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tion, considered their preferred habitat to be primary and secondary forests between 600–1,800 m above sea level.

Despite the well-documented growth of the mურიკი population at the Estação Biológica de Caratinga in the Feliciano Miguel Abdala Private Natural Heritage Reserve (RPPN-FMA) (see Strier *et al.*, 2002) and recent discoveries of some new populations (see Melo *et al.*, 2002; Chiarello *et al.*, 2005), the northern mურიკი, *B. hypoxanthus*, is classified as Critically Endangered on the *IUCN Red List of Threatened Species* (IUCN, 2004). All known populations are small and occur in isolated forest fragments. One of the smallest inhabits the 42-ha forest at Fazenda Esmeralda (FE), in Rio Casca, Minas Gerais.

In his visit to the Fazenda Esmeralda in 1964, Aguirre (1971) estimated 7–8 individuals surviving there. Subsequent studies of this population over a 20-year period, from 1983 to 2003, recorded an increase to a maximum of 18 individuals, followed by a subsequent and steady decline (Fig. 1). As of June 2003, there were only three mურიკis remaining, two adult males and an adult female, all three of them old. This population is not considered to be viable over the long term. We report here on a survey of primates in the forest fragments in and surrounding the Fazenda Esmeralda.

## Study Site and Methods

### Study site

Fazenda Esmeralda (FE) is about 30 km north of the town of Rio Casca, Minas Gerais, at 20°04'16"S, 42°44'22"W (Fig. 2; Location number 1). The forest is seasonal semideciduous and surrounded by farmland and pasture. The climate is tropical humid according to the classification of Köppen (Gilhaus, 1986, cited in Stallings and Robinson, 1991). The peak rainy months are from November to February, and

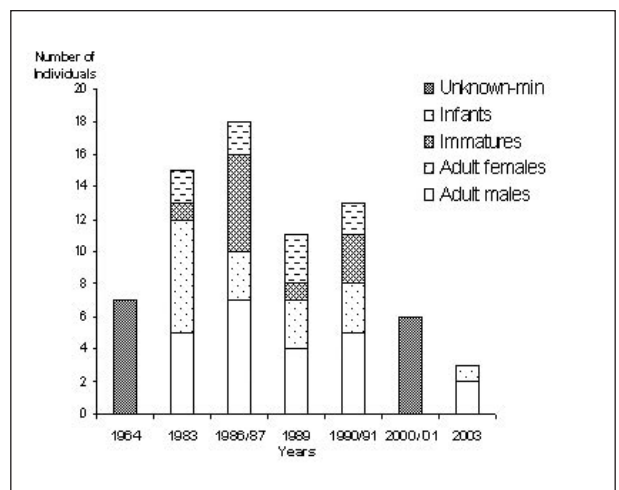
## THE NEAR EXTINCTION OF A POPULATION OF NORTHERN MURIQUIS (*BRACHYTELES HYPOXANTHUS*) IN MINAS GERAIS, BRAZIL

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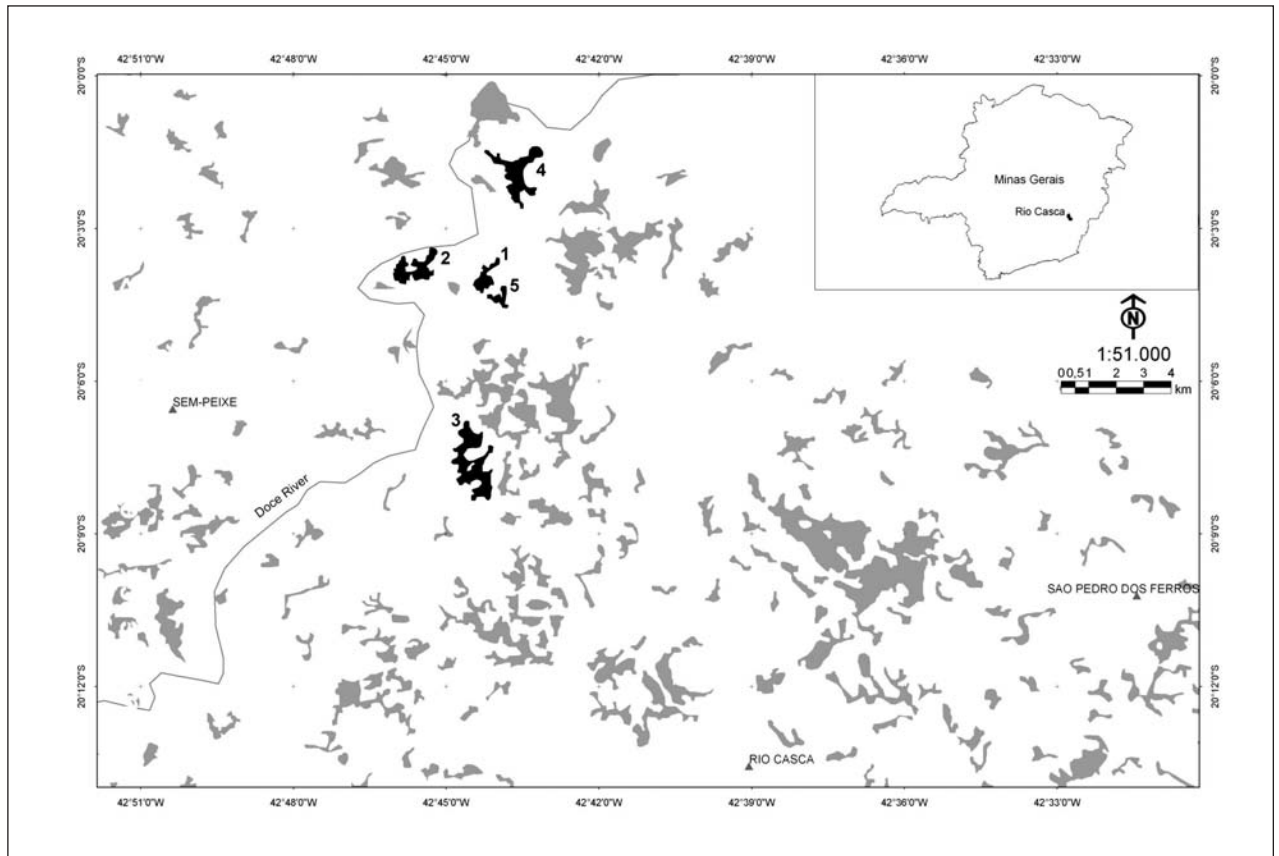
### Introduction

The mურიკი (*Brachyteles*) is the largest Neotropical primate and the largest mammal endemic to Brazil (Fonseca *et al.*, 1994). It is restricted to the southeastern Atlantic Forest where forest destruction is widespread and human activities inimical to wildlife are intense. Its populations are threatened by habitat destruction and fragmentation and, despite prohibitions, there is still hunting in this region of Brazil (Mittermeier *et al.*, 1982, 1987, 1989; Mittermeier and Konstant, 1990; Auricchio, 1997; Cosenza and Melo, 1998).

Adult male and female mურიკis can weigh up to 12–15 kg (Aguirre, 1971). Their original range extended from the southern part of the state of Bahia to southern São Paulo (25°S), including the states of Espírito Santo, Minas Gerais, and Rio de Janeiro (Aguirre, 1971; Strier, 1992; Strier and Fonseca, 1996–1997). Mურიკis also occur in northern Paraná (Martuscelli *et al.*, 1994). Aguirre (1971), who conducted the most complete survey of the mურიკi's distribu-



**Figure 1.** Size and composition of the mურიკi population at Rio Casca, Minas Gerais. Sources are as follows: 1964 (Aguirre, 1971); 1983 (Fonseca, 1985); 1986/87 (Lemos de Sá, 1988); 1989 (Brozek, 1991); 1990/91 (Andrade, 1996); 2000/01 (S. L. Mendes, pers. comm.); 2003 (this study). With kind permission of Karen B. Strier.



**Figure 2.** Map showing the location of the study site (Fazenda Esmeralda, Rio Casca, Minas Gerais), including the forest fragments visited. 1. Study site; 2. Forest fragment 01 (Fazenda Esmeralda); 3. Fazenda Esmeralda de Cima; 4. Fazenda Córrego do Ouro; 5. Forest fragment 02 (Fazenda Esmeralda).

the peak dry months are from June to August. Data from the Rio Doce State Park (about 35 km from the study area) indicate average annual rainfall in the 1960s and 1970s to be 1,480 mm, with an average annual temperature of 22°C (CETEC, 1981). Altitudes in the forests at FE range from 240–480 m. The forests in the area have a long history of disturbance, through cycles of coffee, corn and, more recently, sugarcane plantations, besides the harvesting of wood in the 1960s and 1970s for the production of charcoal. The small forest fragments are today surrounded by pasture dominated by “capim-colonião” (*Panicum maximum*) and agricultural crops. Local farmers reported that the mureiquis were heavily hunted during the 1960s and 1970s, when there were some 800 people living on the Fazenda Esmeralda working for a mining company in the region.

The forest is in various stages of succession, and there are abundant vines and lianas. Some species typical of tall primary forest, such as “bicuíba” (*Virola gardneri* [A. DC.] Ward), “garapa” (*Apuleia leiocarpa* MacBride), “jequitibá-rosa” (*Cariniana legalis* [Mart.] Kuntze), and “peroba” (*Aspidosperma* sp.) remain. There are few epiphytes due to the successive cycles of selective logging. The terrain is steep with slopes of 40–65°.

#### Methods

We carried out four surveys to census the primates and assess the mureiqui population at FE: 1) 29 March to 4 April 2003;

2) 26 April to 1 May 2003; 3) 26 May to 31 May 2003; and 4) 14 June to 19 June 2003. Each expedition involved about 58 hours of fieldwork for a total of 234 hours. We re-opened trails that were used by previous researchers and cut new ones. Morning censuses were begun at 0700 h and lasted approximately four hours. Afternoon censuses were conducted from 1400–1800 h, such that we were able to cover the entire area of forest accessible by the trail system, including all areas used by mureiquis, in one day. We used binoculars and also playback recordings (portable *Diskman*, a CD with vocalizations of *B. hypoxanthus*, *Cebus nigritus*, *Callicebus nigrifrons* and *Callithrix aurita*, and a Mini-twin MT 10 Fender amplifier) to increase the likelihood of finding the primates. Whenever possible, we took photographs with a Sony Mavica FD75 digital camera.

We recorded all sightings of primates, all vocalizations heard, and information obtained from interviews with local inhabitants. Other forest fragments reported to have supported mureiquis in the past were also surveyed to determine whether they might still be present.

#### Results and Discussion

The forest fragment at FE continues to suffer strong anthropogenic pressures. In the past, the main problem was selective logging for charcoal production. Logging has, without doubt, considerably reduced the floristic species diversity.

The remaining secondary forest has enormous numbers of vines and patches of bamboo, with a canopy now reduced to an average height of 6.8 m (Lemos de Sá and Strier, 1992). During the first expedition, we heard dogs barking in the forest. Local residents told us that these dogs have been harassing the primates at FE for years.

### Muriquis

We were in contact with the muriquis for an average of seven hours in each of the expeditions. On the first expedition only three trails were passable, and we had difficulty walking in the forest and locating the muriquis, partly due to the steep terrain and dense vegetation typical of secondary growth. Only on 30 March 2003 did we see an adult male about 12 m from the observer, 10 m from the trail, and 9 m from the ground. At 1800 h on the same day, we heard a second muriqui calling from the other side of the forest in the area called "Porção da água" (there is a small stream there). On 2 April 2003 we saw another individual in the "Porção da água." This part of the forest is the only area that has not been logged, as was evident from the well-developed understorey and the presence of various large trees including "jequitibá" (*Cariniana legalis*), "pau d'alto" (*Gallesia integrifolia*), and "angico" (*Anadenanthera* sp.). Local residents mentioned seeing a solitary muriqui in a neighboring forest fragment (separated by an open field) on 31 March 2003.

For the second expedition, we cut nine new trails and were consequently able to observe three adult muriquis (a female and two males) on four consecutive and complete days. We frequently found the muriquis in a part of the forest with a high density of "leiteira" trees (*Margaritaria nobilis*, Euphorbiaceae) that were in fruit. They fed in these trees throughout the day as well as in other trees, including "angelim-amargoso" (*Andira* sp.), "angico" (*Anadenanthera* sp.), and "vinhático" (*Plathymenia foliolosa*). They fed especially on the mature leaves of "angelim-amargoso," and on lianas and vines, including a species of Bignoniaceae.

We cut four new trails for the third expedition, and were able to reach formerly inaccessible parts of the forest, making us even more successful in contacting and observing the

muriquis. We were able to reconfirm the composition of the group: just the three muriquis seen during the second expedition. *Ad libitum* data (Setz, 1991) indicated that the muriquis spent 60% of the total observation time resting, 23% traveling, and 17% feeding (Fig. 3). The time spent feeding could have been low because of the low availability of food.

Local people informed us that muriquis had been heard calling in another forest fragment in the past year (about 140 m from the study area; not shown in Fig. 2). In 2002, R. Ribeiro (pers. comm.) also saw an adult male muriqui crossing a pasture in the direction of this same forest. During the final, fourth expedition, we visited four other forest fragments near our study area but were unable to confirm the presence of muriquis in any (Table 1; Fig. 2).

### Other primates

While studying the muriquis at FE from 1986 to 1987, Lemos de Sá (1991) recorded the presence of single groups of titi monkeys (*Callicebus nigrifrons*), capuchin monkeys (*Cebus nigrinus*), and buffy-tufted-ear marmosets (*Callithrix aurita*) in the 42-ha forest of our study site. Our surveys confirmed that all three primates still resided there. We also saw two buffy-tufted-ear marmosets (*Callithrix aurita*), together with a group of *Callicebus nigrifrons* (titi monkeys), in a neighboring fragment separated from the study site by a road, but considered here as part of the same area.

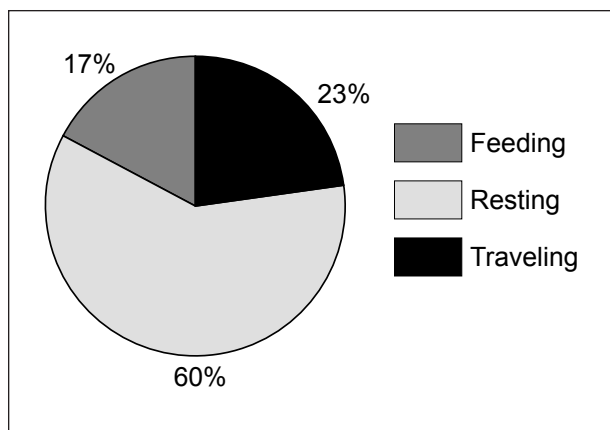
During the last expedition (14–19 June 2003) we recorded the presence of titi monkeys, black-horned capuchins, and buffy-tufted-ear marmosets in two other fragments (Fazenda Esmeralda and Fazenda Esmeralda de Cima), and found another group of capuchin monkeys in a third forest in the Fazenda Córrego do Ouro, all near our study site (Table 1; Fig. 2).

### The fate of the three muriquis

The situation of the muriquis at Rio Casca was discussed at the Second Meeting of the Committee for the Conservation and Management of the Muriqui (*Comitê Brasileiro para Conservação do Muriqui*), recently created by the Instituto Brasileiro de Desenvolvimento Sustentável e dos Recursos

Table 1. Census results from study site and neighboring forest fragments.

Map	Local	Coordinates	Area (ha)	Species encountered	Encounter type
1	Fazenda Esmeralda (study site)	20°04'16"S 42°44'22"W	42	<i>Callithrix aurita</i> <i>Callicebus nigrifrons</i> <i>Cebus nigrinus</i> <i>Brachyteles hypoxanthus</i>	Visual Visual Visual Visual
2	Fazenda Esmeralda (forest fragment 01)	20°03'21.0"S 42°44'10.0"W	85	<i>Callithrix aurita</i> <i>Callicebus nigrifrons</i> <i>Cebus nigrinus</i>	Vocal Vocal Visual
3	Fazenda Esmeralda de Cima	20°07'03.0"S 42°44'11.0"W	177	<i>Callithrix aurita</i> <i>Callicebus nigrifrons</i> <i>Cebus nigrinus</i>	Reported by local Vocal Visual
4	Fazenda Córrego do Ouro	20°01'21.0"S 42°43'37.0"W	127	<i>Cebus nigrinus</i>	Reported by local
5	Fazenda Esmeralda (forest fragment 02)	20°04'22.0"S 42°43'55.0"W	22	<i>Cebus nigrinus</i>	Visual



**Figure 3.** Percentage of time the muriquis were feeding, resting, and traveling during 28 hours of observation in the Fazenda Esmeralda (study area), Rio Casca, Minas Gerais.

Naturais Renováveis (IBAMA). The meeting was held from 30 June to 1 July 2003 in Belo Horizonte, Minas Gerais. Three alternatives were proposed:

- Continue to monitor the remaining individuals in this population without interfering with them;
- Capture the three muriquis, and release them in another forest with an extant muriqui population;
- Capture the three individuals and maintain them in captivity.

If captured, they would be transported to a Triage Center at the Universidade Federal de Viçosa. Following quarantine and medical examinations (including analyses of parasite loads, genetics, and reproductive status), the fate of the muriquis (reintroduction or permanence in captivity) would be determined in a special meeting of the Muriqui Committee. We estimate that to capture and transport the muriquis and to build them a suitable enclosure would cost about R\$12,000. The option to capture the three muriquis was accepted by the Muriqui Committee at its meeting on 1 July 2003 and is awaiting final approval and permits from IBAMA.

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population at FE (Fig. 1), for sharing the original references, and for her help with translation and her suggestions on an earlier version of this manuscript.

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## LIMITES CLIMÁTICOS E VEGETACIONAIS DAS DISTRIBUIÇÕES DE *CEBUS NIGRITUS* E *CEBUS ROBUSTUS* (CEBINAЕ, PLATYRRHINI)

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### Introdução

Os primatas do gênero *Cebus* apresentam ampla distribuição geográfica, estendendo-se por toda a região Neotropical. Os macacos-prego (subgênero *Sapajus*) são exclusivos da América do Sul, enquanto que os caiararas (subgênero *Cebus*) ocorrem na Amazônia e América Central. Estes animais são notáveis por explorarem habitats diversos. A proposta taxonômica utilizada no presente estudo foi desenvolvida por Silva Jr. (2001), considerando *Cebus nigrinus* e *C. robustus* como espécies válidas, pertencentes ao subgênero *Sapajus*, que compreende ainda *C. apella*, *C. macrocephalus*, *C. libidinosus*, *C. caye* e *C. xanthosternus*.

A distribuição geográfica das diversas formas deste subgênero não é muito bem delineada, pois a determinação da distribuição geográfica de um táxon tradicionalmente baseia-se na ligação dos pontos de registro empírico mais externos da distribuição. Isto pode gerar vários erros, já que os fatores ambientais não são levados em consideração (Cerqueira, 1985, 1995; Cerqueira *et al.*, 1998). Este é o caso de *Cebus* e *Sapajus*.

A distribuição geográfica pode ser avaliada mais precisamente através do conceito de distribuição potencial, onde a área de distribuição de um táxon seria aquela correspondente à distribuição dos fatores ambientais ligados a ocorrência dos habitats e nicho de uma espécie, determinando assim os limites geográficos externos da distribuição (Cerqueira, 1985; Taylor e Taylor, 1979). Um método proposto para a determinação de hipóteses de distribuições potenciais foi delineado por Cerqueira (1985, 1995). De acordo com este método, para cada ponto de registro empírico devem ser levantados dados sobre fatores ambientais considerados potencialmente relevantes. Análises subsequentes permitem estimar quais fatores são importantes para a distribuição do táxon. Depois de mapeadas as distribuições destes fatores, as áreas em comum obtidas através da sobreposição dos mapas indicam a distribuição potencial de uma espécie, criando uma hipótese passível de verificação.

### Metodologia

Foram considerados os 141 registros de ocorrência de *Cebus nigrinus* e 94 de *C. robustus*, levantados por Silva Jr. (2001), a partir de dados de museus e literatura. Para cada localidade obtivemos dados referentes à vegetação e aos fatores climáticos. Os dados de vegetação foram levantados no mapa digital de ecorregiões (Dinerstein *et al.*, 1995), sendo então calculada a frequência de ocorrências