populations suggest that affected individuals are capable of compensating impairments and thus to survive and even reproduce (Schultz 1939, 1956; Stokes & Byrne 2006; Arlet *et al.* 2009, Ferrari *et al.* 2010). Fractures (and perhaps other impairments) occurring at an early phase of life are suggested to be less fatal than those obtained during adulthood (Bulstrode *et al.* 1986). Here we report the case of a wild moustached tamarin, *Saguinus mystax*, who lacked one foot, probably from birth or shortly after birth on.

### Methods

The observations reported here were made at the Estación Biológica Quebrada Blanco (EBQB) in north-eastern Peruvian Amazonia (4°21'S 73°09'W). Groups of *S. mystax* and its congener, the black-fronted tamarin, *Saguinus nigrifrons*,[1*] are observed at EBQB during behavioural and ecological projects by researchers, students and local field assistants or routinely in-between projects by local field assistants. Apart from project-specific data, we also record unusual and rare events in the life of the tamarins.

### Results and discussion

On 12 September 2008, we detected that one juvenile in our *S. mystax* study group 2 (by that time consisting of two adult males, one adult female, and two juvenile males born around 20 September 2007) lacked the right foot. The juvenile's right leg ended in a round and naked stump with skin slightly lighter than the palms of the hands and the other foot (see video at http://www.soziobio.uni-goettingen.de/Peru/patita.html). It is unknown whether the foot was already missing at birth, lost soon after birth or later through an accident or a bite. We suspect the first or second alternative: during observations of that group between 24 and 26 September 2007 we recorded one infant in an unusual position on the lower back of the carrier, and also falling from the back of the carrier, suggesting that the infant could not hold normally to the carrier and that the foot was already missing at that time.

At first glance, the locomotion of the juvenile male (*Patita*) was inconspicuous. Only when looking very scrupulously did it become evident that *Patita* was occasionally slipping from the substrate with his right leg. When travelling on large branches, *Patita* simply touched the substrate with the stump; when travelling on small branches, this could not be unequivocally observed. *Patita* used the same routes for travelling than the other group members, but sometimes seemed to be more hesitative when a large leap had to be made. During foraging, *Patita* employed all manoeuvres typical for *S. mystax*, i.e. rapid grasping, lunging and pouncing (see Peres 1993). He was also feeding and foraging on thin terminal branches, and clinging vertically to the trunks of *Parkia* trees to consume exudates. *Patita* was not seen falling from a tree more often than other tamarins with fully functional extremities. Only on very smooth surfaces did *Patita* have obvious problems with locomotion. When trying to reach the infructescences of *Wettinia maynensis* (Arecaceae), he was sliding down the basal part of the fronds rather than climbing down headfirst, and also climbed up with difficulty compared to other *S. mystax*.

*Patita* was regularly seen in rough-and-tumble and chase playing with his slightly larger twin brother, although we had the impression that his playing was less vigorous than in non-handicapped tamarins. He participated in carrying twins born in January 2009 only very sporadically, while his twin brother did almost two-thirds of all infant carrying. He was last seen with his natal group on 7 December 2009. On 9 December 2009, *Patita* participated in an intergroup encounter as member of a neighbouring group to which he obviously had immigrated.

While healed fractures of the extremities and congenital malformations of hands and feet are known from callitrichids in captivity and in the wild (Schultz 1956; French 1986; Ferrari *et al.* 2010), the complete lack of a cheiridium has not been reported. While we do not know the cause of the lack of a foot in *Patita*, our observations indicate that despite some handicap during locomotion on smooth surfaces, this tamarin compensated the impairment and performed most behaviour normally, as also reported for wild *Mico argentatus* with a congenital lack of the big toe (Ferrari *et al.* 2010). However, *Patita* was clearly handicapped with regard to infant carrying. This is not surprising, given the constraints that the heavy load represented by callitrichid infants imposes on locomotion and foraging, even in captive callitrichids (Schradin & Anzenberger 2001; Caperos *et al.* 2012).

Tamarin societies are highly cooperative, and *S. mystax* may modify their behaviour in response to an injured group member (Tirado Herrera & Heymann 2004). In the absence of quantitative data, we do not know whether *Patita's* group also had modified its behaviour, particularly in the

1* A recent phylogenetic analysis by Matauschek et al. (2011) concluded that most subspecies of *Saguinus fuscicollis*, like *Saguinus fuscicollis nigrifrons*, should be elevated to species rank.

critical transitional phase between infant dependency and locomotor independence. Primates with impairments are obviously also capable of surviving without any assistance from conspecifics (Struhsaker *et al.* 2011), but cooperation by group members would certainly be conducive to compensate impairments and thus to increase the likelihood of survival.

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## OBSERVAÇÃO DE COMPORTAMENTO AGONÍSTICO DE *CEBUELLA PYGMAEA* SOBRE *SCIURUS SPADICEUS* EM UM FRAGMENTO FLORESTAL NO ESTADO DO ACRE, BRASIL

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O leãozinho, *Cebuella pygmaea* Spix, 1824 (Primates, Cebidae: Callitrichinae) é a menor espécie de primata neotropical, medindo cerca de 23 cm do focinho a ponta da cauda e pesando de 120 a 190 g quando adulto (Ankel-Simons, 2007). Ocorre na região amazônica, abrangendo o Brasil (nos estados do Acre, parte de Rondônia e sul do Amazonas), Colômbia, Equador, Peru e norte da Bolívia (Bicca-Marques e Calegaro-Marques, 1995; van Roosmalen e van Roosmalen, 1997; Buchanan-Smith *et al*., 2000; Rylands *et al*., 2009). Embora normalmente viva em florestas primárias não perturbadas, também pode ocorrer em florestas secundárias e habitats degradados (Soini, 1988; Reis *et al*., 2008). O esquilo-vermelho, *Sciurus spadiceus* Olfers, 1818 (Rodentia, Sciuridae: Sciurinae) conhecido popularmente em vários locais na Amazônia como quatipuru-vermelho, é uma espécie neotropical, medindo pouco mais de 30 cm do focinho a ponta da cauda e pesando de 225 a 240 g quando adulto (Reis *et al*., 2006; Bonvicino *et al*., 2008), podendo ser encontrada no Peru, Equador, Bolívia e Brasil (sul do rio Amazonas e oeste do rio Tapajós) (Emmons & Feer, 1997). Segundo Patton *et al.* (2000), o quatipuru-vermelho somente é encontrado em florestas primárias ou secundárias de terra firme, nunca em florestas de várzea.

A observação registrada aqui parte de um estudo em andamento com um grupo de oito indivíduos de *C. pygmaea* (um macho e uma fêmea adultos, um subadulto macho, dois subadultos, dois juvenis e um filhote cujos sexos não foram identificados), ocorrendo durante a segunda semana de habituação do mesmo, no qual se pretende estudar sua ecologia e padrões comportamentais em um fragmento urbano de aproximadamente 150 ha (Parque Zoobotânico, 9°56'30" - 67°52'08" S, 9°57'19" - 67°53'00" W). O Parque Zoobotânico é um fragmento florestal urbano

pertencente à Universidade Federal do Acre (UFAC). O parque foi criado em 1979, sendo uma área de floresta secundária em diferentes estágios de regeneração, fruto da retirada de madeira e da agricultura de subsistência que ocorreu na área a mais de 40 anos (Meneses-Filho *et al.* 1995). Além disso, ocorre uma dinâmica florestal provocada pela mortandade simultânea do bambu *Guadua weberbaueri*, a cada 32 anos (Silveira, 1999), espécie comum na área (Calouro *et al*., 2010). O clima é considerado tropical úmido, com uma estação seca compreendendo os meses de maio a outubro e uma estação chuvosa de novembro a abril. Para se identificar individualmente os indivíduos do grupo foram utilizadas duas características, a coloração e o tamanho corporal. O período de habituação teve início no dia 1 de agosto de 2010, onde o grupo era acompanhado principalmente pela parte da manhã (6 horas diárias), durante todos os dias.

No dia 11 de agosto de 2010, às 09:15 da manhã, a oito metros do observador, foi registrado o encontro de um indivíduo macho adulto de leãozinho com um quatipuru-vermelho. O leãzinho estava forrageando insetos em uma árvore (*Cedrela* sp.) sem flores, frutos ou sementes (posteriormente a árvore foi confirmada como local de alimentação de *C. pygmaea*) quando o quatipuru-vermelho adulto apareceu na mesma árvore, mas em direção oposta a trajetória realizada pelo leãozinho (o qual estava subindo). Ao se encontrarem, ambos demonstraram comportamento agonístico de pêloereção durante grande parte do tempo (aproximadamente três minutos) em que foram observados. Logo em seguida, se agrediram fisicamente com rápidas mordidas, voltando a apresentar pêloereção, até que o leãozinho expulsou o quatipuru-vermelho para fora da árvore onde estavam. O tempo total da observação foi de aproximadamente quatro minutos. Durante o comportamento apresentando por ambas as espécies, outros dois indivíduos de *C. pygmaea* (o macho subadulto e a fêmea adulta) se encontravam próximos da árvore do acontecido, a cerca de dois metros de distância, apresentando comportamento de fuga ao início do comportamento agonístico.

Somente um estudo relatou esse tipo de comportamento contra *Sciurus* sp. (Soini, 1988), mas o mesmo não fornece maiores detalhes sobre como ocorreu esse comportamento. Nesse estudo, Soini (1988) afirma que o comportamento se deu principalmente porque *C. pygmaea* estava protegendo suas árvores de alimentação, os quais são utilizadas eventualmente por *Sciurus* sp. para se alimentar, embora o exsudato contribua minimamente para sua dieta (Soini, 1988), a qual é composta principalmente por sementes de *Astrocaryum* sp., *Attalea* sp., *Dipteryx panamensis* e *Syagrus romanzoffiana* (Emmons, 1984; Forget, 1993; Galetti *et al*., 1992; Paschoal & Galetti, 1995; Miranda, 2005). *Cebuella pygmaea* é classificado como sendo exsudatívoro-insetívoro, baseado em estudos ecológicos no Peru, Colômbia e Equador (Moynihan, 1976; Soini, 1982; Yépez *et al*., 2005), enquanto que *Sciurus spadiceus* é considerado frugívoro, predando principalmente sementes de palmeiras (Emmons, 1984). Em seu ambiente natural, o leãozinho é simpátrico com outros calitriquíneos (e.g. *Saguinus* sp. e *Callimico goeldii*) (Dalton e Buchanan-Smith, 2005; Ferrari, 1993) e outras espécies de primatas (e.g. *Callicebus* sp.). Apesar de ser simpátrico com estas espécies, *C. pygmaea* não forma grupos mistos nem associações poliespecíficas com as mesmas.

Uma possível explicação para o comportamento observado por *C. pygmaea* é que, além de apresentar uma baixa tolerância à presença de outras espécies em seus locais de alimentação, a presença constante do observador na área de vida da espécie pode ter de alguma forma, estressado o animal, fazendo-o apresentar tal comportamento perante um invasor. Comportamentos agonísticos devido à presença humana foram descritos para *Alouatta caraya* (Humboldt, 1812) por Aguiar *et al*. (2005) e para *Cebus libidinosus* (Spix, 1823) e *Callithrix penicillata* (Hershkovitz, 1977) por Vilela (2007). Entretanto, não existem informações disponíveis para *Cebuella pygmaea*.

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## FURTHER INFORMATION ON NEOTROPICAL MONKEYS IN THE XVI CENTURY: PART 3

*Bernardo Urbani*

Here, I report on further descriptions and mentions of Neotropical monkeys when Europe first began its colonization of the New World. In 1498, Christopher Columbus (hereafter referred to as C. Colón) landed on the island of Trinidad, four days before stepping foot on continental America in Paria, Venezuela. Hernando Colón (1488–1539), son of the admiral of Genoa, wrote a chronicle about the travels of his father, including the day he first visited Trinidad. H. Colón indicated in his posthumous work (1571) that "in the point named Galea [currently known as Galeota Point, southeastern Trinidad]… They found many animal footprints that looked like goats, and also bones from one, but, since the head did not have horns, they believed it was a *gato paúl*, or monkey, later they knew that it was, since they saw many *gatos paúles* in Paria. That same day, August first [1498], sailing between Cape Galea and Cape Playa, to starboard, to the South, we saw *Tierra Firme*…" (H. Colón 1932: 132). As in the report of C. Colón about primates in Paria (Colón 1996, Urbani 1999), this mention not only refers to the first observation of remains alleged to be a monkey on the island of Trinidad (probably *Cebus albifrons trinitatis* or *Alouatta macconelli*), but also remarks on monkeys on the continent (*A. arctoidea* or *C. olivaceus*) seen by C. Colón a few days later in northeastern Venezuela.

Regarding the first report about monkeys on *terra firma* written by C. Colón in 1498 (Colón 1996, Urbani 1999), Pedro Martir de Anglería (1457–1526) added further information in 1500 indicating that "Another very singular thing the Admiral [C. Colón] has told me, and which is confirmed by his companions (all worthy of credence and whom I carefully questioned concerning the details of the voyage), is that he sailed twenty-six leagues, that is to say, one hundred and forty-eight miles, in fresh water; and the farther he advanced to the west, the fresher the water

became. Finally, he saw a very lofty mountain, of which the eastern part was inhabited only by a multitude of monkeys with very long tails. All this side of the mountain is very steep, which explains why no people live there… It was learned by signs that that country was called Paria, that it was very extensive…" (Anglería 1912: 75). P. M. de Anglería also indicated that in the regions of Curiana and Cauchieta, in today's Venezuela where the Peninsula of Paria is located, "The Spaniards brought away some very pretty monkeys and a number of parrots of varied colors, from that country" (Anglería 1912: 85). This seems to be the first report of primate trafficking from the Neotropics. The monkeys were probably wedge-capped capuchins (*C. olivaceus*) or howler monkeys (*A. arctoidea*).

In 1504, Angelo Trevisan, assistant to the Venetian ambassador to the Spanish Crown, provided information on the primates encountered in continental America (Vannini de Gerulewicz 1989). He narrated part of the story of Pedro Alonso-Niño (1569–1502), who in 1499 directed an expedition to the region of Paria. Trevisan (1989: 151) wrote that "Entering the island [refers to *terra firme* = Paria], they saw forests with the tallest dense trees, from where voices of animals filled the country with strange howls. But they saw that there were no dangerous animals, because the local inhabitants of those forests walked quietly, without fear, with their bows and spears. " Considering the particular tendency of reporting primates in the earliest XV century chronicles (Urbani 1999, this study), it is quite probable that the above mentioned animals with their particular vocalization were almost certainly howler monkeys (*A. arctoidea*).

Few illustrations have been found that show primates from Brazil during the XVIth century. In 1557, the German traveler Hans Staden (1525–1579) provided an illustration of a primate together with Amerindians and a European (Fig. 1). In 1558, the French traveler and cleric André de Thevet (1502–1590) published his *Les singularitez de la France Antarctique*. This book has illustrations of three primates with humans (Fig. 2). Thevet visited the region of Rio de Janeiro, and it seems he was recording how Tupi Amerindians interacted with monkeys (see also Urbani 1999). In 1585, Jean de Léry's *Histoire d'un voyage faict en la terre du Bresil,…* published not only descriptions of primates from the Brazilian coast but also an illustration. De Léry (1536–1613), a French explorer, visited the land of the Tupi in eastern Brazil. In this book, he presented an illustration of Tupinamba Amerindians with a monkey (Fig. 3). In 1592, the publisher Theodore de Bry (1527–1598) printed a scene in the Brazilian coast of an indigenous community with Europeans and mythological entities, where a monkey was included (Fig. 3). These primates seem to be similar in term of the style with those illustrated Old World primates represented in the incunable books produced during the first century of printing (B. Urbani, unpublished).

By 1558, the renowned Swiss naturalist Konrad Gessner (1516–1565) already published his *Historiæ animalium*.

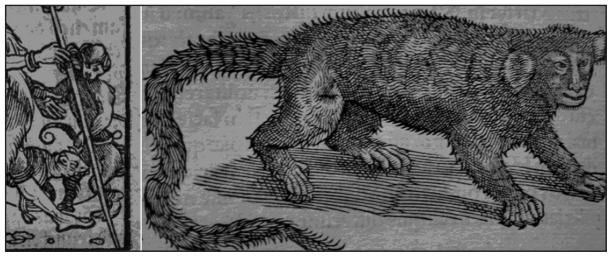

**Figure 1.** The monkey of Hans Staden (1557, left), and the "sagoin" of C. Gessner (1558, right).

**Figure 2.** The monkeys of André de Thevet´s *Les singularitez de la France Antarctique.*

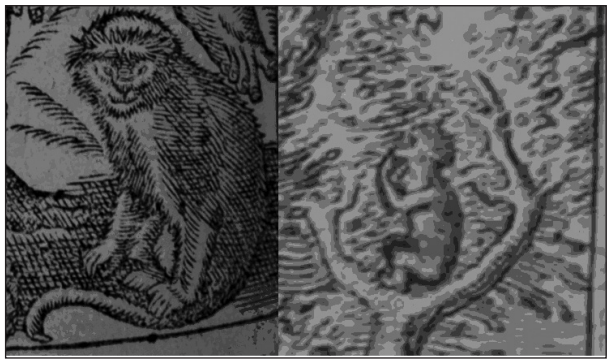

**Figure 3.** The monkey of the Tupinamba in Jean de Léry (1585)'s chronicle (left), and Theodore de Bry (1592, right).

This work included a review of the primates known in Europe by the first half of the XVIth century. In 1560, Gessner published his *Icones animalium* where the pre-Linnean zoologist published what seems to be the first scientific representation of a Neotropical monkey. The author showed different Old World monkeys such as a baboon and a macaque, primates from the Medieval imaginary, as well as the sagoin as an illustrated primate from the Americas (Fig. 1). A brief profile of this monkey, a marmoset (Callithrix sp.), is also presented. He noticed morpho-behavioral characteristics such as its small size, and its agile and elusive nature. Gessner used the term Galeopithecum for referring to this primate.

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# POPULATION DENSITY OF THE RED HOWLER MONKEY (*ALOUATTA SENICULUS*) IN A TROPICAL DRY FOREST FRAGMENT IN NORTHWESTERN COLOMBIA

*Juan Carlos Mejía Flórez*
*Jorge Andrés López Delgado*

## Introduction

The tropical dry forest is one of the most endangered habitats in Colombia. This habitat has been reduced to 1.5% of its original range due to anthropogenic effects (Murphy and Lugo 1986; Ramírez and Tesillo 2001). New World primates are dependent on arboreal habitats, so habitat loss in this region has caused primates to be restricted to the remaining forest fragments. Although habitat destruction continues to threaten Neotropical primates (Defler 2003; Michalski and Peres 2005), there are some species that can persist in these disturbed ecosystems (Crockett 1998; Horwich 1998). The red howler monkey (*Alouatta seniculus*) is the primate with the largest range of distribution in Colombia (dwelling in habitats from 0 to 3200 meters above sea level) and seems to be the most adaptable of these primates, occurring in habitats with a minimal amount of forest where other species of primates have disappeared (Crockett 1998; Horwich 1998; Defler 2003). Although *A. seniculus* is not considered endangered in Colombia (it is categorized as "Low Concern" for this country) (Defler 2003), populations of this species inhabiting tropical dry forest could be threatened with extirpation due to habitat loss and fragmentation. Although *A. seniculus* is one of the most studied Neotropical primates, few studies have reported the status of its populations in tropical dry forest fragments (Green 1978; Salazar 2000; Avila and Padilla 2005). This study reports a survey of *A. seniculus* in a conserved remnant of tropical dry forest at Hacienda El Ceibal, Municipio de Santa Catalina, Bolívar, Colombia with the aim of estimating density and evaluating population structure of this species in the area. At the study site the Fundación Proyecto Titi (FPT) has carried out long-term investigations on the cotton-top tamarin, *Saguinus oedipus,* and led conservation activities including community-based programs.

## Methods

*Study area*

Data were collected from the remnant of tropical dry forest (300 ha) at Hacienda El Ceibal (10°37'36" N; 75°14'50"W) located in northwestern Colombia (Figure 1). This forest fragment is located in the northern part of the Hacienda El Ceibal and is surrounded by pasture for cattle ranching. The study area has a maximum elevation of 34 m.a.s.l. and temperature ranges from 24 to 38 °C. Rainfall (1200 mm/yr) varies seasonally with two dry seasons, one from January to March and one in December. Ramírez and Tesillo (2001) report that 75–80% of the trees lose their leaves during the dry season of January to March. Although this forest fragment is not a national park or sanctuary, it is under protection for conservation by the Fundación Proyecto Titi since the establishment of biological station in 1999. Three species of primates inhabit this forest fragment: *S. oedipus, A. seniculus*, and *Cebus capucinus.* However, of these three primate species, only *S. oedipus* had been subject of studies in this area.

*Data collection*

We estimated the density of red howler monkeys following the protocol presented by Peres (1999). From November 28 to December 1, 2005, five transects ranging from 800 to 1200 m were prepared from south to north in the forest fragment (Fig. 1). These five transects were walked from December 2005 to February 2006. Transects were

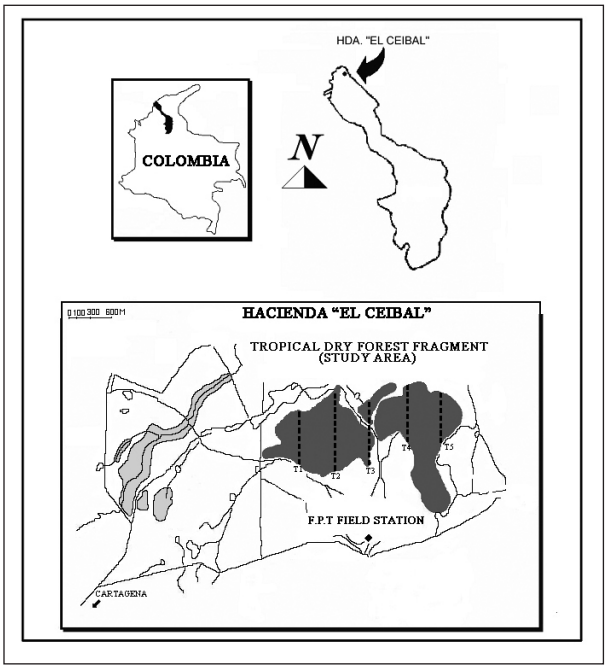


**Figure 1.** Location of Hacienda "El Ceibal", Bolívar, Colombia. Dotted lines refer to the position of transects used for the estimation of population density of *Alouatta seniculus* in the forest fragment at Hacienda "El Ceibal" (FPT, Fundación Proyecto Tití).

walked during 24 days by two observers with an average speed of 1.25–1.5 km/h. At every encounter with red howler monkeys we collected the following data: perpendicular distance (distance between the first animal seen and the transect), group size and location along the transect. Since surveys offer data from brief contact spans (no more than 15 minutes), which can lead to an underestimation of individual density of red howler monkeys (Pruetz and Leasor 2002; Gómez-Posada *et al.* 2005), we followed three groups in addition to the transect surveys to obtain a more reliable composition and size of groups (only three groups were followed because of time limitations). During these direct counts the following data were collected: 1) group size, 2) sex of adult individuals, and 3) age of individuals. We followed the characteristics used by Defler (1981) to determine the sex and age of individuals, and divided age into three categories: adults (the sum of adults and subadults), juveniles and infants.

*Data analysis*

To estimate the density of howler monkeys in the fragment, we initially estimated the group ecological density for each transect, using the following formula:

$$D = \frac{N}{2 \bullet (ESW) \bullet L}$$

In which:

**D** = density (groups/km$^2$);
**N**= number of sightings in each transect.
**ESW** = Effective Strip Width, in m, calculated by the DISTANCE 5.0 software release "1" (Thomas *et al.* 2005).
**L** = total transect length, in km (the total length walked in each transect).

The formula above was used given that the sample size was not large enough to estimate density accurately with the DISTANCE software (Chiarello and Melo 2001; Palacios and Peres 2005). The total group density was obtained as the average of ecological density for the five transects. We also estimated the individual density using data from groups followed out of surveys. Individual density was obtained as the product of total group density and average group size of groups followed out of surveys. We calculated the adult sex ratio (adult male:adult female) and the adult female:immature ratio. For the later we used immature as the sum of the "juvenile" and "infant" categories.

## Results

*Density*

A total of 98.9 km was walked and 42 encounters with *A. seniculus* were recorded at the study area. Three of these encounters were with isolated males and, given that living as solitary individuals is a temporary condition (Gómez-Posada *et al.* 2005), we did not include these encounters in the analyses to estimate density. With an ESW of 0.016 km we estimated the following ecological densities for each transect: T1: 11.04, T2: 9.70, T3: 1.83, T4: 17.2 and T5: 10.51 groups/km$^2$. The total group density estimated for the study site was 10.37 ± 4.43 groups/km$^2$. From the three groups followed, we obtained an average group size of 11 ± 5 individuals per group and estimated an individual density of 114.07 ± 22.15 individuals per km$^2$. With these density values we estimated a population size of 343 ± 66.45 howlers in 31 ± 13.29 groups in the tropical dry forest at Hacienda El Ceibal.

*Group composition*

Group composition of the three howler monkey groups followed is presented in Table 1. We calculated a ratio of 1:1 for both the adult sex ratio and the adult female to immature ratio.

**Table 1.** Group composition of three groups of red howler monkeys at Hacienda El Ceibal, Bolívar, Colombia.

| Group | Males | Females | Juveniles | Infants | Total of individuals |
|---|---|---|---|---|---|
| G1 | 3 | 4 | 2 | 2 | 11 |
| G2 | 6 | 5 | 3 | 2 | 16 |
| G3 | 2 | 2 | 1 | 1 | 6 |
| **TOTAL** | 11 | 11 | 6 | 5 | 33 |
| Average | 3.66 | 3.66 | 2 | 1.66 | 11 |
| % | 33.33 | 33.33 | 18.18 | 15.15 | |

## Discussion

*Population density*

This study provides the first estimate for population density of *A. seniculus* in a conserved remnant of tropical dry forest at Hacienda El Ceibal, Bolivar, Colombia. The Colombian tropical dry forest is one of the most endangered habitats in the country, and few red howler monkey populations remain in these forests (Salazar 2000; Defler 2003). The tropical dry forest at Hacienda El Ceibal is one of the few remnant fragments in the northwestern coast of Colombia, encompassing approximately 300 hectares of forest under conservation.

Population density of *A. seniculus* at Hacienda El Ceibal is within the wide range reported for the species, but among the highest densities reported (Table 2). These reports show that higher densities of red howler monkeys, and other species of the genus *Alouatta*, are found in forest fragments than in continuous forest (Chapman and Balcomb 1998; Defler 2003; Gómez-Posada *et al.* 2005, 2007, 2009, 2010; Link *et al*. 2010; Londoño and Gómez-Posada 2010). After isolation, forest fragments can act as refuges for primate species that can persist within these disturbed habitats (Defler 1981; Chapman and Balcomb 1998; Gómez-Posada *et al.* 2005, 2007, 2009, 2010). Folivorous primates, such as red howler monkeys, are expected to adapt better to habitat loss and fragmentation than other primate species (Chapman 1988; Crockett 1996; Defler 2003). This ability to survive in small fragments may be due to the fact that red howler monkeys can rely on a limited set of plant species, "minimizing energy expenditure" (Strier 1992). Gómez-Posada and collaborators (2005) reported the highest population density (254 ind/km²) of red howler monkeys at Vereda Montegrande in Caicedonia, Colombia. These authors attributed this value to the high number of individuals inhabiting a small isolated fragment of forest (154 individuals in 60.4 ha). In the present study we estimated a total of 343 ± 66.45 individuals inhabiting 300 ha of isolated forest.

In addition to fragmentation, the protection of the area is another main factor that may be influencing the population density of red howler monkeys at Hacienda El Ceibal. We suggest that population density of *A. seniculus* is probably positively influenced by the conservation activities conducted by the Fundación Proyecto Tití at the study site. Although these activities are conducted for the protection of *S. oedipus*, they have indirectly led to the conservation of the other two primate species, and of all the flora and fauna associated with this forest fragment. Even when conservation efforts are not specifically directed towards howler monkey populations, conservation areas may allow the recovery and conservation of howler monkey populations (Horwich 1998). For example, Fedigan and Jack (2001) documented the recovery of the mantled howler monkey (*Alouatta palliata*) population in the 28 years after the establishment of the Santa Rosa National Park in Costa Rica. However, because of lack of data available on population density for *A. seniculus* before the establishment of the biological station of the Fundación Proyecto Tití we cannot be certain that the howler monkey population inhabiting Hacienda El Ceibal has increased due to conservation activities.

*Group composition*

We report an adult sex ratio of 1:1 at Hacienda El Ceibal, a value unexpected for this species (Defler 1981; Chapman and Balcomb 1998; Defler 2003). In red howler monkeys there usually are slightly more adult females than adult males (Defler 1981; Jones 2004). The data on group composition obtained from the three followed groups included

**Table 2.** Population density of *Alouatta seniculus* reported in the literature.

| Study site | Density (ind/km²) | Average Group Size | Author |
|---|---|---|---|
| Colombia, Vereda Montegrande* | 254 | 8.11 | Gómez-Posada et al. 2005 |
| Colombia, Yotoco | 191 | 8.2 | Gómez-Posada et al. 2005 |
| Colombia, vereda Maravélez* | 163.4 | 9.0 | Gómez -Posada et al. 2009 |
| Bolivia | 120 | 7.4 | Freese *et al* 1982 |
| Venezuela, Hato Masaguaral | 83–118 | 8.46 | Neville 1972; Crockett and Eisenberg 1987 |
| **Colombia, Hacienda El Ceibal*** | **114.1** | **11** | **Present study** |
| Colombia, Otún Quimbaya | 72.6 | 7.3 | Gómez-Posada et al. 2007 |
| Colombia, Río Barbas* | 72.2 | 11.3 | Londoño and Gómez-Posada 2010 |
| Venezuela, Hato El Frio | 54 | 6.3 | Braza *et al.* 1981 |
| Colombia, Nana Luisa* | 51.5 | 5 | Gómez-Posada et al. 2005 |
| Venezuela, Hato Masaguaral | 50 | 8.3 | Crockett and Eisenberg 1987 |
| Colombia, Cuenca del Río Nima | 22.6 | 6 | Gómez-Posada et al. 2005 |
| Colombia, Reserva Patasola | 18.6 | 8.5 | Gómez-Posada et al. 2010 |
| Colombia, La Macarena | 10 | 7.5 | Stevenson et al. 1991 |

* = Fragmented forests.

a group containing six males and five female adults. This high number of reproductive individuals of both sexes is not common for the species (Defler 1981; Soini 1992; Chapman and Balcomb 1998). Crockett (1996) argued that the success of subordinate males in beginning a new group might be restricted by the lack of habitat availability to migrate. Thus, the isolation of the forest fragment may cause howler monkeys to remain in their natal group or to disperse to another established group, which may lead to a crowded population and to a change in the sex ratio. Similar variations in red howler monkey group composition had been found in other forest fragments in Colombia (Gómez-Posada *et al*. 2010). However, because of the small sample of groups followed in this study we cannot be certain that fragmentation is the cause of altered group structure of red howler monkeys at Hacienda El Ceibal.

It is argued that the ratio of adult female to immature may be used to measure population "health" (Heltne *et al.* 1976; Defler 1981). In red howler monkeys, populations with less than 0.75 immatures for each adult female are expected to be in difficulty; on the contrary, populations with higher number of immature individuals per adult female are expected to be stable or expanding (Heltne *et al.* 1976; Defler 1981). In this study we found a ratio (adult female: immature) of 1:1 which does not seem to indicate a decreasing population.

In conclusion, the population density of red howler monkeys at Hacienda El Ceibal is high compared to other densities reported in the literature, but is consistent with densities reported in fragmented habitats. This value might be a result of the capacity of the species to inhabit in anthropogenic habitats in conjunction with the protection of the area. However, at this site, there is a need to conduct long-term studies to assess the impact of fragmentation and protection of this area on the existing populations of *A. seniculus*.

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## REGISTRO OCASIONAL DA PREDAÇÃO DA POMBA-DE-BANDO (*ZENAIDA AURICULATA* DES MURS, 1847) PELO SAGÜI-DO-CERRADO (*CALLITHRIX PENICILLATA* É. GEOFFROY, 1812) NO INTERIOR DE SÃO PAULO, SP

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O sagui-do-cerrado, *Callithrix penicillata* (Primates: Callithrichidae), é a menor espécie dentre os primatas do Brasil Central, pesando entre 350 e 500 gramas (Stevenson e Rylands, 1988), primitivamente uma espécie de Cerrado, ocupando matas de galeria, cerradões e cerrado *strictu sensu* (Bicca-Marques *et al.*, 2006). Sua dieta é baseada em artrópodos, frutos, néctar e, principalmente, exsudatos de plantas, sendo a espécie considerada gomívora-insetívora (Stevenson e Rylands, 1988). Primatas do gênero *Callithrhix* também são conhecidos por eventualmente forragear em ninhos de aves (Miranda e Faria, 2001; Lyra-Neves *et al.*, 2007). Por exemplo, Mendes Pontes e Soares (2005) citam a predação por *C. jacchus* em ninhegos de pombo-doméstico (*Columba livia domestica*, Columbidae) e sabiá-laranjeira (*Turdus rufiventris*, Turdidae); Silva *et al.* (2008) relatam a predação de *C. penicillata* em uma rolinha-roxa (*Columbina talpacoti*, Columbidae); Begotti e Landesmann (2008), relatam algumas tentativas e predações de um grupo híbrido de *C. jacchus e C. peniccilata* em ovos da pomba-de-bando (*Zenaida auriculata,* Columbidae), do sabiá-barranco (*Turdus leucomelas,* Turdidae) e do sabiá do campo (*Mimus saturninus*, Mimidae). Nosso objetivo é relatar a predação de dois ninhegos da pomba-de-bando, *Z. auriculata*, por um grupo de *C. penicillata* na região noroeste do estado de São Paulo, onde a sagüi-do-cerrado é uma espécie introduzida.

Ao dia 08 de Agosto de 2008, por volta da 09:50 h. da manhã, ouvimos a agitação de um grupo de *C. penicillata* no jardim do estacionamento da Universidade Estadual Paulista-UNESP (20° 47'09.82 S, 49° 21'31.69" O), *Campus* de São José do Rio Preto, interior de São Paulo. Ao nos aproximarmos, observamos um grupo de três indivíduos adultos em uma palmeira (Arecaceae). O grupo emitia guinchos e estava bastante agitado. Registramos em fotografia, um dos indivíduos, aparentemente um macho, com uma pequena ave morta nas mãos, a cerca de três metros de altura (Fig. 1). O sagüi se afastou dos demais, carregando a presa com a boca e, subiu para um galho mais elevado, a aproximadamente quatro metros do solo, consumindo-a sem dividi-la com os demais. Os outros membros do grupo ficaram guinchando e observando sua movimentação. Longe destes, o sagüi manipulou a pequena ave, observando-a sob as asas e patas, como se estivesse buscando ectoparasitas; mordeu a cabeça e pescoço e, em seguida soltou-a ao chão. O grupo de *C. penicillata* então desceu da palmeira, correndo pelo chão até outra árvore, distante aproximadamente 8 metros, não sendo possível observá-los por mais tempo. Toda observação foi ocasional, não sendo parte de outro estudo e durou em torno de 10 minutos. Após o grupo de *C. penicilata* se afastar do local, nos aproximamos da palmeira e verificamos que se tratava de um ninhego de *Z. auriculata* . Na base da árvore observamos um segundo indivíduo morto e, assim como o primeiro, encontrava-se parcialmente predado, com apenas a região da cabeça consumida, sendo que todo o restante do corpo da ave encontrava-se inteiro e sem ferimentos. As aves apresentavam penugem juvenil, com muitas penas em desenvolvimento, sendo a primeira ave observada, menor que a segunda (120 mm. e 140 mm. de comprimento total, sem a cabeça, respectivamente). Verificamos um ninho na mesma árvore, possivelmente de onde os ninhegos foram obtidos. Adultos da ave não foram observados nas proximidades, mas a espécie é bastante comum na área, como pudemos constatar em observações anteriores.

**Figura 1.** Indivíduo de *Callithrix penicillata* durante a predação do ninhego de *Zenaida auriculata* em São José do Rio Preto, noroeste de São Paulo, Brasil.

Espécimes de *C. penicillata* foram introduzidos por meio do tráfico ilegal para serem utilizados com animais de estimação (Begotti e Landesmann, 2008), nos estados do Rio de Janeiro e porção centro-sul de São Paulo (Olmos e Martuscelli, 1995; Bicca-Marques *et al.*, 2006). Introdução de espécies não-nativas pode gerar competição interespecífica e transmissão de doenças à fauna nativa (Costa *et al.*, 2005; Ruiz-Miranda *et al.*, 2006; Mendes Pontes *et al.*, 2007). O hábito de forrageio em ninhos de aves é conhecido para *Callithrix*, porém mais habitualmente sobre os ovos (Stevenson e Rylands, 1988, Miranda e Faria, 2001; Lyra-Neves *et al.*, 2007). Argel de Oliveira (1995) cita que a predação de ninhos pode reduzir a riqueza e diversidade da avifauna local, e nossa observação corrobora a interferência negativa de espécies introduzidas na avifauna nativa. O fato observado pode ter sido um comportamento oportunista, não sendo necessariamente relacionado a limitações de recursos, visto que os indivíduos residentes na universidade já foram observados se alimentando de exsudatos, frutos ou sendo alimentados por seres-humanos. Nossa observação evidencia a importância destes pequenos mamíferos em uma série de importantes processos ecológicos (De Esteven e Putz, 1984; Fragoso, 1994), como a predação de espécies nativas e a competição com espécies sinantrópicas.

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# News

## SIMPOSIO "PRIMATOLOGÍA EN EL PERÚ: HISTORIA, ESTADO ACTUAL Y PERSPECTIVAS"

Perú es uno de los países con la mayor diversidad de primates, tanto a nivel de la región Neotropical como a nivel mundial (IUCN 2010). No obstante esta diversidad, las actividades primatológicas en el Perú parecen bastante limitadas, realizadas por unas pocas instituciones/científicos y poco coordinadas; en consecuencia, la información disponible es bastante escasa y dispersa. Para analizar estos problemas y fomentar la primatología en el Perú, era necesaria una evaluación de la situación actual de la primatología en el Perú, su historia, y desarrollar perspectivas para el futuro de la primatología en el país. Con estos fines, se realizó el simposio "Primatología en el Perú: Historia, Estado Actual y Perspectivas", entre el 17 y 22 de octubre 2011, en Lima (Perú). Las instituciones organizadoras fueron Yunkawasi (Lima), el Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos (UNMSM, Lima) y el Deutsches Primatenzentrum (DPZ, Göttingen, Alemania). Este simposio convocó a 105 científicos y estudiantes, mayormente del Perú, pero también de Alemania, Bolivia, Colombia, Ecuador, EE.UU., España, Francia, Inglaterra y México. Se realizó en las instalaciones del Museo de Historia Natural, UNMSM y la Facultad de Biología, Universidad Ricardo Palma (Lima).

La inauguración oficial del evento tuvo lugar en el Museo de Historia Natural UNMSM, el 18 de octubre, y contó con la presencia del decano de la Facultad de Ciencias Biológicas de la Universidad Ricardo Palma, Dr. Tomás Agurto, de la directora del Museo de Historia Natural UNMSM, Dra. Betty Millán y del Secretario General del Servicio Nacional de Áreas Naturales Protegidas por el Estado –SERNANP, Dr. Carlos A. M. Soria Dall'Orso. Durante la inauguración, se celebró también la presentación del Álbum Filatélico "Primates del Perú" y la carta del primer día de emisión (Fig. 1), en un álbum filatélico conmemorativo. Se manifestó la esperanza que la emisión de estas estampillas aumente el conocimiento y el orgullo del público en general sobre los primates peruanos.

El simposio incluyó las siguientes actividades:

- Conferencias magistrales (Bertha Alvarado, Perú; Mark Bowler, Inglaterra; Fanny M. Cornejo, Perú; Xyomara Carretero-Pinzón, Colombia; Liliana Cortés-Ortíz, EE.UU y México; César Flores, Perú; Fernando Guerra, Perú; Eckhard W. Heymann, Alemania; Christian Matauschek, Alemania; Dirk Meyer, Alemania; Pablo Puertas, Perú; Jennifer A. Rehg, EE.UU.; Stella de la Torre, Ecuador.; Robert B. Wallace, Bolivia.)
- Presentaciones orales y posters


**Figura 1.** Carta del primer día de emisión y estampillas con primates del Perú, emitida el 18 Octubre 2011, en el marco de la inauguración del simposio "Primatología en el Perú".

- Mesa redonda: "Estudios primatológicos en Latinoamérica"
- Taller de especialistas: "Vacíos de información y prioridades de investigación primatológica y de conservación de primates en el Perú"

Además, se realizaron los siguientes talleres metodológicos:

- Tópicos básicos en primatología (Fanny M. Cornejo y Mark Bowler)
- Herramientas moleculares para el estudio y conservación de primates (Liliana Cortés-Ortíz, Christian Matauschek y Dirk Meyer)
- Estudios poblacionales y uso de DISTANCE para estimados de densidad (Miguel Antúnez)
- Herramientos botánicas para primatología (Ricardo Zarate)
- Métodos de observación de comportamiento y ecología de primates (Eckhard W. Heymann)
- Bioacústica (Dirk Meyer)
- Uso de GPS y Sistemas de Información Geográfica (Yvan Lledo-Ferrer)
- Ser un primatólogo en Perú: claves y tips (Fanny M. Cornejo y Mark Bowler)
- Envolviendo al público: educación en ciencia para la conservación (Mark Bowler y Fanny Fernández)

En la mesa redonda "Estudios primatológicos en Latinoamérica", representantes de los países vecinos –Bolivia (Robert B. Wallace), Colombia (Xyomara Carretero-Pinzón), Ecuador (Stella de la Torre) –presentarón información sobre el estado de la primatología de dichos países. Como los dos primatólogos peruanos de mayor prestigio internacional, Rolando Aquino y Filomeno Encarnación (autores del libro "Primates of Peru –Los Primates del Perú") infelizmente no pudieron atender al evento, la situación en el Perú fue presentada por Eckhard W. Heymann, quien realiza estudios primatológicos en el Perú desde 1982. Se identificaron los problemas comunes y los problemas específicos y se concluyó que, tanto desde el aspecto científico como desde el aspecto de conservación será necesario la formación de nexos entre los primatólogos de estos países.

La misma conclusión se dio en el taller de especialistas sobre "Vacíos de información y prioridades de investigación primatológica y de conservación de primates en el Perú". En este taller se revisó el estado taxonómico de los primates peruanos, el conocimiento sobre su distribución geográfica y el estado de las poblaciones. En el taller se concluyó que como consecuencia de las últimas revisiones taxonómicas del género *Saguinus* por Matauschek et al. (2011) y del género *Pithecia* Laura Marsh (en preparación), el número de especies de primates que existen en el Perú ahora es de por lo menos 45, seis más que la lista previa de Pacheco et al. (2009). Futuras revisiones taxonómicas (p. e. de los

géneros *Callicebus* y *Cebus*) posiblemente aumentarían esta cifra. Como los limites de distribución lógicamente no coinciden con los límites nacionales, la integración de conocimientos y trabajos a ambos lados de las fronteras es de gran importancia para llenar los vacíos que todavía existen sobre la distribución geográfica. Por ejemplo, la presencia de *Alouatta sara* en Bolivia, en la zona fronteriza con el Perú (Wallace et al. 2010), hace muy probable su presencia en el extremo sur del Perú, pero no existen estudios que lo confirmen. Sólo con la integración de conocimientos y la formación de nexos se puede llenar este y otros vacíos. Además de los primatólogos, el taller de especialistas contó con la participación de guardaparques y profesionales de diferentes áreas naturales protegidas del Perú, gracias a la colaboración del Servicio Nacional de Áreas Naturales Protegidas por el Estado (SERNANP). Esto fue de gran importancia, ya que el personal del SERNANP, por su casi continua presencia en estas áreas, acumula bastante información y conocimientos que de otra manera no llegan a ser divulgados.

Las presentaciones orales (11) y los posters (25) de los estudiantes y científicos jóvenes fueron juzgados por un comité de evaluación. Las cinco mejores presentaciones orales y los ocho mejores posters fueron premiados con los libros "Primate conservation biology" de Guy Cowlishaw y Robin Dunbar y "Field and laboratory methods in primatology" por Joanna Setchell y Deborah Curtis respectivamente, donados por University of Chicago Press y Cambridge University Press. Los autores y títulos de los premiados se encuentran en http://www.monosperu.org/ganadores.html.

En una plenaria hacia el final del simposio, los participantes acordaron por unanimidad la formación de un grupo de primatología dentro de la Sociedad Peruana de Mastozoología. Esperamos que con este grupo las actividades primatológicas en el Perú sigan creciendo, tanto en el número de investigaciones primatológicas como en las acciones de conservación de los primates peruanos que estas promuevan y soporten. El simposio ha sido un primer e importante paso hacia esta dirección.

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**Figura 1.** Carta del primer día de emisión y estampillas con primates del Perú, emitida el 18 Octubre 2011, en el marco de la inauguración del simposio "Primatología en el Perú"

## GOLDEN-HEADED LION TAMARIN RESEARCH IN THE 21ST CENTURY: RECENT ADVANCES AND POTENTIAL AREAS OF FUTURE RESEARCH

On 7 and 8 December 2011, students, researchers, and conservationists with a vested interest in golden-headed lion tamarins (*Leontopithecus chrysomelas;* GHLTs) gathered at the State University of Santa Cruz (UESC; Ilhéus, Bahia, Brazil) for the symposium *`Golden-Headed Lion Tamarin Research in the 21st Century: Recent Advances and Potential Areas of Future Research´* with the aim of sharing recent work and discussing potential future avenues for research. Within the last 5 years, several doctoral dissertations and masters theses were completed that focused on the biology, ecology, and/or conservation of GHLTs in addition to the ongoing work of established scientists who have devoted their professional lives to the study of this

species and the Atlantic Forest. However, language barriers and the fact that many members of the GHLT community are based at institutions throughout the world have complicated widespread access to these results and collaborations among researchers. The primary goals of this symposium were to (1) promote the exchange of existing information, (2) contribute towards a better synchronization of research efforts, and (3) identify important steps for more efficient/collaborative conservation efforts for GHLTs and their habitat. This symposium brought together 30 participants from 12 institutions in Brazil, Belgium and the USA and allowed for the dissemination of information to the global GHLT community, compilation of recent advances in research, and identification of gaps in knowledge of GHLT biology, ecology and conservation, which ultimately fostered discussions on how attendees could collaborate to fill knowledge gaps.

## Golden-headed lion tamarins

GHLTs are small arboreal primates threatened by extreme habitat fragmentation and loss of the Atlantic Forest in southern Bahia, Brazil (Pinto and Rylands 1997; IUCN 2012). They are frugi-faunivores that live in small groups (5–7 individuals on average) and maintain home ranges that can be quite large (20–200 ha; Raboy and Dietz 2004; Oliveira et al 2011). In addition to mature and secondary forest, the species uses shade-cocoa plantations known locally as *cabruca* (Raboy et al 2004, Oliveira 2010). The species´ geographic range is characterized by two distinct vegetation types: coastal humid forest in the east, where cocoa production is the predominant agricultural activity, and semi-deciduous mesophytic forest in the west, where cattle ranching is widely practiced (Pinto and Rylands 1997). Because shade-cocoa production in this region utilizes a canopy of native trees, large swaths of forested habitat are still available for GHLTs throughout the east compared to the small, fragmented forest cover interspersed by open cattle ranches in the west. However, forest throughout the species' range was lost at a rate of 13% over the last 20 years, and this deforestation rate is projected to increase as shade cocoa plantations are converted to cattle pastures following declines in cocoa prices and fungal epidemics that devastated the cocoa industry beginning in the early 1990's (Schroth & Harvey, 2007). Additionally, planned changes to Brazil's Forest Act will eliminate enforced protection of certain areas of existing forest (Calmon et al., 2011). Because the majority of native vegetation within the GHLT range is found on private land where extreme pressure for agricultural expansion is highest (Sparovek et al., 2010; Ferreira et al., 2012), a better understanding of the needs of GHLTs and the protection of their habitat is becoming increasingly critical for the survival of this species.

## Overview of existing knowledge relevant to the *in situ* conservation of the species

The two-day symposium was structured to allow for a day of research presentations and a day of discussion. Through 16 presentations, participants presented the major results of their recently concluded or ongoing research programs. Topics included ecology and behavior of GHLTs in various habitat types, genetic structure and health of GHLT populations, the impacts of forest fragmentation/connectivity and climate change on the species, and updates on the activities of NGOs and the status of protected areas within the species´ distribution range. Following presentations, participants summarized existing knowledge on *in situ* GHLT biology, ecology and conservation based on past research programs/publications and on the information presented at the symposium (Tables 1 & 2). Additional information (e.g. population surveys, extensive GIS work, population and landscape modelling, genetic sampling, and health assessments) not listed in Table 2 is available at the level of the entire distribution range.

## Defining priorities for future research and conservation

Following the summation of existing knowledge, participants worked in break-out groups to identify what they deemed the top five most significant research gaps in GHLT research and knowledge. Working group results were presented and discussed in a plenary session. The topics identified as highest priority research areas included:

*1. Ecology, biology, health status, and genetic differentiation of western populations*: Demographic and landscape modeling have demonstrated that without protective measures, all western populations are in immediate danger of extinction in the short term (Zeigler, unpubl. data). Despite this urgency, basic scientific information (i.e. ecology, basic biology, genetic differentiation, and health status) needed to develop sound conservation measures is still unavailable for these populations. Such information will improve our understanding of the species´ management needs throughout its range.

*2. GHLTs and* cabruca *agroforest*: *Cabruca* plantations can range from heavily managed monocultures to highly natural mosaics of cacao trees and endemic tree species, and not all forms are suitable as GHLT habitat. Research focusing on the presence/absence of GHLTs and their comparative demography and ecology along the full spectrum of *cabruca* agroforest is essential to understanding the species´ habitat and management needs and balancing regional socioeconomics with conservation.

*3. GHLT dispersal and survival in fragmented landscapes*: Very little is known about how GHLTs move and survive in fragmented forest; how often individuals leave forest boundaries and move through non-forest matrix, how far

**Table 1.** Definitions used to categorize the scope of available knowledge, sample size and duration of available studies on which the assessment in Table 2 is based.

| Scope of information | Definition of scope | Sample on which knowledge is based | Duration of study |
|---|---|---|---|
| Homogeneous habitat | Principally composed of relatively continuous mature forest, with only smaller patches of secondary forest. | Maruim-REBIO Una, 17 groups (one study-site) | 11 years |
| Heterogeneous habitat | Composed of a mixture of small and large patches of a wide variety of habitat types. Types of habitats include selectively logged and secondary forest in different stages of regeneration interspersed with abandoned agricultural fields and pastures in the process of regeneration (e.g. cocoa, rubber and jackfruit stands) as well as a mosaic of primary and secondary forest with *cabruca* agroforest. | Piedade-REBIO Una, 5 groups (one study-site); 4 groups in the municipalities of Camacan, Jussari, Una and Arataca | 8 years for Piedade-REBIO-Una, 1 year for other groups |
| *Cabruca* agroforest | Cacao agroforest where the understory is replaced by cacao trees and around 10% of native canopy trees are left to provide shade for understory. The suitability of *cabruca* for GHLTs varies depending on the diversity and density of shade trees. | 3 groups concentrated in the municipality of Ilhéus | 4 years and on-going |
| Semi-deciduous forest | Seasonal forested habitat in the western portion of the species range. | 1 fragment, 2 groups | 1 year |
| Restinga | Vegetation adapted to sandy soil; normally distributed along the coast and on soils under marine influence. | Currently no studies | Currently no studies |
| High altitude forest | Areas of the GHLT range above 400m. | Limited information from survey work across the species' range and from two groups using a mosaic forest that were monitored for a few months in the *cabruca* study | 1 season |

individuals travel through non-forest matrix, what landscape elements individuals are willing to travel through and which elements act as barriers to dispersal, the probability that dispersing individuals will survive the journey, and whether other characteristics (such as patch occupancy by GHLTs) influence dispersal and settlement. This information is critical for landscape-level conservation planning.

*4. A new census of the current GHLT distribution*: Given continuing threats across the species' distributional range, the size and locations of populations are likely to still change/decline. Knowing how many individuals/populations exist and where they are located is of vital importance to managing and protecting the species in addition to improving our understanding of population trends and gauging the effectiveness of conservation efforts.

*5. GHLT use and behavior in unknown habitat types*: Research has thus far focused on GHLTs in primary forest, degraded forest, and *cabruca* agroforest. Little is known regarding if and how GHLTs use other habitat types such as *restinga*, high altitude forest, or other agroforestry systems.

*6. Threat impact analysis*: Threats to GHLT survival have been identified and include broad processes like forest loss and fragmentation and climate change. Information on the specific nature of these threats and their impacts on GHLT survival, however, is limited. A better understanding of these threats is necessary for protecting GHLT populations from negative impacts.

*7. Environmental services provided by GHLTs*: GHLTs are hypothesized to have an important role in ecosystem functioning. Research is needed to better understand the importance of the species in maintaining the structure and viability of the Atlantic Forest through, for example, seed dispersal. Since a major part of Brazil's economy relies on Atlantic Forest resources, demonstrating that GHLTs themselves play a critical role in the functionality of the forest may be an alternative approach to securing conservation of the species and its habitat.

*8. Environmental education*: Research into the perceptions of local people towards GHLTs and conservation in general is important for improving our understanding of their attitudes and offers important information for developing sound, efficient and viable education and outreach programs that involve all relevant stakeholders.

**Table 2.** Overview of key research topics relevant for the *in-situ* conservation of golden-headed lion tamarins and the current level of available knowledge (both published and unpublished) for those topics. Information is categorized per habitat/landscape or as global knowledge using the following scale: (0) No Information, (1) Little Information (i.e. information based on a single field season and/or on only a few GHLT groups/individuals), (2) Moderate Information, (3) High Amount of Information (i.e. information based on multiple field seasons and GHLT groups/individuals). Asterisks (*) indicate that data have been collected but not yet analyzed.

| Category of knowledge | Scope of knowledge | | | | | |
|---|---|---|---|---|---|---|
| | *Homogeneous* | *Heterogeneous* | *Cabruca* | *Semi-deciduous* | *Restinga* | *Altitude* |
| Mortality | 3 | 2 | * | 1 | 0 | 0 |
| Reproduction | 3 | 2 | 2 | 1 | 0 | 0 |
| Diet | 2 | 2 | 2 | 1 | 0 | 0 |
| Activity budget | 3 | 3 | 2 | 1 | 0 | 0 |
| Tree use | 3 | 3 | * | 1 | 0 | 0 |
| Predation | 3* | 3 | 3 | 0 | 0 | 0 |
| Space use | 3 | 3 | 2 | 1 | 0 | 0 |
| Density | 3 | 2 | 2 | 1 | 0 | 0 |
| Group size | 3 | 2 | 2 | 1 | 0 | 1 |
| Home range size | 3 | 2* | 2 | 1 | 0 | 0 |
| Health (parasites) | 1 | 1 | 1 | 0 | 0 | 0 |
| Associations with *C. kuhlii* | 3* | 2 | 2 | 1 | 0 | 0 |
| Genetic diversity | 3 | * | 1 | 1 | 0 | 0 |
| Movement within fragments | 3 | 3* | 3* | 1 | 0 | 0 |
| Movement between fragments | 0 | 0 | 0 | 0 | 0 | 0 |
| Anthropic pressure | 1 | 1 | 1 | 2 | 0 | 0 |
| Community ecology | 2 | 1 | 0 | 0 | 0 | 0 |
| Environmental education | 3 | 0 | 0 | 0 | 0 | 0 |
| Mortality within matrix | 0 | 0 | 0 | 0 | 0 | 0 |
| Migration/emigration/immigration | 2 | 1 | 0 | 0 | 0 | 0 |
| Ethnozoology | 0 | 0 | 0 | 0 | 0 | 0 |
| Environmental quality | 2 | 2 | 0 | 1 | 0 | 0 |
| Extinction | 3 | 3 | * | 2 | 0 | 0 |
| Extinction rate | 3 | 2 | 0 | 0 | 0 | 0 |

The symposium was concluded with a discussion of how we can fill these major research gaps and how communication between researchers and stakeholders can be improved in order to disseminate the results of research and improve the efficiency of conservation efforts of the species.

## Conclusion

We considered this meeting a very significant event because it brought together the majority of researchers involved with the *in situ* conservation of GHLTs to discuss research and exchange ideas. The resulting overview of existing knowledge and the list of knowledge gaps can serve as guidelines for the development of future research projects that wish to ultimately contribute to the development of conservation actions for the species. With this information, next steps will include reaching out to stakeholders involved with activities relevant to the conservation of the Atlantic Forest in general and GHLTs in particular. It is important that research results presented during this symposium become available to the wider public, particularly to federal and non-governmental institutions and civil society. The format of the distributed information should allow stakeholders to see how their respective activities might affect GHLTs and the landscape in which they reside while suggesting the kind of alterations that may be required to make those activities more compatible with GHLT conservation.

Ultimately, to maximize the long-term persistence of GHLTs, we need to conserve a functionally connected

landscape that offers adequate resources and allows GHLTs to move and breed successfully within the exceptionally heterogeneous environment of southern Bahia. Partly, this includes a much better understanding of the anthropogenic pressures on GHLTs and their habitat. Of equal importance is the consideration of GHLTs within their broader ecological network and the Atlantic Forest ecosystem. Studying GHLTs as an integral part of the ecological network of which they are a part will improve our understanding of the species' needs as well as its role within the ecosystem, contributing to more efficient conservation actions in the long-term. To get to this point, critical research is still needed at both broader and narrower scales as described in this document. Broadening our focus to the entire Atlantic Forest while continuing to study essential aspects of the species´ biology, is likely the most efficient conservation strategy over the long-term. There is an increasing demand for large-scale projects that focus on regions, their ecological functionality, and the species within those regions. We hope that this document serves as a guideline for how to develop new projects and partnerships that incorporate this demand and contribute to the long-term persistence of GHLTs and the Atlantic Forest.

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# Recent Publications

### BOOKS

*Field and Laboratory Methods in Primatology: A Practical Guide*, edited by Joanna M. Setchell & Deborah J. Curtis. 2011. Cambridge University Press. 456 pp. ISBN: 978–052114213. The second edition of this guide to research on wild primates covers the latest advances in the field, including new information on field experiments and measuring behavior. It provides essential advice on the technical and practical aspects of both field and laboratory methods. *Contents:* 1. An ethno primatological approach to interactions between human and non-human primates –Jones-Engel L, Engel GA & Fuentes A; 2. Habituating primates:

processes, techniques, variables and ethics –Williamson EA & Feistner ATC; 3. Habitat description and phenology –Ganzhorn JU, Rakotondranary SJ. & Rakotondranary YR; 4. Geographical information systems and remote sensing –Osborne PE & Glew L; 5. Monitoring local weather and climate –Mayes JC & Pepin N; 6. Survey and census methods: population distribution and density –Ross C & Reeve N; 7. Trapping primates –Jolly CJ, Phillips-Conroy JE & Müller AE; 8. Handling, anaesthesia, heatlh evaluation and biological sampling –Unwin S, Ancrecaz M & Bailey W; 9. Morphology, morphometrics and taxonomy –Groves C & Harding J; 10. Marking and radio-tracking primates –Honess PE & Macdonald DW; 11. Field experiments with non-human primates: a tutorial –Zuberbühler K & Wittig RM; 12. Feeding ecology, frugivory and seed dispersal –Dew JL; 13. Dietary analysis I: food physics –Lucas PW, Osorio D, Yamashita N, Prinz JF, Dominy NJ & Darvell BW; 14. Dietary analysis II: food chemistry –Lucas PW, Corlett RT, Dominy NJ, Essackjee HC, Riba-Hernandez P, Ramsden L, Stoner KE & Yamashita N; 15. Collecting arthropods and arthropod remains for primate studies –Ozanne CMP, Bell JR & Weaver DG; 16. Recording primate vocalizations –Geissmann T & Parsons S; 17. Photography and video for field researchers –Rowe N & Myers M; 18. Chronobiological aspects of primate research –Erket HG; 19. Thermoregulation and energetics –Schmid J; 20. Field endocrinology: monitoring hormonal changes in free-ranging primates –Hodges JK & Heistermann M; 21. Collection, storage and analysis of non-invasive genetic material in primate biology –Goossens B, Anthony N, Jeffery K, Johnson-Bawe M & Bruford MW; 22. Tips from the bush: an A-Z of suggestions for successful field work –Bearder SK & Nekaris AI.

**ARTICLES**


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## ABSTRACTS

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# Meetings

**2012**

### III Congreso Colombiano de Primatología

La Asociación Primatológica Colombiana junto con la Universidad del Norte y la Fundación Proyecto Tití, organizarán el III Congreso Colombiano de Primatología dentro del marco del evento *Biodiversidad: Recurso Estratégico*, el cual se llevará a cabo en Abril de 2012, en la ciudad de Barranquilla Colombia.

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### 5th Conference of the International Society for Gesture Studies: the communicative body in development

The conference, sponsored by the International Society for Gesture Studies (ISGS) will be held from July 24–27 at Lund, Sweden. For more information visit http://www.gesturestudies.com/isgs2012/

### International Symposium on Primate Research

The symposium will be held at Kunming, Yunnan, China P.R. from August 19–21, 2012, and is sponsored by the Yunnan Key Laboratory of Primate Biomedical Research. For more information visit http://www.lpbr.cn/symposium

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# 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 Spanish contributions to: Erwin Palacios, Conservación Internacional – Colombia, Carrera 13 # 71-41 Bogotá D.C., Colombia, Tel: (571) 345-2852/54, Fax: (571) 345-2852/54, e-mail: <epalacios@conservation.org>, and all Portuguese contributions to: Júlio César Bicca-Marques, Departamento de Biodiversidade e Ecologia, Pontifícia Universidade Católica do Rio Grande do Sul, Av. Ipiranga, 6681 Prédio 12A, Porto Alegre, RS 90619-900, Brasil, Tel: (55) (51) 3320-3545 ext. 4742, Fax: (55) (51) 3320-3612, e-mail: <jcbicca@pucrs.br>.

**Contributions**
Manuscripts may be in English, Spanish or Portuguese, and should be double-spaced and accompanied by the text on CD for PC compatible text-editors (MS-Word, WordPerfect, Excel, and Access), and/or e-mailed to <epalacios@conservation.org> (English, Spanish) or <jcbicca@pucrs.br> (Portuguese). 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 their English manuscripts 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 and conservation), Biogeography, Ecology and Conservation. Text for full articles should be typewritten, double-spaced with no less than 12 cpi font (preferably Times New Roman) and 3-cm margins throughout, and should not exceed 25 pages in length (including references). Please include an abstract in the same language as the rest of the text (English, Spanish or Portuguese) and (optional) one in Portuguese or Spanish (if the text is written in English) or English (if the text is written in Spanish or Portuguese). Tables and illustrations should be limited to six, except in cases where they are fundamental for the text (as in species descriptions, for example). Full articles will be sent out for peer-review. For articles that include protein or nucleic acid sequences, authors must deposit data in a publicly available database such as GenBank/EMBL/DNA Data Bank of Japan, Brookhaven, or Swiss-Prot, and provide an accession number for inclusion in the published paper.

***Short articles.*** These manuscripts 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 that 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 that occur in them. Text should be typewritten, double-spaced with no less than 12 cpi (preferably Times New Roman) font and 3-cm margins throughout, and should not exceed 12 pages in length (including references).

***Figures and maps.*** Articles may include small black-and-white photographs, high-quality figures, and high-quality maps. (Resolution: 300 dpi. Column widths: one-column = 8-cm wide; two-columns = 17-cm wide). Please keep these to a minimum. We stress the importance of providing maps that are publishable.

***Tables.*** Tables should be double-spaced, using font size 10, and prepared with MS Word. Each table should have a brief title.

***News items.*** Please send us information on projects, field sites, courses, Thesis or Dissertations recently defended, recent publications, awards, events, activities of Primate Societies, etc.

***References.*** Examples of house style may be found throughout this journal. In-text citations should be first ordered chronologically and then in alphabetical order. For example, "…(Fritz, 1970; Albert, 1980, 2004; Oates, 1981; Roberts, 2000; Smith, 2000; Albert *et al.*, 2001)…"

In the list of references, the title of the article, name of the journal, and editorial should be written in the same language as they were published. All conjunctions and prepositions (i.e., "and", "In") should be written in the same language as rest of the manuscript (i.e., "y" or "e", "En" or "Em"). This also applies for other text in references (such as "PhD thesis", "accessed" – see below). 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.

***Website***
UNESCO. 2005. UNESCO Man and the Biosphere Programme. United Nations Educational, Scientific, and Cultural Organisation (UNESCO), Paris. Website: http://www.unesco.org/mab/index.htm. Accessed 25 April 2005. ("Acessada em 25 de abril de 2005" and "Consultado el 25 de abril de 2005" for articles in Portuguese and Spanish respectively).

***For references in Portuguese and Spanish:***
"and" changes to "e" and "y" for articles in Portuguese and Spanish respectively.

"In" changes to "Em" and "En" for articles in Portuguese and Spanish respectively.

"Doctoral thesis" changes to "Tese de Doutoramento" and "Tesis de Doctorado" for articles in Portuguese and Spanish respectively.

"MSc Thesis" changes to "Dissertação de Mestrado" and "Tesis de Maestría" for articles in Portuguese and Spanish respectively.

"Unpublished report" changes to "Relatório Técnico" and "Reporte no publicado" for articles in Portuguese and Spanish respectively.

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## Articles



## Short Articles



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